

institut max von laue · paul langevin · grenoble · france



annual report 1981

10th anniversary of the hfr operation

Applications for the use of ILL facilities

All research proposals have to be submitted to the Scientific Council for approval. The Council meet twice each year and the closing dates for the acceptance of applications are:

February 15 and August 31.

The completed research proposal forms should be sent to:

The Office of the Scientific Secretary
Institut Max von Laue - Paul Langevin
156 X
38042 Grenoble Cedex
France
Tel. (76) 97.41.11 Ext. 82.44 Telex: 320621 F

As from April 1st 1982: Tel. (76) 48.71.11 Ext. 72.44

(Appropriate application forms may be obtained on request from the above office).

Under normal circumstances the ILL makes no charge for the use of its facilities. However special equipment, (other than the existing instruments, counters, standard cryostats and shielding requirements) must be provided by the user. This applies particularly to the experimental samples which must, in all cases, be provided by the user. Chemistry and Biology laboratory facilities are available for any necessary sample preparation.

The ILL makes a limited contribution towards the travel and subsistence expenses for experimentalists coming from approved laboratories in the three member countries. (Details on request).

FRONT-COVER PHOTOGRAPH:

A view inside the ILL-HFR's swimming pool with the typical Cerenkov radiation. The 16 December 1981 was the tenth anniversary of the date when the reactor reached its full power of 57 megawatts. The reliable operation of the HFR permits every year the carrying out of more than 700 experiments involving about 1600 scientific visitors from the 3 member countries as well as from many other states. The ILL can be regarded as an example of excellent international collaboration.

annual report 1981

Institut von Laue . Langevin Grenoble . France

contents

| | | |
|---------------------------------|------|----|
| ORGANISATION OF THE ILL in 1981 | page | 4 |
| THE INSTITUT LAUE-LANGEVIN | page | 7 |
| INTRODUCTION, DIRECTOR'S REPORT | page | 13 |

Instrumentation

| | | |
|----------------------------------|------|----|
| Statistics and instrument tables | page | 27 |
| New experimental techniques | page | 32 |

Instrument Operation Department

| | | |
|--|------|----|
| Fundamental and nuclear physics | page | 41 |
| Three-axis spectrometers | page | 45 |
| Time-of-flight, high resolution and diffuse scattering | page | 48 |
| Diffraction instruments | page | 54 |
| Monochromator group | page | 60 |
| Central group | page | 63 |
| Sample environment group | page | 64 |

Colleges

| | | |
|---|------|----|
| College 2: Theory | page | 67 |
| College 3: Fundamental and nuclear physics | page | 69 |
| College 4: Excitations in crystals | page | 76 |
| College 5: Crystal and magnetic structures | page | 79 |
| College 6: Liquids, gases and amorphous materials | page | 84 |
| College 7: Imperfections | page | 86 |
| College 8 and EMBL Grenoble: Biochemistry | page | 89 |
| College 9: Chemistry | page | 92 |

Sections with Special Tasks

| | | |
|------------------------------------|------|----|
| Project office | page | 98 |
| Safety and health physics group | page | 98 |
| Office of the Scientific Secretary | page | 99 |

Technical Department

| | | |
|---|------|-----|
| Mechanical construction | page | 103 |
| Design studies and construction project group | page | 104 |
| Building and instrument maintenance equipment group | page | 105 |
| Mechanical construction and maintenance section | page | 107 |

Reactor Operation Department

| | | |
|---------------------------------|------|-----|
| Reactor operation 1981 | page | 111 |
| Operation of the sub-assemblies | page | 113 |

Computing and Electronics Department

| | | |
|---|------|-----|
| Instrument control and data acquisition service | page | 117 |
| Central computer service | page | 119 |
| Data treatment group "Gratin" | page | 120 |

Administration

| | | |
|-----------|------|-----|
| Personnel | page | 125 |
| Welfare | page | 127 |
| Finance | page | 129 |

Miscellaneous

| | | |
|--|------|-----|
| Experiments carried out at the ILL | page | 138 |
| Workshops and conferences organised by the ILL | page | 152 |
| Theses | page | 152 |
| Publications | page | 153 |
| Author index of publications | page | 165 |
| List of publications accepted | page | 171 |

External organisation of the Institut Laue-Langevin 1981

Associates of the Institut

Great Britain

SCIENCE AND ENGINEERING
RESEARCH COUNCIL (SERC)

France

COMMISSARIAT A L'ENERGIE ATOMIQUE
(CEA)

CENTRE NATIONAL DE LA RECHERCHE
SCIENTIFIQUE (CNRS)

Germany

KERNFORSCHUNGSZENTRUM
KARLSRUHE (KFK)

Steering Committee (at its last meeting)

Egginton - (SERC)
Hobbis - (SERC)
Leadbetter - (Univ. of Exeter)
Wroe - (SERC)

Cribier - (CEA)
Horowitz (Chairman) - (CEA)
Mercouroff - (CNRS)
Roux - (CNRS)

Döll - (BMFT)
Hofbauer - (BMF)
Huber - (Univ. Erlangen)
Klose - (KFK)

Audit Commission

Mead
Millington

Gouzien
Racine

Riess
Binder

Scientific Council (at its last meeting)

| | | |
|------------------------------|-----------------------------|------------------------------|
| Armbruster - GSI Darmstadt | Fuller - Univ. Keele | Mitchell - Univ. Oxford |
| Benoit - CNRS Strasbourg | Galy - CNRS Toulouse | Ottewill - Univ. Bristol |
| Coles - Imp. College, London | Goodenough - Univ. Oxford | Rainford - Univ. Southampton |
| Cowley - Univ. Edinburgh | Hart - King's Coll., London | Schmatz - KfK Karlsruhe |
| Dachs - HMI Berlin | Horner - Univ. Heidelberg | Schofield - AERE Harwell |
| Drifford - CEN Saclay | Joly - CEN Saclay | Schult - KfA Jülich |
| Ebel - IBMC Strasbourg | Lemaire - CEN Saclay | Springer - ILL (Chairman) |
| Farge - LURE, Orsay | Miller - Univ. Oxford | Stuhrmann - DESY, Hamburg |
| Fender - ILL | Mills - Univ. Reading | Villain - CEN Grenoble |
| | | Wegner - Univ. Freiburg |
| | | Winter - ILL |

SUBCOMMITTEES OF THE SCIENTIFIC COUNCIL

| Fundamental and Nuclear Physics | Excitations in crystals | Crystal and Magnetic structures | | Liquids, gases amorph. mat. | Imperfections | Biochemistry | Chemistry | Instruments |
|---------------------------------|-------------------------|---------------------------------|-------------|-----------------------------|---------------|---------------|-----------------|-----------------|
| Leroux | Boccara | Delapalme | Galy | Cyrot | Coles | Blundell | Bienfait | Farnoux |
| Lynn | Challis | Fuess | Hahn | Enderby | Kleitz | Fuller | Charvolin | Forsyth |
| Sandars | Cowley | Goodenough | Lucas | Hensel | Peisl | Helene | Forstmann | Gläser |
| Schult | Hanke | Lemaire | Marezio | Janot | Schilling | Miller | Higgins | Nifenecker |
| Specht | Horner | Prandl | Sim | Schofield | Souletie | Nierhaus | Hüller | Press |
| Vinh Mau | Rossat-Mignod | Wilkinson | Simon | Wölfle | Stewart | Parello | Kilian | Rainford |
| | | | Tofield | | | Saenger | Mills | Renouprez |
| | | | | | | Schulz | Monnerie | Schmatz |
| | | | | | | Tardieu | North | Steyerl |
| | | | | | | | Ottewill | Stirling G. |
| | | | | | | | Oudar | |
| | | | | | | | Rivail | |
| | | | | | | | Wegner | |
| | | | | | | | Weill | |
| | | | | | | | Weiss | |
| | | | | | | | Thomas | |

Internal organisation of the Institut Laue-Langevin at 1.1.82

SCIENCE BOARD

| | |
|----------|------------|
| Beaufils | Gönnenwein |
| Brown | Jacrot |
| Dorner | Winter |
| Faudou | Springer |
| Fender | Maier |

DIRECTORATE

| | |
|----------|---------------|
| Springer | - Director |
| Fender | - Co-Director |
| Winter | - Co-Director |

MANAGEMENT BOARD

Springer
Fender
Winter
Grillo
Jacquemain

OFFICE OF THE SCIENTIFIC SECRETARY

Maier

PROJECT OFFICE

Faudou

SAFETY & HEALTH PHYSICS

Sallé

DELEGUE TECHNIQUE

Jacquemain

COLLEGES (College Secretaries)

College 2: THEORY
Capellmann

College 3: FUNDAMENTAL AND
NUCLEAR PHYSICS
Faust

College 4: EXCITATIONS
Currat

College 5: CRYSTAL AND
MAGNETIC STRUCTURES
Hewat/Burke

College 6: LIQUIDS, GASES,
AND AMORPHOUS
MATERIALS
Cummings

College 7: IMPERFECTIONS
Heidemann

College 8: BIOCHEMISTRY
May

College 9: PHYS. CHEMISTRY/POLYMERS
Poisignon/Oberthür

INSTRUMENT GROUPS

3 - AXIS SPECTROMETERS
Dorner - Stirling

INSTRUMENTS FOR FUNDAMENTAL
AND NUCLEAR PHYSICS
Gönnenwein - Schreckenbach

DIFFRACTOMETERS
Brown - Lehmann

DIFFUSE SCATTERING AND TIME
OF FLIGHT SPECTROMETERS
Beaufils - Mezei

MONOCHROMATORS
Freund

LIBRARY

Castets

SCIENTISTS' SECRETARIAT

Parisot

DEPARTMENTS

INSTRUMENT OPERATION
DEPARTMENT
Gönnenwein

REACTOR DEPARTMENT
Franzetti

TECHNICAL DEPARTMENT
Faudou

COMPUTING AND ELECTRONICS
DEPARTMENT
Rimmer

ADMINISTRATION
Grillo

1
0
1

the institut max von laue- paul langevin

The Institut Max von Laue - Paul Langevin (ILL) at Grenoble was formally founded in January 1967, with the signature of an intergovernmental convention between France and the Federal Republic of Germany. The aim was to provide the scientific community of the affiliated countries with a unique neutron beam facility applicable in fields such as the physics of condensed matter, chemistry, biology, nuclear physics and materials science. The construction of the Institut and its high flux reactor was undertaken as a joint French-German project, with a total capital investment of 335 million FF. The reactor went critical in August 1971 and reached its full power of 57 MW for the first time in December 1971. The year 1972 saw the start-up of the cold and hot sources, the first instruments and the beginning of the experimental programme. On January 1, 1973 the United Kingdom joined the Institut as a third equal partner, contributing its share to the total capital investment. The corresponding intergovernmental convention was formally signed in July 1974 by the pertinent ministers from the three affiliated countries. On December 9, 1981 a protocol was signed by representatives from the three member countries which extended the life of the ILL until December 31, 1992.

The ILL is a non-trading company under French civil law. The three countries are represented by the following Associates:

- Kernforschungszentrum Karlsruhe GmbH, Germany
- Centre National de la Recherche Scientifique, France
- Commissariat à l'Énergie Atomique, France
- Science Research and Engineering Council, United Kingdom.

These Associates are represented on a Steering Committee, which establishes the general rules of the management of the ILL. The Institut is headed by a Director and two Assistant Directors, all with a five year tenure, the former to be nominated alternately by the German and the British Associates, the other two by the remaining Associates. A Scientific Council, nominated by the Associates, advises the Directors on the scientific programme and on practical aspects relating to its operation.

The scientific users' community of the ILL is represented in 8 Subcommittees of the Scientific Council, which meet twice a year to select those research proposals which are to be carried out at the neutron beam facilities of the ILL. A further Subcommittee of the Scientific Council deals with questions of instrumentation, serving as a discussion platform between the ILL and its external users.

The purpose of the ILL thus differs from other research institutes in so far as it is a central facility created so that chemistry, solid state physics, fundamental and nuclear physics, biology and metallurgy specialists from laboratories in the partner countries can use the unique power of neutron techniques to broaden the attack on their problems. Designing and operating instruments and helping the visiting users to carry out their experiments is thus the principal task of the Institute's own scientists. The experimental use of the instruments by ILL staff is subject to the same approval system as their use by external teams.

10th anniversary of the hfr operation

On 16 December 1981 the ILL celebrated the tenth anniversary of the day when the high flux reactor reached its full power of 57 MW. During these 10 years, the reactor has been in use for 98 % of the scheduled hours at full power.

To mark the occasion, a scientific colloquium was held at the ILL. M. Jean Chatoux, formerly leader of the reactor project team, spoke on the design and construction of experimental reactors, as exemplified by the ILL high flux reactor. Professor Dr. Wolfgang Paul took as his theme "What do we know about the neutron?". Mr. Bernard Jacrot, deputising at short notice for Sir John Kendrew, spoke on the impact of X-ray and neutron diffraction in biology. The ILL was particularly glad to welcome at this colloquium over 100 distinguished visitors and former members of the project team.

In the afternoon Mr. Anthony Egginton, Chairman of the Steering Committee, and Mr. Jacrot formally opened the new "Rechenzentrum" and "Chartreuse" buildings, which house the new ILL computer, the EMBL's Grenoble outstation, and new biological and chemical laboratories. Finally there was an informal party for all the ILL staff and the visitors.

M. Chatoux during his lecture in the amphitheatre.



Mr. A. J. Egginton during his speech on the occasion of the inauguration of the ILL's new buildings (computer and EMBL/Biology buildings).





Guests assembled in the ILL lecture hall where the celebration ceremony took place.

Many dignitaries attended the lectures, amongst others Profs. R.L. Mössbauer and H. Maier-Leibnitz, former Directors of the ILL and Prof. Paul (in the first row from left to right).



visits and events in 1981



Staatssekretär H. Haunschild of the BMFT (Bundesministerium für Forschung und Technologie, Federal Republic of Germany) visited the ILL on 23 and 24 June 1981. The picture shows H. Haunschild (in the middle) in the ILL Neutron Guide Hall together with Prof. T. Springer, ILL (left), Mr. Patermann, BMFT (second from right) and M. Jacquemain, ILL (right).



U. Dübber, Mitglied des Deutschen Bundestages, visited the ILL on 24 and 25 September 1981. On his tour through the Institut he was guided by Prof. T. Springer (on the picture in front of the joint CERN/University of Padua/RL experiment on $n\bar{n}$ -oscillations).

Dr. J. Winter, the new French Assistant Director who started his tenure on 1 July 1981.



introduction

bericht des direktors

Die Verlängerung des Staatsabkommens bis 1992

Das grosse Interesse der Wissenschaftler aus den drei Partnerländern an der Nutzung der Apparaturen des Instituts Laue-Langevin und die erzielten Resultate hatten die Gesellschafter des Instituts 1979 veranlasst, einem Modernisierungsprogramm für das Institut zuzustimmen. Parallel zu den laufenden wissenschaftlichen und technischen Aufgaben des Instituts ist dieses nun voll in Gang gekommen und die Modernisierungsmassnahmen sollen Ende 1985 abgeschlossen sein. In Verbindung damit stand die Unterzeichnung der Vereinbarung über die Verlängerung des Staatsabkommens des Instituts bis zum 31. Dezember 1992. Die Unterzeichnung durch die Botschafter der Bundesrepublik Deutschland und Frankreichs sowie einen britischen Regierungsvertreter fand am 9. Dezember 1981 in London statt. Das Institut ist den Regierungen der drei Länder und dem Lenkungsausschuss für die Unterstützung dankbar, welche zum Modernisierungsprogramm und schliesslich zu diesem Abkommen führte.

Modernisierungsprogramm; zweite Kalte Quelle

In der Sitzung des Lenkungsausschusses am 11. Dezember 1981 wurde nach ausführlicher Diskussion und mit positiver Empfehlung des Wissenschaftlichen Rats dem grössten Projekt innerhalb des Modernisierungsprogrammes zugestimmt, nämlich der zweiten Kalten Quelle. Sie soll in den horizontalen Kanal H 5 eingebaut werden und mit zwei Neutronenleitern sechs Instrumente speisen. Nach unseren gegenwärtigen Vorstellungen werden hiervon drei zusätzlich gebaut (augenblicklich gibt es 35 Benutzerinstrumente); zwei dieser Positionen können durch den Transfer bestehender Instrumente besetzt werden; eine Position schliesslich steht als starker, eventuell polarisierter Strahl zur Verfügung. Die Quelle soll 1986 in Betrieb gehen. Sie wird die wissenschaftliche Arbeit auf Forschungsgebieten stärken und erweitern, auf denen das Institut glaubt auch in Zukunft besonders erfolgreich zu sein. Das betrifft vor allem die hochauflösende Neutronenspektroskopie für Probleme der physikalischen Chemie und der Festkörperphysik, sowie die Kleinwinkelstreuung für die Physik der Polymere und Kolloide, für die Biologie und die Metallphysik; schliesslich wird die Anwendung kalter polarisierter Neutronen für Probleme des Festkörpermagnetismus sowie auch für die Elementarteilchenphysik eine bedeutende Rolle spielen.

Die verschiedenen Instrumente im Modernisierungsprogramm sind entweder im Bau oder sie gehen Mitte des Jahres 1982 in Betrieb. Hierzu gehört das Dreiachsenspektrometer IN 1B, das Flüssigkeitsdiffraktometer D4 B, das Diffraktometer für Biologie D16 B und das Spaltprodukt-Koinzidenz-Spektrometer PN 8. Das magnetische Dreiachsenspektrometer IN 20 befindet sich im Bau und wird Ende 1982 aufgebaut. Das "Diffraktometer-Tandem" (D19/20/2B) befindet sich nun ebenfalls in Konstruktion und die Ausschreibung erfolgt Mitte 1982. Die Konstruktion der vertikalen Quelle, welche die bestehende Kalte Quelle ersetzen wird, geht gut voran und die Installation soll während des grossen Reaktorhaltes Ende 1982 erfolgen.

Das ursprünglich beschlossene Projekt eines magnetischen Diffraktometers wurde nach ausführlicher Diskussion im Wissenschaftlichen Rat annulliert. Ein Teil der vorgesehenen Forschungsaufgaben übernimmt das genannte Instrument IN 20. Im Gefolge mit dieser Frage wurde die Zukunft der Instrumente PN 1 und IN 4 diskutiert: Sie sollen mindestens bis 1985/86 weiterbetrieben werden. Wir haben in diesem Zusammenhang die nützliche Einsicht gewonnen, dass alle Instrumente systematisch von Zeit zu Zeit in Frage gestellt werden sollten, um die vorhandenen Strahlpositionen jeweils mit den bestmöglichen Apparaturen zu besetzen. Die Diskussionen in den zuständigen Subkomitees des Wissenschaftlichen Rates über die Instrumente wurden als besonders hilfreich angesehen.

Neuartige Verfahren sind die wichtigste Grundlage bei der Entwicklung von interessanten Instrumenten. Deshalb wurden auch im vergangenen Jahr grosse Anstrengungen auf diesem Gebiet unternommen, und zwar betrifft dies: Die Weiterentwicklung von Polarisatoren auf der Grundlage von Multischicht-Spiegeln; die Herstellung und Anwendung von fokussierenden Monochromatoren, wobei die Zusammenarbeit mit externen Labors eine besondere Rolle spielt (Cristaltec; Institut für Festkörperforschung in Jülich, Max-Planck-Institut für Pulvermetallurgie in Stuttgart, Néel-Labor des CNRS); sowie schliesslich die Weiterentwicklung von ein- und zweidimensionalen Vielfachzählern. Dieses Gebiet nimmt, vor allem im Hinblick auf die damit verbundenen Probleme der Elektronik und Software für die online Auswertung, einen sehr grossen Umfang an, der sorgfältig mit den anderen Aktivitäten am Institut koordiniert werden muss.

Der Neubau "Chartreuse", welcher gemeinsam mit dem EMBL in Heidelberg errichtet wurde, ist nun praktisch vollständig bezogen. Nicht zuletzt wird er unseren Besuchern verbesserte Unterbringungsmöglichkeiten bieten sowie auch eine Vergrösserung des Laborraums. Besonders erfreulich ist es, dass der neue Zentralrechner DEC 1091 nun fehlerfrei läuft; die alte DEC 10 wurde Ende November endgültig abgeschaltet.

Überlegungen zur Weiterentwicklung des wissenschaftlichen Programms

Die Verlängerung der Lebensdauer des Instituts Laue-Langevin legt es nahe, einige Überlegungen wiederzugeben, die wir im vergangenen Jahr über die Zukunft des wissenschaftlichen Programms des Instituts angestellt haben. Aus der Vielfalt des "User-" und "Inhouse-" Programmes heraus lassen sich Themenkreise identifizieren, unter denen interessante Entwicklungen zu erwarten sind. Wir denken dabei an die folgenden vier Gebiete, und wir würden ergänzende oder auch widersprechende Bemerkungen unserer Kollegen hierzu besonders begrüssen:

Die Ausnutzung der **Neutron-Spinecho-Methode** mit ihren Möglichkeiten steht erst am Anfang. Dies betrifft zunächst die Untersuchung der internen Brownschen Bewegung von sehr grossen Molekülen: Polymere, kolloidale Teilchen, und (mit Vorbehalt) auch biologische Systeme. Weiterhin ist vorstellbar, dass die Verbindung zwischen Spinecho-Methode und Dreiachsenspektrometrie neue Gebiete öffnen wird, nämlich die genaue Messung der Lebensdauer von Phononen, die Aufschluss gibt über deren Wechselwirkung mit Elektronen, Molekülrotationen, Gitterdefekten und mit ihresgleichen.

Ein traditionelles und problemreiches Gebiet des Instituts ist die **Kleinwinkelbeugung** zum Studium der Morphologie von Polymeren, biologischen Systemen (z.B. Viren, Membranen) sowie nicht zuletzt von ungeordneten metallischen Systemen. Die Zukunftsentwicklung geht wahrscheinlich in die Richtung der Untersuchung kinetischer Phänomene in diesen Gebieten, d.h. die Messung der Zeitabhängigkeit des Beugungsbildes und auch dessen Abhängigkeit von äusseren Parametern (z.B. Polymere unter äusserer Spannung oder im Strömungsfeld; Kinetik des Kristallwachstums; Kinetik des D-H-Austausches). Weiterhin werden in zunehmendem Umfang kompliziertere Systeme als bisher untersucht.

Die Weiterentwicklung der **Polarisationsanalyse** dient vor allem dem Verständnis der räumlichen Verteilung von magnetischen Elektronen in paramagnetischen Stoffen, was hohe Anforderungen an die magnetische Strukturanalyse stellt. Weiterhin ermöglicht sie die genaue Messung der magnetischen Fluktuationen von ungeordneten magnetischen Systemen (verdünnte Legierungen; Valenzfluktuationen; Spingläser). Diese Fragen hängen zum Teil mit einem der Grundprobleme des Magnetismus zusammen, nämlich der Frage nach der Lokalisierung der magnetischen Elektronen. Schliesslich geht möglicherweise die alte Hoffnung in Erfüllung, durch Spinanalyse die Selbst- und die Paarkorrelationsfunktionen für ein und dasselbe Atom getrennt zu bestimmen.

In der Kernphysik zeigt sich offensichtlich ein neuer Aufschwung bei den Präzisionsuntersuchungen von **neutroneninduzierten Reaktionen**. Dies betrifft auf der einen Seite das Studium sehr seltener Spaltereignisse, insbesondere der "kalten Fragmentation", bei der fast die gesamte Energie kinetisch und das Spaltprodukt fast nicht angeregt ist. Auf der anderen Seite zeigt sich neu erwachendes Interesse an den Anregungszuständen von Kernen mittels Gammaskopie im Lichte des "Interacting Boson"-Modells. Auch die Anwendung der Neutronen zum Studium elementarer Teilcheneigenschaften entwickelt sich weiter; dies betrifft im wesentlichen Experimente, welche sich mit der inneren Struktur des Neutrons selbst befassen, sowie Experimente mit Neutrinos aus dem Reaktorkern.

Arbeiten am Reaktor; das Strahlrohraustauschprogramm

Am 16. Dezember 1981 feierte das Institut das zehnjährige Jubiläum des Leistungsbetriebs des Höchstflussreaktors, wobei während dieser Periode nicht mehr als 1,5 % der vorgesehenen Betriebszeit durch unvorhergesehene Abschaltung verloren ging. Sieht man von den nachher erklärten Unterbrechungen ab, so konnte im übrigen den Gastgruppen wieder ein im wesentlichen vollwertiger Experimentierbetrieb ermöglicht werden.

Der grosse Reaktorhalt von Ende März bis Ende Juni wurde für wichtige Erneuerungs- und Verbesserungsarbeiten am Reaktor benutzt. Die grössten betrafen den erstmaligen Austausch eines Strahlrohres, nämlich eines Kanals an der heissen Quelle, sowie den Austausch der Neutronenleiternasen im Kanal H1/2. Die beiden ziemlich komplizierten Eingriffe verliefen ohne nennenswerte Dosisbelastung des betroffenen Personals und ohne unkontrollierte Kontamination. Weiterhin wurden Massnahmen getroffen, welche vor allem den Umgang mit den Instrumenten im Hinblick auf die Sicherheitsmassnahmen für die externen Benutzer übersichtlicher machen.

Das laufende Bestrahlungsprogramm an den Aluminiumproben wurde fortgesetzt. Das Studium dieser Proben sowie des im Oktober ausgebauten thermischen Kanals H 13 zeigten Material-Veränderungen als Folge der Strahlungs-dosis und auch als Folge des demineralisierten Wassers, dem das Material ausgesetzt ist. Die Reaktorabteilung hat inzwischen im Lichte aller vorliegenden Beobachtungen an diesen Materialien in enger Zusammenarbeit mit den französischen Sicherheitsbehörden die Betriebsbedingungen des Reaktors kritisch überdacht: Alle normalen, d.h. Helium-gefüllten Strahlrohre sind im Hinblick auf ein eventuelles Auslaufen von Schwerem Wasser im Falle einer Undichtigkeit durch die automatischen Ventile geschützt. Bezüglich des Vakuumkanals H 9 haben Vorbehalte, welche noch nicht ausgeräumt sind, zur präventiven Flutung mit Helium geführt. Infolgedessen musste zu unserem Bedauern das Instrument "Lohengrin" (PN1) vorübergehend stillgelegt werden.

Die Direktion wird im Wissenschaftlichen Rat im April 1982 einen Bericht über das geplante gesamte Strahlrohraustauschprogramm vorlegen. Dieses wird verbindliche Aussagen für die nähere Zukunft sowie Optionen für die folgenden Jahre enthalten. Das Programm betrifft voraussichtlich neun Strahlrohre und es wird spätestens 1985 abgeschlossen sein. Die vorliegenden Erfahrungen zeigten, dass unter günstigen Bedingungen ein Strahlrohr innerhalb eines normalen Reaktorhaltes ausgetauscht werden kann; die damit verbundene Stilllegung eines (oder eventuell auch zweier) betroffener Instrumente dürfte in der Regel mehrere Wochen bis zu einem Reaktorzyklus dauern. Pro Jahr können sicher zwei (eventuell auch drei) Strahlrohre ausgewechselt werden.

Wir bitten die wissenschaftlichen Gäste und Benutzer unserer Instrumente um ihr Verständnis dafür, dass nach zehn erfolgreichen Betriebsjahren unseres Reaktors die notwendigen Erneuerungsarbeiten unvermeidlich eine Störung des Instrumentenbetriebs verursachen. Das Institut wird grosse Anstrengungen unternehmen, damit diese so gering wie möglich bleiben und dass nach Ablauf der Erneuerungsperiode wieder ein vollwertiger Betrieb möglich sein wird.

Personalfragen

Am 1. Juli 1981 schied der stellvertretende französische Direktor, Herr J. Joffrin, aus dem Institut aus und seine Nachfolge trat Herr J. Winter an.

Am 1. Juli des Jahres 1981 übernahm Prof. Gönnerwein für eine Periode von zwei Jahren als Nachfolger von Dr. Jane Brown die Leitung der Abteilung Instrumentenbetrieb. Wie bereits im Wissenschaftlichen Rat besprochen, soll der Bereich "Vercors" aufgeteilt werden. Für den Teil, der sich mit chemischen und biologischen Fragestellungen befasst, wird Prof. Beaufils, der bisherige Leiter des Bereichs "Vercors", zuständig sein. Für den anderen Teil "Metallphysik und fehlgeordnete Stoffe" übernimmt hingegen am 1. Juli 1982 die Leitung Prof. Janot, der für fünf Jahre von der Universität Nancy an das ILL abgeordnet werden wird. Dies wird sicher die wissenschaftlichen Aktivitäten auf diesem wichtigen Gebiet neu beleben.

Im Hinblick auf das Modernisierungsprogramm mangelt es dem Institut an zusätzlichem und erfahrenerem Personal, welches von den nationalen Forschungszentren an das Institut für bestimmte Projekte angeordnet werden soll. Vor allem im technischen Bereich wirkt sich dies sehr spürbar auf den Ablauf dieses Programms aus. Wir werden alle nur möglichen Anstrengungen unternehmen, um diese Situation zu verbessern, die durch kürzliche Gesetzesmassnahmen bezüglich der Arbeit von Teilzeitkräften noch erschwert wurde.

Am Ende dieses Berichtes ist es unsere traurige Aufgabe, auch dieses Jahr wieder den Tod zweier unserer Mitarbeiter, der Herren Ammareller und Tournet, zu beklagen.

T. SPRINGER.
Direktor
Dezember 1981.

rapport du directeur

Prolongation de la Convention Intergouvernementale jusqu'en 1992

Le grand intérêt pour l'ILL manifesté par les chercheurs des trois pays membres, prouvé par l'utilisation des instruments et les résultats obtenus, a amené les Associés de l'Institut, en 1979, à approuver un programme de modernisation. Parallèlement aux activités scientifiques et techniques courantes, ce programme est désormais en voie d'exécution et son achèvement est prévu pour fin 1985.

En liaison avec ce dernier, l'avenant prolongeant la Convention intergouvernementale jusqu'en 1992 a été signé par les Ambassadeurs de la France et de la République Fédérale Allemande ainsi que par un représentant du gouvernement britannique le 9 décembre 1981 à Londres. L'Institut remercie les gouvernements des trois pays ainsi que le Comité de Direction de leur soutien qui a conduit à la réalisation du programme de modernisation ainsi qu'à la prolongation de la Convention intergouvernementale.

Programme de modernisation ; seconde source froide

Lors de sa réunion du 11 décembre 1981, le Comité de Direction a, après une discussion approfondie et une recommandation positive exprimée par le Conseil Scientifique, approuvé le projet le plus important du programme de modernisation, à savoir la construction de la source froide. Elle sera installée sur le canal H5 et alimentera six instruments placés sur deux guides de neutrons. En ce qui concerne ces instruments, nous envisageons d'en construire trois supplémentaires (leur nombre est actuellement de 35) ; ces deux emplacements pourront être occupés à la suite du transfert d'instruments existants à des positions de faisceau plus favorables ; enfin, un emplacement restera disponible pour un faisceau puissant éventuellement polarisé. La source sera mise en service en 1986. Elle renforcera et élargira les domaines où l'on peut penser que les recherches de l'Institut continueront à être couronnées de succès. Il s'agit avant tout de la spectroscopie neutronique à haute résolution utilisée pour les problèmes de chimie physique et de physique des solides, ainsi que de la diffusion aux petits angles utilisée pour la physique des polymères et des colloïdes ainsi que pour la biologie et la métallurgie ; enfin, l'utilisation des neutrons froids polarisés jouera un rôle déterminant en ce qui concerne les problèmes de magnétisme des solides et de physique des particules élémentaires.

Les divers instruments du programme de modernisation sont, ou bien en cours de construction, ou bien seront mis en service vers le milieu de 1982. Parmi ceux-ci, citons le spectromètre à trois axes IN 1B, le diffractomètre à liquides D4 B, le diffractomètre pour la biologie D 16B et le spectromètre à produits de fission à coïncidence PN8. Le spectromètre magnétique à trois axes IN 20 est en construction et sera monté fin 1982. Le complexe de diffractomètres D19/20/2B se trouve également en construction et l'appel d'offres aura lieu en 1982. La construction de la source verticale qui remplacera l'actuelle source froide, progresse de façon satisfaisante et son installation sera effectuée pendant le grand arrêt du Réacteur, fin 1982.

Le projet d'un diffractomètre magnétique, décidé à l'origine, est annulé à la suite d'une discussion approfondie au sein du Conseil Scientifique. Une partie des travaux de recherche prévus seront repris par l'instrument IN 20, mentionné précédemment. En liaison avec cette question, l'avenir des instruments PN 1 et IN4 a fait l'objet de discussions : ils fonctionneront au moins jusqu'en 1985/86. A ce propos, nous sommes arrivés à la conclusion positive que tous les instruments pouvaient systématiquement être, de temps à autre, remis en question, afin de placer aux différentes positions de faisceau le meilleur dispositif possible. La discussion sur les instruments au sein des sous-comités compétents du Conseil Scientifique s'est avérée particulièrement utile.

De nouveaux procédés sont la base essentielle de la mise au point d'instruments intéressants. C'est la raison pour laquelle, l'année dernière, des efforts ont été poursuivis dans ce domaine. Ils concernent : la mise au point de polarisateurs sur la base de miroirs à couches multiples ; la fabrication et l'utilisation de monochromateurs focalisants pour lesquels la collaboration avec les laboratoires extérieurs a joué un rôle particulièrement grand (Cristaltec, Institut de Physique des Solides de Jülich, Max Planck Institut pour la Métallurgie des Poudres de Stuttgart, Laboratoires Louis Néel, CNRS) ; enfin, la mise au point de multicompteurs à une et deux dimensions. Ce domaine prend une grande importance compte tenu du fait qu'il soulève des problèmes d'électronique et de logiciel pour l'exploitation des données "on-line" et il devra être soigneusement coordonné avec d'autres activités de l'Institut.

La construction du nouveau bâtiment "Chartreuse", en commun avec EMBL de Heidelberg, est maintenant pratiquement achevée. Il offrira également de meilleures possibilités de travail à nos visiteurs ainsi qu'un agrandissement des laboratoires. Soulignons tout particulièrement que le nouveau calculateur DEC 1091 fonctionne sans défaillance ; l'ancien calculateur DEC 10 a été définitivement arrêté fin novembre.

Réflexions sur la poursuite du programme scientifique

La prolongation de la vie de l'Institut Laue-Langevin amène à reproduire quelques réflexions élaborées l'année dernière sur l'avenir du programme scientifique de l'Institut. La diversité du programme "utilisateurs" et "Institut" permet d'identifier les thèmes qui aboutissent à d'intéressants développements. Nous pensons plus précisément aux quatre domaines suivants et souhaiterions recevoir à ce sujet les remarques complémentaires, voire contradictoires de nos collègues.

Mentionnons en premier lieu l'utilisation de la **méthode neutronique spin-echo**. Elle concerne tout d'abord l'étude du mouvement interne brownien des très grandes molécules : polymères, particules colloïdales et (sous réserve) systèmes biologiques. Il est en outre permis d'imaginer que l'alliance de la méthode spin-echo et de la spectrométrie à trois axes ouvrira de nouveaux domaines de recherches, à savoir la mesure précise de la durée de vie des phonons qui renseignera sur leur interaction avec des électrons, les rotations moléculaires, les défauts réticulaires, etc...

Citons, en second lieu, un domaine traditionnel de l'Institut où de nombreux problèmes restent à résoudre : celui de la **diffusion aux petits angles** pour l'étude de la morphologie des polymères, des systèmes biologiques (tels que, par exemple, virus, membranes) ainsi que des systèmes métalliques désordonnés. A l'avenir, ces recherches s'orienteront, sans doute, vers l'étude de tous les phénomènes cinétiques dans les divers domaines, c'est-à-dire de la mesure de la variation au cours du temps de l'image de diffraction ou bien de l'influence des paramètres extérieurs (par exemple polymères sous tension extérieure ou dans le champ de flux ; cinétique de la croissance cristalline ; cinétique de l'échange D/H). Par ailleurs, des systèmes plus compliqués que précédemment seront de plus en plus étudiés.

Le développement de l'**analyse de polarisation** sert, avant tout, à comprendre la répartition dans l'espace des électrons magnétiques dans des substances paramagnétiques — questions exigeant un niveau élevé de connaissance en matière d'analyse magnétique des structures. L'analyse de polarisation permet, en outre, de mesurer avec précision les fluctuations magnétiques des systèmes magnétiques désordonnés (alliages dilués ; fluctuations de valence, verres de spin). Ces questions sont, pour la plupart, liées à l'un des problèmes fondamentaux du magnétisme, la question de la localisation des électrons magnétiques. Enfin, peut-être l'ancien espoir de déterminer séparément, grâce à l'analyse de spin, les fonctions de corrélation de paires d'un seul et même atome et les fonctions d'autocorrélation, sera-t-il comblé un jour.

Dans le domaine de la physique nucléaire, les analyses précises des **réactions induites des neutrons** prennent, de toute évidence, un nouvel élan. Celles-ci concernent d'une part, l'étude des phénomènes très rares de fission, en particulier de la "fragmentation à froid" pour laquelle presque toute l'énergie est cinétique et le produit de fission, presque pas excité. D'autre part, un nouvel intérêt se manifeste pour les états d'excitation des noyaux grâce à la spectroscopie "gamma" à la lumière du modèle "Interaction Boson". En outre, l'utilisation des neutrons pour l'étude des propriétés des particules élémentaires se poursuit ; il s'agit essentiellement d'expériences ayant trait à la structure interne du neutron même, ainsi que d'expériences avec les neutrinos émis par le cœur du réacteur.

Travaux dans le Réacteur ; programme d'échange des doigts de gant

L'Institut a célébré le 16 décembre 1981 le 10^e anniversaire du fonctionnement du Réacteur à Haut Flux ; sur toute cette période, les arrêts imprévus représentent moins de 1,5 % du temps de fonctionnement. Si l'on fait abstraction des interruptions mentionnées ci-après, un fonctionnement expérimental de qualité a pu être mis à disposition des groupes extérieurs.

Le grand arrêt du Réacteur qui a duré de fin mars à fin juin 1981, a été mis à profit pour effectuer d'importants travaux d'amélioration et de rénovation dans le Réacteur. Les plus importants concernent l'échange, réalisé pour la première fois, d'un doigt de gant, à savoir un canal sur la source chaude ainsi que le remplacement des nez des guides de neutrons sur le canal H1/2. Ces deux interventions assez complexes se sont déroulées sans irradiation notable du personnel concerné ni contamination incontrôlée. Par ailleurs, des mesures ont été prises, afin de rendre plus compréhensible aux utilisateurs extérieurs le maniement des instruments du point de vue de la sécurité.

Le programme d'irradiation en cours des échantillons d'aluminium a été poursuivi. L'étude de ces échantillons ainsi que celle du canal thermique H13, démonté au mois d'octobre, a montré des altérations du matériau qui sont la conséquence des doses d'irradiation à laquelle ce matériau est exposé ainsi que de la présence d'eau déminéralisée. A la lumière des observations faites, le Département Réacteur a, en collaboration étroite avec les services français de sécurité, repensé d'un point de vue critique les conditions de fonctionnement du Réacteur. Pour tous les doigts de gants normaux, c'est-à-dire remplis d'hélium, la sécurité est préservée en cas de fuite éventuelle d'eau lourde par des vannes automatiques. En ce qui concerne le canal sous-vide H9, certaines réserves qui n'ont pu encore être écartées, ont conduit à le remplir d'hélium à titre préventif, ce qui a, à notre regret, entraîné l'arrêt temporaire de l'instrument "Lohengrin".

La Direction soumettra au mois d'avril 1982 au Conseil Scientifique un rapport sur l'ensemble du programme de remplacement des doigts de gant. Ce dernier comportera des mesures engageant l'Institut pour un proche avenir ainsi que des options pour les années suivantes. Ce programme concernera probablement neuf doigts de gant ; il sera achevé, au plus tard, en 1985. Les expériences récentes montrent que, dans des circonstances favorables, un doigt de gant peut être échangé pendant un arrêt normal du Réacteur ; l'arrêt qui en résulte d'un (ou éventuellement de deux) instruments concernés sera probablement d'une durée allant de quelques semaines à un cycle du Réacteur. Il est permis d'espérer que deux (éventuellement trois) doigts de gant pourront être remplacés chaque année.

Nous demandons à nos chercheurs invités, utilisateurs de nos instruments, de bien vouloir comprendre qu'après dix années ininterrompues de fonctionnement du Réacteur, les travaux de rénovation inévitables, entraînent nécessairement une perturbation du fonctionnement instrumental. L'Institut s'efforcera de la réduire au maximum et de parvenir, à l'expiration de la période de rénovation, à un fonctionnement normal.

Questions de personnel

C'est le 1^{er} juillet 1981 que le Directeur Adjoint français, M. J. Joffrin, a cessé ses fonctions à l'Institut : M. J. Winter lui a succédé.

A la même date, M. Gönnerwein a pris, pour une période de deux ans, la direction du Département Exploitation des Instruments, en tant que successeur de J. Brown. Ainsi qu'il en a été discuté au Conseil Scientifique, le domaine "Vercors" sera partagé. Cette mesure est désormais possible. M. Beaufils, actuellement à la tête du domaine Vercors, sera compétent pour toutes les questions d'ordre chimique et biologique. L'autre domaine, celui de la "Physique des Métaux et des systèmes désordonnés", sera confié à partir du 1^{er} juillet 1982 à M. Janot, détaché de l'Université de Nancy pour une durée de cinq années à l'ILL. Cette décision imprimera certainement un nouvel essor aux activités scientifiques de cet important domaine.

Par suite du programme de modernisation, l'Institut manque de personnel expérimenté supplémentaire devant être détaché des centres de recherche nationaux pour certains projets.

C'est avant tout dans le domaine technique que ce manque de personnel exerce ses effets sur le déroulement du programme de modernisation. Nous nous efforcerons de remédier à cette situation, rendue encore plus difficile par les nouvelles mesures législatives relatives au travail du personnel en régie.

En conclusion de ce rapport, nous avons le triste devoir de faire part, cette année également, du décès de deux de nos collaborateurs, MM. Ammareller et Tournet.

T. SPRINGER.
Directeur
Décembre 1981.

director's report

Extension of the Intergovernmental Agreement until 1992

The great interest shown by the scientists from the three partner countries of the Institut Laue-Langevin in the use of the instruments and their results to date led the Associates of the ILL to approve in 1979 a modernisation programme for the Institut. This is now in progress in parallel with the normal scientific and technical work of the Institut, and the modernisation measures should be completed by the end of 1985. Associated with this was the extension of the Intergovernmental Agreement on the ILL until 31 December 1992. This document was signed by the Ambassadors of France and the Federal Republic of Germany as well as by a representative of the British Government in London on 9 December 1981. The Institut is grateful to the governments of the three countries and to the Steering Committee for their support, which has resulted in the modernisation programme and finally in this agreement.

Modernisation Programme; Second Cold Source

After a detailed discussion at the meeting of the Steering Committee on 11 December 1981, following the positive recommendation by the Scientific Council, approval was given to the Second Cold Source, the largest project under the modernisation programme. It will be installed in the horizontal beam-tube H 5, and with neutron guides it will serve six instruments. Our present plan is that three additional instruments will be built (at present there are 35 user instruments); two positions can be occupied by the transfer of existing experiments to (better) beam positions; one position finally is available as a stronger, possibly polarised beam.

The source should be operational in 1986. It will strengthen and extend the scientific work in research fields in which the Institut can expect to be particularly successful in the future. This concerns in particular high resolution neutron spectroscopy for problems of physical chemistry and solid state physics, small angle scattering for the physics of polymers and colloids, for biology and metal physics; finally the application of cold polarised neutrons to problems of solid state magnetism and to elementary particle physics will also have an important part to play.

The various instruments in the modernisation programme are either under construction or will start operation in the middle of 1982. This includes the triple-axis spectrometer IN 1B, the liquids diffractometer D4 B, the biology diffractometer D16 B and the fission product coincidence spectrometer PN8. The magnetic triple-axis spectrometer IN 20 is under construction and will be installed at the end of 1982. The H11 complex (D19/D20/D2B) is now also at the construction stage and the invitation to tender will be issued in the middle of 1982. The construction of the vertical source, to replace the existing cold source, is making good progress, and installation should take place at the end of 1982.

The project for a magnetic diffractometer which was previously agreed has been cancelled after detailed discussion in the Scientific Council. Part of the research work planned for this diffractometer will be taken over by IN 20, the instrument mentioned above. In connection with this question the future of the instruments PN1 and IN4 was discussed; these are to continue operation at least until 1985/86. The useful knowledge has been gained from this discussion that all instruments should be reexamined from time to time, to ensure that the available beam positions are always used for the best possible instruments. The discussion of the instruments in the appropriate subcommittees of the Scientific Council was regarded as particularly useful.

New procedures are the most important basis for the development of interesting instruments. Great efforts have therefore been made in this area in the past year. This includes the further development of polarisers on the basis of multilayer mirrors; the production and use of focussing monochromators, in cooperation with external laboratories, particularly Cristaltec, the Institut für Festkörperforschung (Solid State research) at Jülich, the Max-Planck-Institut für Pulvermetallurgie (powder metallurgy) at Stuttgart and the Louis Neel Laboratory, CNRS; and finally the further development of one and twodimensional multicounters. This area is becoming very important, in particular in view of the associated problems of electronics and software for on-line evaluation, which must be carefully coordinated with other activities at the Institut.

The new "Chartreuse" building, which has been built jointly with EMBL (Heidelberg), has now been almost completely occupied. Among other improvements this provides better accommodation for our visitors, and increased laboratory space. We are pleased to report that the new DEC 1091 central computer is operating satisfactorily; the old DEC 10 was finally disconnected at the end of November.

Thoughts on the Further Development of the Scientific Programme

The extension of the life of the Institut Laue-Langevin makes it desirable to record some reflections from the past year on the future of the ILL's scientific programme. Subject areas can be identified out of the wide range of "user" and "in house" programmes, where interesting developments may be expected. We are thinking of the following four areas, and we should particularly welcome complementary or contradictory comments from our colleagues on this.

The utilization of the *neutron spinecho method* with all its possibilities has only begun. This concerns first of all the investigation of the internal Brownian movement of very large molecules such as polymers, colloidal particles, and (with reservation) biological systems. It is also conceivable that the combination of spinecho methods and triple-axis spectrometry will open up new areas, i.e. the precise measurement of the life of phonons; giving information on their interaction with electrons, molecular rotations, lattice defects, etc.

A traditional field of the ILL, which covers a large number of problems, is *small angle scattering* for the study of the morphology of polymers, biological systems (e.g. viruses, membranes) and also of disordered metallic systems. Future developments will probably be in the direction of the investigation of kinetic phenomena in all these fields, i.e. the measurement of the time dependence of the diffraction pattern, or its relation to external parameters (e.g. polymers under external stress or in the flow field; kinetics of crystal growth, kinetics of the D-H exchange). More complicated systems than in the past will be increasingly studied.

The further development of *polarisation analysis* is particularly useful for the understanding of the three-dimensional distribution of magnetic electrons in paramagnetic materials, which makes great demands on the magnetic structure analysis. This also connects the precise measurement of the magnetic fluctuations of disordered magnetic systems (dilute alloys, valency fluctuations, spin glasses). These questions are often connected with one of the basic problems of magnetism, i.e. the question of the localisation of the magnetic electrons. Finally it is possible that the old hope may be fulfilled that the self — and pair — correlation functions for the same atom can be determined separately.

In nuclear physics there appears to be a new interest in precision measurements of *neutron-induced reactions*. This covers on the one hand the study of very rare fission events, in particular "cold fragmentation", where almost the entire energy is kinetic and the fission product is scarcely excited. On the other hand there is a new interest in the excitation stage of nuclei by means of gamma spectroscopy in the light of the "interacting Boson model". The application of neutrons to the study of elementary particle properties is also developing further; this covers essentially experiments on the inner structure of the neutron itself, and experiments with the neutrinos from the reactor core.

Work on the Reactor; The Beam-Tube Replacement Programme

On 16 December 1981 the Institut celebrated the tenth anniversary of the first time the high flux reactor reached full power. During this period only 1.5% of the programmed operating time was lost due to unscheduled shutdowns. Apart from the interruptions explained below, practically normal experimental operation was possible for the user groups.

The long reactor shutdown from the end of March until the end of June was used for major replacement and improvement work on the reactor. The largest projects were the first ever replacement of a beam tube (at the hot source) and the replacement of the neutron guide noses in the beam tube H1/2. The two very complicated interventions were carried out without any notable irradiation of the staff concerned or any uncontrolled contamination. Measures were also taken to make the handling of instruments clearer for external users as regards safety precautions.

The current irradiation programme on the aluminium samples was continued. The study of these samples and of the thermal beam tube H13 removed in October has shown material changes as a result of irradiation and of the demineralized water to which they are exposed. In the light of all information available on this material the reactor department has carried out a critical review of the reactor operating conditions in close cooperation with the French safety authorities. All normal, i.e. helium-filled beam tubes are protected by automatic valves against a possible leak of heavy water. Reservations which could not be eliminated for the time being on the vacuum tube H9 have led to preventive flooding with helium. As a result we regret that the instrument "Lohengrin" has had to be closed down for a limited period.

The ILL Management will submit a report on the planned overall beam tube replacement programme to the Scientific Council in April 1982. This will give precise information for the immediate future, and options for the following years. The programme is expected to cover 9 beam tubes and will be completed not later than 1985. Experience to date shows that under favourable conditions a beam tube can be replaced during a normal reactor shutdown; the associated closure of one (or possibly two) instruments should normally last from a few weeks to one reactor cycle. Certainly two (possibly three) beam tubes can be replaced each year.

We ask our guest scientists and instrument users to appreciate that after the successful years of operation of our reactor the necessary renewal work inevitably causes some disturbance to the instrument operation. The Institut will make every effort to ensure that these disturbances are kept to a minimum and that full operation will be possible again after completion of the modernisation work.

Scientific Staff

On 1 July 1981 Mr J. Joffrin, the French Assistant Director, left the Institut, and was succeeded by Mr J. Winter.

On 1 July 1981 Professor Gönnerwein succeeded Dr. Jane Brown as Head of the Instrument Operation Department for a period of two years. As has already been discussed in the Scientific Council, the "Vercors" area is to be divided. This step has now become possible. Professor Beaufils, the present Head of the "Vercors" area will be responsible for chemical and biological questions. Professor Janot, who will be seconded to the ILL for five years from 1 July 1982 from the University of Nancy, will be responsible for the other part, Metal Physics and Disordered Materials. This will certainly give a new lease of life to the scientific activity in this important area.

With regard to the modernisation programme the Institut is in need of additional experienced staff to be seconded to the Institut from the national research centres for particular projects. The effect of this on the implementation of the modernisation programme is particularly noticeable in the technical area. We shall make every effort to improve the situation, which has been made still more difficult by new legislation on the employment of part-time staff.

It is with sadness that we close this report by recording the death of two of our colleagues, Mr Ammareler and Mr Tournet.

T. SPRINGER.
Director
December 1981.

1

instrumentation

Einleitung

Ein Teil der im Modernisierungsprogramm begonnenen Instrumente geht im Jahre 1982 in Betrieb, nämlich das Dreiachsenspektrometer IN 1B und das Diffraktometer für Flüssigkeiten D4 B, beide an der heissen Quelle, das Diffraktometer für biologische Experimente D 16B und PN 8, das Spaltprodukt-Koinzidenzspektrometer. Mit der Konstruktion und/oder der Fabrikation des magnetischen Dreiachsenspektrometers IN 20 und des Einkristalldiffraktometers D 19 mit Vielfachzähler wurde inzwischen begonnen. Das Instrument IN 20 wird 1982, das Instrument D 19 im Jahre 1983 installiert. Die Konstruktion von D 2B und D 20, welche mit D 19 eine Einheit am Kanal H 11 bilden, wurde ebenfalls in Angriff genommen. Der Aufbau dieser Instrumente wird erst 1983 erfolgen. Das Projekt des magnetischen Diffraktometers D 5B wurde, entgegen der ursprünglichen Absicht, zugunsten des Strahls für die zweite Kalte Quelle annulliert. Die für D 5 B vorgesehenen Aufgaben können teilweise durch das Instrument IN 20 wahrgenommen werden.

Schliesslich wurde der Neubau von D 7 (genannt D7 B) als Spektrometer mit Spinanalyse sowie die Erweiterung von IN 11 durch einen Vielfachzähler zur Messung sehr kleiner Impulsüberträge entschieden. Die Arbeiten für diese Instrumente wurden in die Wege geleitet.

Einen Gesamtüberblick über alle Instrumente und ihre Anordnung am Reaktor bzw. in der Neutronenhalle gibt die nachfolgende schematische Darstellung.

Nach wie vor wird der Methodenentwicklung grosse Aufmerksamkeit gewidmet. Darüber werden genauere Einzelheiten in den entsprechenden Kapiteln des Jahresberichts wiedergegeben, und zwar über Vielfachzähler und Superspiegel im folgenden Abschnitt "New Experimental Techniques" und über die Entwicklung von Monokromatorkristallen im Kapitel 2 "Instrument Operation".

Das grösste Projekt im Rahmen des Modernisierungsprogramms ist die zweite Kalte Quelle, über deren Bau nunmehr entschieden worden ist. Die Quelle soll zwei Neutronenleiter speisen und Platz für sechs verschiedene Instrumente geben. Sie soll im Jahre 1986 in Betrieb gehen.

Der Ersatz des Carine-Systems ist nun weitgehend vollzogen und die meisten Instrumente sind mit Kleinrechnern ausgestattet.

Introduction

Some of the instruments started under the modernisation programme will begin operation in 1982, i.e. the triple-axis spectrometer IN 1B and the liquids diffractometer D4 B, both on the hot source; the diffractometer for biological experiments D16 B and the fission product coincidence spectrometer PN 8. A start has also been made on the construction and/or manufacture of the magnetic triple-axis spectrometer IN 20 and the single-crystal diffractometer D 19 with multi-counter. The instrument IN 20 will be installed in 1982 and D 19 in 1983. The construction of D 2B and D 20, which form one complex with D 19 on beam tube H 11, has also been started. These instruments will be installed in 1983. Contrary to the original intention, the project for the magnetic diffractometer D 5B has been cancelled in favour of the beam for the second cold source. The work planned for D5 B can be partly taken over by IN 20.

Finally the reconstruction of D 7 (known as D7 B) as a spectrometer with spin analysis, and the extension of IN 11 by a multiscaler for the measurement of very small momentum transfers has been decided. Work has started on these instruments.

The following diagram gives an overall view of all the instruments and their arrangement around the reactor or in the neutron guide hall.

Great attention has continued to be paid to the development of methods. Further details of this are given in the appropriate sections of the Annual Report, multiscalers and supermirrors being covered in the next section in "New Experimental Techniques" and the development of monochromator crystals in section 2 "Instrument Operation".

The largest project under the modernisation programme is the second cold source, the construction of which has now been decided. The source is to serve two neutron guides and to provide space for six different instruments. It is to start operation in 1986.

The replacement of the Carine system is now largely completed, and most of the instruments have been equipped with mini-computers.

Introduction

Une partie des instruments commencés dans le cadre du Programme de Modernisation entreront en fonctionnement en 1982, à savoir : le spectromètre à trois axes IN 1B et le diffractomètre pour fluides D4 B, tous deux installés sur la source chaude, le diffractomètre pour les expériences biologiques D 16 B et le spectromètre à coïncidence de produits de fission PN 8. Depuis a commencé la construction et/ou la fabrication du spectromètre magnétique à trois axes IN 20 et du spectromètre à monocristal D 19 avec multicompteurs. L'instrument IN 20 sera installé en 1982 et l'instrument D 19 en 1983. La construction de D 2B et D 20, formant une unité avec D 19 sur le canal H11, a également été entreprise. Le montage de ces instruments se fera en 1983. Le projet du diffractomètre D 5B a été annulé, contrairement à ce qui était prévu initialement, en faveur du faisceau pour la deuxième source froide. Les expériences qu'il était prévu de réaliser sur D 5B pourront l'être en partie sur IN 20.

Enfin, la reconstruction de D 7 (dénommée D 7B) en spectromètre avec analyse spin ainsi que l'extension d'IN 11 au moyen d'un multicompteur pour mesurer de très faibles transferts d'impulsions, ont été décidées. Les travaux pour ces instruments ont été mis en route.

Le schéma suivant donne une vue d'ensemble de tous les instruments et de leur position sur le réacteur ainsi que dans le hall des guides de neutrons.

Une grande attention est toujours consacrée au développement des méthodes. Les précisions sont données dans les chapitres correspondants du rapport annuel; en ce qui concerne les multicompteurs et les supermiroirs; dans la partie intitulée "New Experimental Techniques" et pour ce qui est du développement des cristaux monochromateurs: au chapitre 2 "Instrument Operation".

Le projet le plus important dans le cadre du Programme de Modernisation est la deuxième source froide, dont la construction vient d'être décidée. Cette source doit alimenter deux guides de neutrons et fournir de la place pour six instruments différents. Elle doit entrer en fonctionnement en 1986.

Le remplacement du système Carine est maintenant achevé et la plupart des instruments sont équipés de mini-ordinateurs.

statistics and instrument tables

Table I — Instrument operation January-December 1981. The reactor has operated for 206 days during 1981. Operating time which was affected by unscheduled shut-downs was recuperated by extending the operating cycle.

| Instrument | Scheduled Operating Time (days) | Coll. 3 | Coll. 4 | Coll. 5 | Coll. 6 | Coll. 7 | Coll. 8 | Coll. 9 | Instrument tests, experiment change- over and minor repairs | Comments | |
|------------|---------------------------------------|------------|------------|------------|------------|------------|------------|------------|---|--|--------------------------------------|
| IN1 | 34 | 15 | | | | | 19 | | | Operating to March 1981 - Removed for rebuild. | |
| IN2 | 152 | 138 | | | | | 24 | | 54 | | |
| IN3 | 152 | 130 | | | | | 12 | | 10 | 54 | |
| IN4 | 145 | | | | 32 | | 59 | | 54 | 61 | |
| IN5 | 161 | | | | 27 | | 45 | | 3 | 86 | 45 |
| IN6 | 96 | | | | 30 | | 17 | | 6 | 43 | Commissioned June 1981. |
| IN8 | 52 | 52 | | | | | | | | Extensive modifications March-Dec. 1981. | |
| IN10 | 119 | | | | 15 | | 30 | | 74 | 43 | One reactor cycle for analyser test. |
| IN11 | 160 | 36 | | 10 | | 11 | | 19 | 84 | 46 | |
| IN12 | 148 | 92 | | 16 | | 28 | | 12 | | 58 | |
| IN13 | 55 | | | | | | 32 | | 5 | 18 | Commissioned June 1981. |
| D1A | 164 | 149 | | | | | 15 | | | 42 | |
| D1B | 142 | | | | 77 | | 3 | | 5 | 57 | 64 |
| D2 | 154 | 48 | | 44 | | 22 | | 40 | | 52 | |
| D3 | 155 | 155 | | | | | | | | 51 | |
| D4 | 28 | 4 | | 24 | | | | | | Operating to March 1981 - removed for rebuild. | |
| D5 | 136 | 116 | | 20 | | | | | | Reduced schedule. Installation of PDP11/34. | |
| D7 | 46 | | | | 4 | | 42 | | | Instrument withdrawn for Tanzboden and polarisation analysis installation. | |
| D8 | 160 | 160 | | | | | | | | 46 | |
| D9 | 152 | 152 | | | | | | | | 54 | |
| D10 | 55 | 55 | | | | | | | | Reduced schedule. Spin-echo tests. | |
| D11 | 149 | | | | 4 | | 26 | | 59 | 60 | 57 |
| D15 | 158 | 156 | | | | | | 2 | | 48 | |
| D16 | 44 | | | | | | | 27 | | 17 | Rebuild and commissioning. |
| D17 | 167 | 3 | | 5 | | 29 | | 56 | | 74 | 39 |
| D18 | 60 | 15 | 20 | | 18 | | 7 | | | First scheduled in July 1981 | |
| PN1 | 171 | 171 | | | | | | | | 35 | |
| PN2 | 165 | 165 | | | | | | | | 41 | |
| PN3 | 181 | 181 | | | | | | | | 25 | |
| PN6 | 178 | 178 | | | | | | | | 28 | |
| PN8 | 0 | | | | | | | | | Instrument under installation. | |

Table II — New Instruments or Instrument Reconstructions

| | |
|-------------------------|---|
| D4B* | D4B (replacing D4) is a liquids diffractometer operating in the wavelength range of $0.3 < \lambda < 0.7 \text{ \AA}$. A considerably higher flux will be achieved by curved monochromators. It will be equipped with a 64 cell multidetector and a small angle scattering facility ($Q \geq 0.05 \text{ \AA}^{-1}$). The reconstruction work is progressing smoothly. The joint D4B/IN1 monochromator shielding is near completion and the spectrometer body is assembled. Separate tests of the data acquisition system and of the multidetector are presently being made on a separate beam. The instrument will be installed on the Tanzboden by early Spring 1982. |
| IN1B* | IN1B Triple-Axis Spectrometer at the Hot Source. Utilizing the total aperture of the beam-hole H8 as well as vertically curved monochromators and analysers, the neutron flux on IN1B will be substantially increased. It will also have higher and lower take-off angles with respect to IN1. The monochromator shielding of the new instrument has been installed at the reactor. A monochromator with variable vertical curvature will permit an optimal vertical focussing at different monochromator take-off angles and will be controlled by a SOLAR computer. The secondary spectrometer is presently being assembled and tested on a separate Tanzboden. The instrument will be completed from a mechanical and electronic point of view and installed at its position by early spring 1982. Test runs with and without neutrons will follow and the commissioning of the instrument is expected by Summer 1982. |
| PN8 "Cosi fan tutte" | This fission product mass spectrometer measures the speed and energy of the primary fission products in coincidence by a 10^{-9} s time-of-flight technique and two high resolution ionisation chambers and will allow greater flexibility in the choice of targets compared to PN1 where the target is in-pile. The installation of the instrument is expected by early 1982. |

* Time-sharing mode with IN1B and D4B, respectively.

Table III — Instrument Modifications

| | |
|------|---|
| D3 | <p>Polarized Neutron Diffractometer</p> <p>The 3 months reactor shut-down was used as a unique opportunity for renewing the continuously running 4.6 Tesla cryomagnet. A compact variable temperature insert has been designed which was largely copied from the well-tested "ILL-system". This new insert was manufactured at the ILL as a replacement for the existing sample chamber. At the same time the liquid helium bin capacity was doubled. The helium autonomy is now 4 days independent of the sample temperature which can be varied continuously in the range 1.3 - 300 K.</p> <p>The above amendment has turned out to be a full success and was due to the excellent work of the ILL's Cryogenics Lab.</p> |
| D7 | <p>Diffuse Scattering Instrument</p> <p>D7 was put back into service after being shut down for the installation of a new focussing monochromator and a new monochromator shielding and the building of a Tanzboden Floor. The instrument is now routinely available again with unpolarized and polarized neutrons (polarization with super-mirror polarizer). Polarization analysis will be available as from February 1982 with a configuration of 8 detectors (to be increased to 32). A high field superconducting magnet ($H = 11$ Teslas!, asymmetric split Helmholtz pair coils for polarized neutrons, 30 mm gap) is expected to arrive at the beginning of 1982 and will be routinely available for users.</p> |
| D10 | <p>4-Circle Diffractometer with Analyser</p> <p>As from January 1982 D10 will be equipped with its new much more flexible analyser protection which gives the possibility to perform energy scans. To improve the resolution, collimators are foreseen before and after the analyser. In order to use this improved facility in an efficient way the corresponding software for inelastic measurements has been adapted and successfully tested. Due to its limited flux and resolution D10 will never replace a triple-axis instrument like IN3, but it should be mentioned that it combines the advantage of the Eulerian cradle with the energy analysis. For variable low temperature experiments the D10 4-circle cryostat (4 - 300 K) is now computer-controlled so that automatic temperature changes are programmable in advance.</p> <p>The D10 Spin-Echo test facility has been successfully operated for quasi-elastic scattering for which relative energy resolutions of 10^{-4}, i.e. 100 times better than classically, have been obtained. Phonon work has been initiated and will go on in 1982.</p> |
| D16B | <p>Multidetector Diffractometer at the Cold Source for $0.03 < Q < 2\text{\AA}^{-1}$.</p> <p>Test experiments on membranes, polymers, clays, liquid crystals, biological solutions, surface chemistry, and single crystals have been conducted and have demonstrated the instrument's performance, capabilities and limitations. The instrument's mechanical parts are near completion. Basic data acquisition and data treatment software are being developed. The cooled Beryllium filter is mounted, with automatic filling of liquid nitrogen, but the permanent shielding of the filters is yet to be built. A design for the collimator shielding has been established and installation should be at the end of January. The data treatment programs for powder and solution work are written, being tested and will be fully implemented during the first reactor period in 1982. The instrument is scheduled for normal running in this period for all but large unit cell crystal experiments. Development of data handling for single crystals will also be done in the same period, so that experiments of this kind might be scheduled at the Spring meeting of the Scientific Council.</p> |
| IN8B | <p>Improved 3-Axis Spectrometer at the Thermal Hole</p> <p>There has been a certain delay of the commissioning of this instrument due to the combination of novel mechanical and electronics equipment. The problems encountered during the test runs in autumn seem to be resolved now and it is hoped that IN8B will be fully operational again by early 1982.</p> |

Table IV — Approved Projects of Instrument Replacements

| | |
|-----------------------------|---|
| IN20 | <p>New Magnetic 3-Axis Spectrometer</p> <p>The construction of the non-magnetic monochromator protection required for magnetic and spin-echo operation is proceeding satisfactorily and on schedule.</p> <p>Detailed design studies have been made for the monochromator support, the velocity selector (for suppression of 2nd and 3rd order neutrons) and the incident beam line. All of the standard, 3-axis rotation modules have been ordered and detailed design of the secondary spectrometer will commence early in 1982.</p> |
| H11-Project (D2B, D19, D20) | <p>For this project, the first tenders relating to the shielding of D19B and the tunnel (for D20 and D2B) will be dispatched in Spring 1982.</p> <p>The second part of the shielding (turret for D20 and D2B) is presently being studied and tenders will be sent out shortly.</p> |

Table V — New Sources and Neutron Techniques

| | |
|-----------------------------------|--|
| Improved Vertical Cold Source VCS | <p>This re-designed cold source replaces the existing one and by virtue of a re-entrant thimble which penetrates to the centre of the D2 moderator vessel, increases the intensity for all cold neutron guides by almost a factor of 2. The installation of a vertical neutron guide is foreseen which will deliver neutrons of 50 m/sec which can be decelerated by a Steyerl-turbine to obtain ultra-cold neutrons. The expected UCN-flux will be much higher than that obtained at the present PN5 facility.</p> <p>The construction of the replacement of the present cold source is progressing normally. The long shut-down from November 18, 1982 until approx. January 5, 1983 will be used for its installation.</p> |
| Improved UCN Liquid Helium Source | <p>The new source which is expected to produce UCN densities of the order of 100 times greater than presently available will be installed at the guide H17 in early Spring 1982.</p> |
| Second Cold Source | <p>At its meeting of 8 December 1981 the Steering Committee approved the construction of a Second Cold Source. This new source is expected to be operational in 1985/86. The beam position envisaged for this horizontal source is H5 (presently serving as beam-tube for D3). Two neutron guides are planned, one being straight to allow for a substantial flux increase in the range 2-6 Å and the other curved for instruments requiring longer wave-lengths (up to 25 Å). So far 3 new instruments have been envisaged: a 3-axis spectrometer, a diffuse scattering machine on the D7 type and a high intensity diffractometer for biology. In addition a high flux polarized neutron beam for special experiments in fundamental physics will be provided. A full description of the 2nd Cold Source may be obtained, on request, from the Office of the Scientific Secretary.</p> |
| Super-Mirrors | <p>The angle of reflectivity of super-mirrors has been further increased. This angle is now a factor of 3 above the critical angle of Nickel.</p> <p>Polarizers using super-mirrors were tested on S6 (thermal beam) and yielded a transmission of 25% of the whole spectrum with the right spin. Using a polarizer with a radius of curvature of 10 m at PN7, a transmission of 52% of the total spectrum has been achieved. The measured polarization was in all cases 94% or higher (including the flipper efficiency being the limiting factor in the case of a broad spectrum).</p> <p>During the forthcoming months a super-mirror polarizer will be used in conjunction with a multidetector ("banana"). The extension of D7 as a multidetector instrument with polarization analysis is progressing well.</p> |

Table VI — Special Beam Experiments carried out, in Progress or under Preparation during 1981

In addition to the 35 permanently installed instruments the ILL is operating a number of special beam facilities (so-called S experiments). These are normally under the full scientific responsibility of external research groups and do not follow the usual scheduling procedure. Technical help and financial support is essentially provided by the external groups. Nevertheless, these facilities are also supported by the ILL to a limited extent and external groups are encouraged to submit proposals for such experiments to the ILL.

| Experiment Number | Beam Position | Proposed by | Title | Time Allocated |
|-------------------|---------------|--|--|----------------|
| 3-07-001 | H 142 | Harvard, Rutherford, Ispra, Sussex Univ. | Search for parity violating neutron spin rotation in Bi & Be | 2 cycles |
| 3-05-018 | H 142 | ILL, Harvard, ISN | Search for parity violation in neutron-proton capture | 4 cycles |
| 7-04-008 | H 16 | Berlin, Munich | Determination of range profiles and lattice positions | Long-term |
| 8-08-008 | H 17 | Grenoble, Uppsala, Rouen | Neutron capture in biological specimens | 60 days |
| 3-05-009 | H 17 | Bonn Univ. | Magnetic bottle for neutron storage at external UCN source | 94 days |
| 3-12-004 | H 18 | CERN, Rutherford, Sussex Univ., Padua Univ. | Search for NN Transitions | 4.5 cycles |
| 01-003 | H 21 | Braunschweig | Experimental determination of h/m | Long-term |
| | H 22 | Darmstadt, Bordeaux, Tübingen, Braunschweig, ILL | 10 in-beam fission experiments; (n, α), (n, γ) reactions | 4.5 cycles |
| 7-03-232 | H 24 | Stuttgart | Comparison of macroscopic & microscopic thermal expansion | Long-term |
| 7-04-005 | H 25 | Munich Univ. | Determination of concentration profiles by (n, γ) and (n, p) reactions | Long-term |
| 3-03-008 | IH 3 | Sussex Univ., Harvard, Munich | Magnetic neutron bottle | Long-term |
| 3-05-033 | IH 3 | Munich Univ. | Image fabrication with UCN | 90 days |
| 3-03-008 | IH 3 | Sussex Univ., Harvard Univ. | Search for EDM of the neutron | Long-term |
| 3-13-22 | B 42 | Munich/Pasadena | Search for axion decay | 90 days |

new experimental techniques

High resolution ionization chamber

(A. Oed, P. Geltenbort, F. Gönnerwein)

The new fission fragment spectrometer "Cosi fan tutte" is under construction under the modernisation programme. With this instrument fragment masses are determined by measuring simultaneously the velocities and kinetic energies of fragments. The velocities are taken by a time-of-flight technique¹. The effort in 1981 was focussed onto the performance of the energy detectors. To achieve a one-to-one mass resolution for a typical fission fragment (in the light mass wing) of mass 100 u and kinetic energy 100 MeV an energy resolution below 1 MeV is required. As this condition cannot be met by the standard heavy ion surface barrier detector one has to go back to gaseous detectors. The challenge, then, is to try to improve the performance of ionization chambers. Two basic designs are known from the literature, one with the electric field perpendicular to the particle trajectory and the other with the field oriented in parallel to the particle path. From the outset the second version was felt to be more promising if a high energy resolution is to be maintained on a large diameter entrance window of the chamber. Accordingly, an "axial" ionization chamber was built with the entrance window serving as a cathode and the fragments to be detected heading towards the Frischgrid and anode. It is very likely that the performance of previous chambers has been mainly impeded by the quality of the thin foils used as entrance windows to the detector volume under gas pressure. These foils should be as thin and as homogeneous as possible in order to avoid excessive energy loss straggling of ions traversing the foils. Two types of foil were tested. One was made from polypropylene (stretched under heat down to a thickness of 60 $\mu\text{g}/\text{cm}^2$), while the other was a commercial "Parylene C" foil with a thickness of 30 $\mu\text{g}/\text{cm}^2$. The second foil proved to be somewhat superior. Another crucial point is the proper choice of the counting gas. In order to prevent large non-ionizing energy losses by head-on collisions between the incoming heavy ions (i.e. fission fragments) and the gas atoms, a gas with light constituent atoms (and of course low ionization energy) should be chosen. Tests were run with high purity methane, n-butane and isobu-

tane. The results were very similar. However, isobutane was finally selected due to its higher stopping power which allows for lower gas pressures (and therefore thinner windows) in a given chamber geometry. The layout of the chamber was carefully designed to ensure gas cleanliness (only gold-plated stainless steel and ceramic components were used), electric field homogeneity and sparkfree high voltage on all electrodes. Finally, the performance of the chamber was checked on the Lohengrin facility. With all parameters optimized an energy resolution well below 400 keV has been reached for typical light mass fission fragments. This figure outdoes the resolution of a surface barrier detector by a factor of 3 and the highest resolution reported so far for fission fragments on an ionization chamber by almost a factor of 1.5². It appears that even this figure could still be improved. The energy (and velocity) resolutions achieved put the "Cosi fan tutte" project on a sound basis.

Another appealing feature of an axial chamber is the possibility of measuring not only the energy but also the nuclear charge of incoming ions. The novel approach relies on the fact that for an axial chamber the anode signal vs. time reproduces the specific energy loss of ions along their track. The method has been tested by using fragments of given total energy and taking the difference between the time when the ion is entering the chamber and the time the anode signal is reaching a certain level. In a first run a charge resolution of about 45 has been obtained for the light mass fragments. This figure is lower than the resolution of about 60 achieved with the conventional $\Delta E - E$ technique but is nevertheless promising. It would allow for a full identification as to mass and charge number of fission fragments by "Cosi fan tutte".

¹ A. Oed, G. Barreau, F. Gönnerwein, P. Perrin, C. Ristori and P. Geltenbort, Nucl. Instr. and Meth. 179 (1981) 265.

² U. Quade, K. Rudolph and G. Siegert, Nucl. Instr. and Meth. 164 (1979) 435.

Super-mirrors

O. Schärpf.

The cut-off angle of reflectivity of super-mirrors has been further increased (see fig. 1). This angle is now a factor of 3 above the critical angle of Nickel. Polarizers using super-mirrors were tested on S6 (thermal beam) and yielded a transmission of 25% of the whole spectrum with the right spin (see fig. 2). Using a polariser with a radius of curvature of 10 m at PN7 a transmission of 52% of the total spectrum has been achieved (see fig. 3). The measured polarisation was in all cases 94% or higher (including the flip-

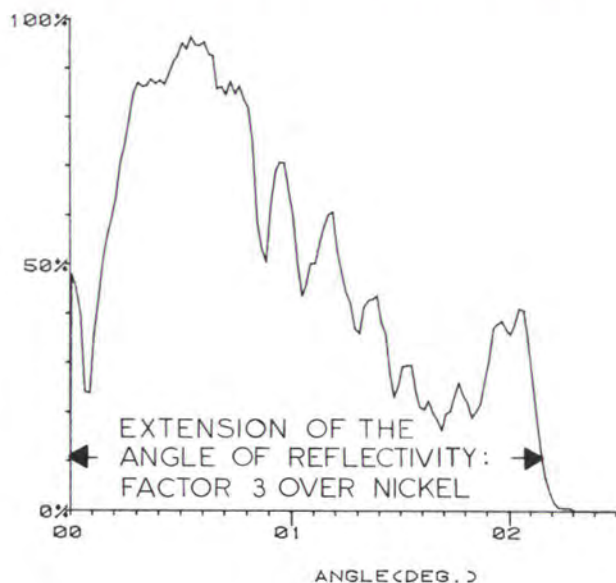


Fig. 1: Reflectivity curve as a function of the angle of incidence of a prototype supermirror with Cobalt and Titanium layers (600 layers) at $\lambda = 7.2 \text{ \AA}$.

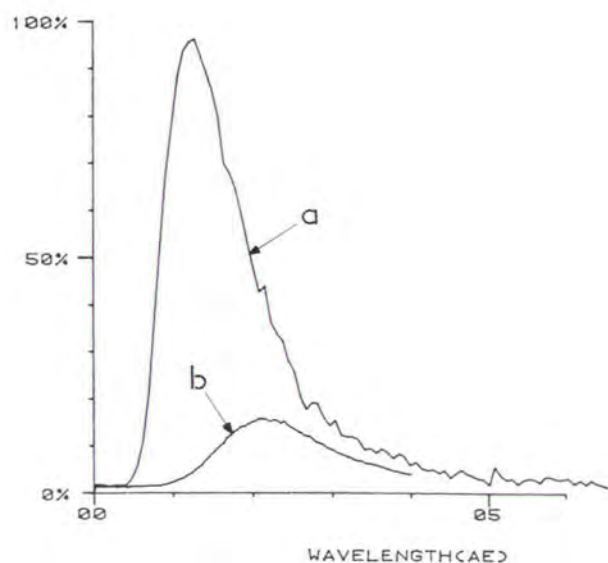


Fig. 2: "Spin-up" spectrum in front of the polariser (thermal spectrum of S6) (a) and the spectrum transmitted by the polariser with radius of curvature = 22.5 m (b) (25% transmission).

per efficiency being the limiting factor in the case of a broad spectrum). During the forthcoming months a super-mirror polarizer will be used in conjunction with a multidetector ("banana").

The extension of D7 as a multidetector instrument with polarization analysis is progressing well.

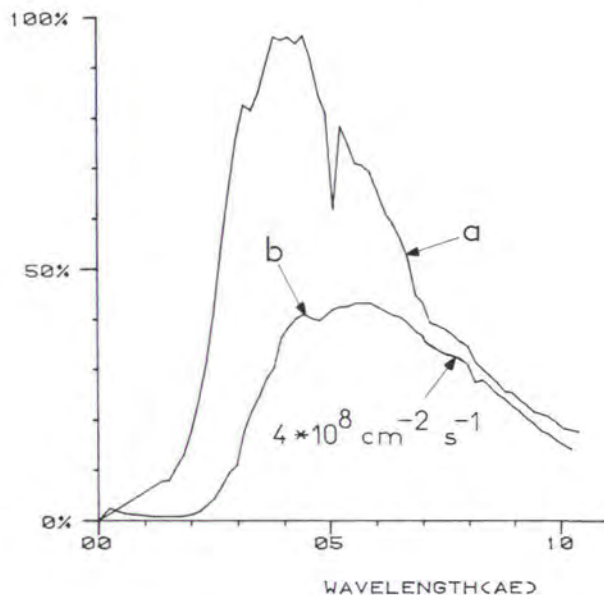


Fig. 3: "Spin-up" spectrum in front of the polariser of PN7 (a) and spectrum transmitted by the polariser (b) (52% transmission).

Application of super-mirrors at the in-beam NMR spectrometer S6

(Marburg Group).

During the reactor shutdown March-June 1981, a super-mirror polarizer was installed on the in-beam spectrometer S6 at H25. This is the first super-mirror polarizer operating at a thermal guide. It consists of 25 glass foils ($300 \times 50 \times 0.1 \text{ mm}^3$) onto which 40 antireflecting CdTi layers and 80 CoTi mirror layers have been evaporated. The foils form a bent sollar-type guide with 22.5 m radius of curvature and a cross-section of $15 \times 50 \text{ mm}^2$. The transmission measured for a thermal beam is 25% for one neutron-spin component. The polarization multiplied by the polarizing efficiency of a Heusler-crystal analyser is found to be 0.93.

The super-mirror replaces a conventional CoFe mirror. The gain in the figure of merit of the new polarizer relative to the old one is about 8.

The white beam of polarized neutrons is used to produce polarized β -active nuclei by capture. The β -decay asymmetry, being a measure of the probes' nuclear polarization, is used to study nuclear magnetic resonance and relaxation (NMR) phenomena in condensed matter (examples, see report of College 7).

Universal collimator system for multidetectors

(A.F. Wright).

The newly-commissioned high temperature furnace (2500°C) is now available with an oscillating radial collimation system based on the "Venetian Blind" type originally developed for the D12. The collimation system designed to eliminate scattering from furnace components originating at a radius of greater than 12 mm from the sample centre has performed well in the experiments with the D1B and D2 multidetectors, removing completely parasitic scattering from the furnace wall and the radiation shields, and substantially reducing that from the tungsten heater element situated at a radius of 6 mm, such that only one moderately strong diffraction line is observed in the diffraction pattern of the furnace (see fig. 4). This will be further reduced in intensity when the heater radius is increased early in 1982. Diffraction from a 5 mm diameter sample is undistorted with a transmission of 85%. Further tests of the collimator with pressure cell are planned, in order to determine the parameters for a universal collimator system for multidetectors.

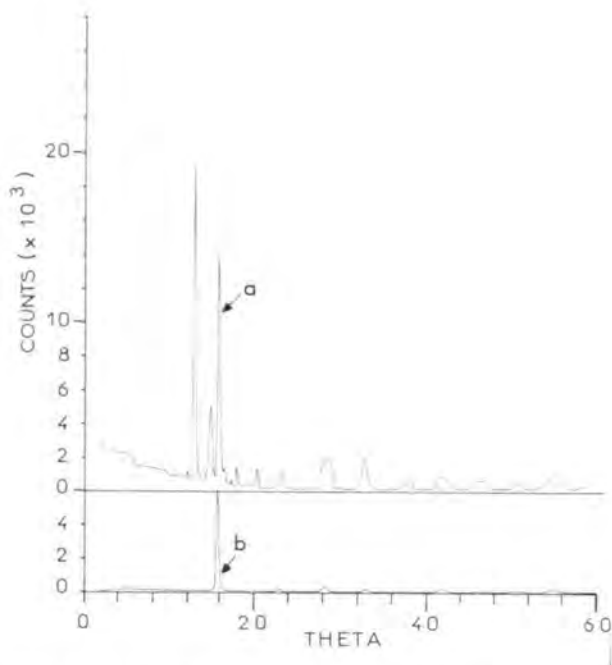


Fig. 4: The figure shows the efficiency of the new collimator system for multidetectors. Plot (a) is the spectrum including parasitic scattering, plot (b) shows the same spectrum using the new collimator system.

Tests on a single crystal multidetector

(M. Thomas, R.F.D. Stansfield, M. Berneron, A. Filhol).

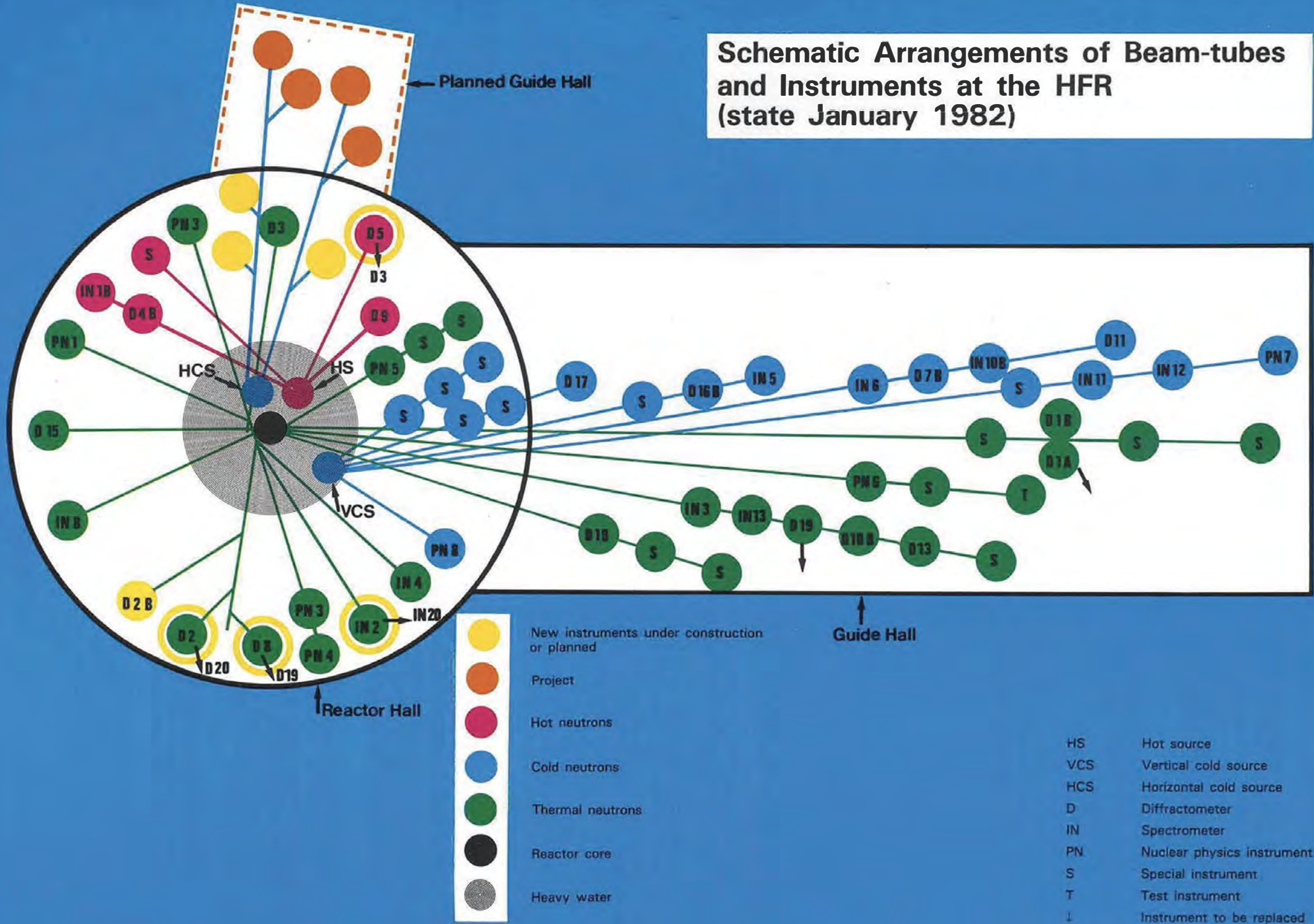
D19 is being constructed under the "deuxième souffle" as part of a programme of multidetector development. It is primarily designed for fast data collection in large molecule crystallography, and will replace D8 on the redesigned H11 beam tube. D19A is a test diffractometer situated on the thermal neutron guide H24.

The detector is one of a new generation of multi-wire proportional counters¹ at the ILL. The prototype on D19A comprises 1024 cells made up of 64 anode wires 2.5 mm apart and 16 cathode wires 5.0 mm apart. At 1.15 m from the sample this corresponds to a possible angular resolution of 0.125 and 0.250°, and a total angular range of $8 \times 4^\circ$. For increased efficiency, and also to obtain good resolution, the multiwire chamber is filled with a mixture of ³He (10 atmospheres) and Argon (1 atmosphere). The final curved detector, to be delivered early in 1982, is made up of 8 such modules and can be supported upright in the present shielding to subtend $64 \times 4^\circ$ at the sample.

The recent emphasis in software development has been to obtain accurate structure factors from precise methods of intensity integration. The three-dimensional arrays of data (two dimensions on the detector surface with crystal rotation as the third dimension) make it possible to improve the intensity determination by allowing the boundary between peak and background to be more accurately defined, thereby improving the statistical quality of the data. For the first data collection experiments carried out this year, the "subunit" detector simply replaced a point detector on the 2θ -arm of a conventional 4-circle arrangement. Thus *single* reflections were directed to the centre of the detector in the equatorial plane. A partial dataset of ~1200 diffracted intensities was collected from a known crystal of Phthalocyanine and used to compare the two new methods of peak integration described below.

BRAGV3² works sequentially on the frames of data from successive ω (crystal rotation) steps, first determining a background level for the frame based on Poisson's statistics, and then contouring that frame to include in the peak those points significantly above background that

Schematic Arrangements of Beam-tubes and Instruments at the HFR (state January 1982)



- New instruments under construction or planned
- Project
- Hot neutrons
- Cold neutrons
- Thermal neutrons
- Reactor core
- Heavy water

- HS Hot source
- VCS Vertical cold source
- HCS Horizontal cold source
- D Diffractometer
- IN Spectrometer
- PN Nuclear physics instrument
- S Special instrument
- T Test instrument
- ↓ Instrument to be replaced

INSTRUMENTS

OPERATIONAL

- | | | |
|--|--|--|
| ■ D1A Two-axis (powders) ● | ■ D13 Crystal testing facility | ■ IN10B Backscattering spectrometer |
| ■ D1B Two-axis (powders) | ■ D15 Mark VI diffractometer (single crystals) | ■ IN11* Spin-echo spectrometer |
| ■ D2 Two-axis (powders, single crystals) ● | ■ D16B Mark VI diffract. (multidetector for single crystals) | ■ IN12 Three-axis spectrometer |
| ■ D3* Polar. n-diffractometer | ■ D17 Small angle scattering camera | ■ IN13 Backscattering spectrometer |
| ■ D4B Two-axis (liquids) | ■ D18 Neutron interferometer | ■ PN1 Fission product spectrometer |
| ■ D5* Polaris. analysis diffractometer | ■ IN1B Three-axis spectrometer | ■ PN2 Conversion electron spectrometer |
| ■ D7B* Diffuse scattering facility | ■ IN2 Three-axis spectrometer ● | ■ PN3 Gamma-ray spectrometer |
| ■ D8 Four-circle diffractometer ● | ■ IN3 Three-axis spectrometer | ■ PN4 Anti-compton spectrometer |
| ■ D9 Four-circle diffractometer | ■ IN4 TOF spectrometer | ■ PN5 Ultra cold neutron source |
| ■ D10 Four-circle diffractometer | ■ IN5 TOF spectrometer | ■ PN6 Fission product spectrometer |
| ■ D11 Small angle scattering camera | ■ IN6 TOF spectrometer | ■ PN7B* Polar. beam (fund. physics) |
| | ■ IN8 Three-axis spectrometer | |

*Polarized neutrons

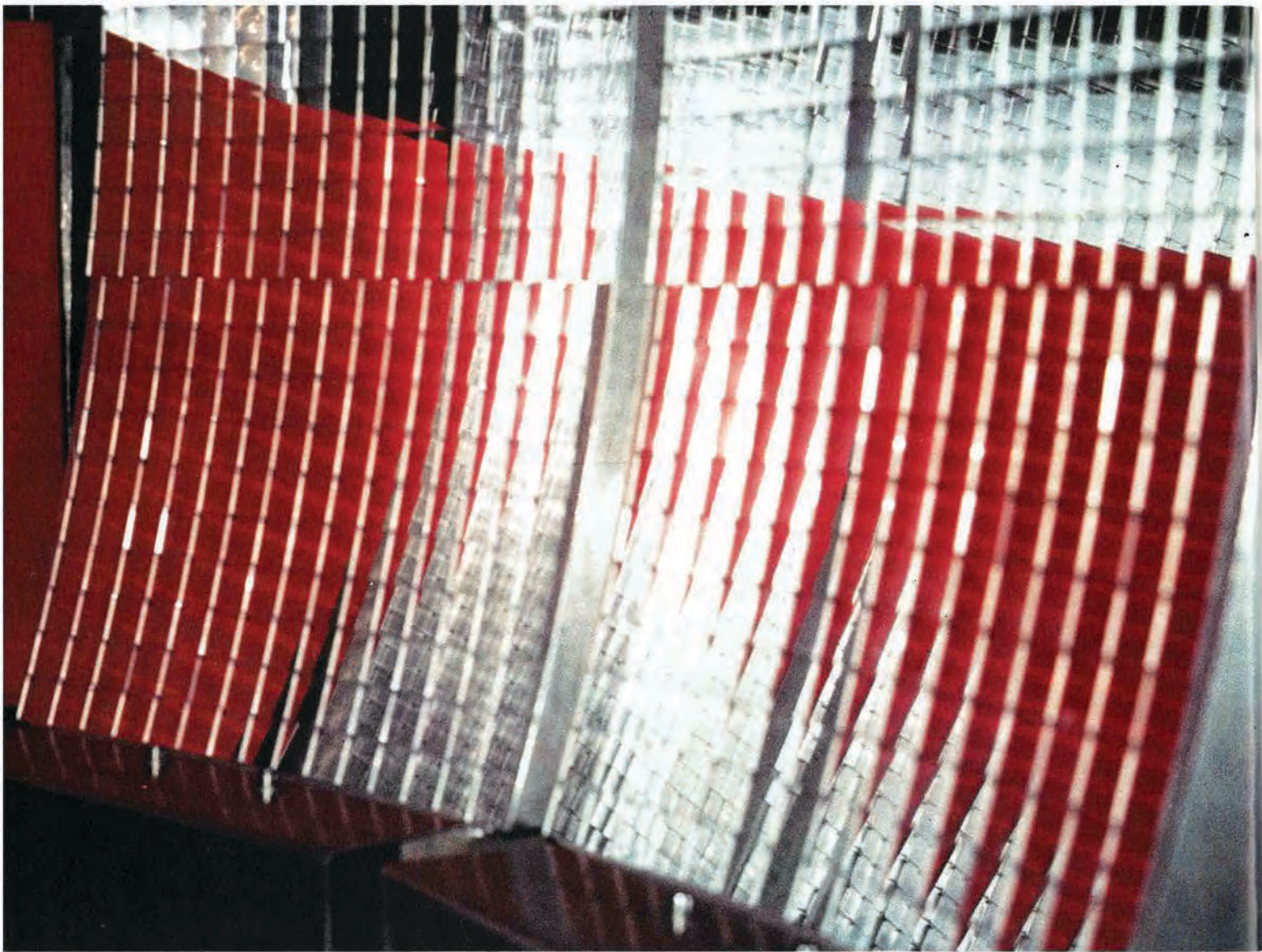
NOT YET OPERATIONAL

- D28 ● Two-axis (high intensity, high res., for powders), replacing D1A
- D20 ● Two-axis (high-intensity; for powders), replacing D2
- D19 ● Two-axis (multidetector; for single crystals), replacing D8
- IN20 ●* Three-axis spectrometer with polaris analysis, replacing IN2
- PNB Fission product coincidence spectrometer

OPTIONS ON HCS

Diffuse scattering spectrometer
Triple axis spectrometer
Polarized beam for fundamental physics

Backscattering spectrometer
Spin-echo spectrometer
High intensity, low resolution diffractometer (biology)



Light reflection from the analyser crystals of the new backscattering spectrometer IN13.

2

instrument
operation
department

Einleitung

Die Abteilung Instrumentenbetrieb ist allgemein verantwortlich für den Betrieb und die Verbesserung der Experimentiereinrichtungen. Sie leistet ausserdem den Gastforschern die notwendige technische Hilfe bei der Durchführung ihrer Experimente. Die Instrumente sind in vier Gruppen aufgeteilt, die für ihren Betrieb und ihre Weiterentwicklung sorgen. Die übrigen Gruppen der Abteilung erbringen die für alle Instrumente notwendigen Apparaturen und Fachkenntnisse.

Die Monochromatoren-Gruppe hat ein viertes γ -Spektrometer bestellt, und ist im Begriff, es aufzubauen. In Verbindung mit diesem Instrument wird Anfang 1982 ein Ofen zum Ziehen von Kristallen zur Verfügung stehen. Grosse Ge- und Cu-Kristalle wurden in Zusammenarbeit mit dem C.E.N.-Grenoble erfolgreich gezogen. Daneben werden für den Bau grosser fokussierender Monochromatoren (30 cm hoch, 20 cm breit) auch weiterhin Anstrengungen unternommen.

Die Zentralgruppe ist allgemein für den Betrieb der Instrumente zuständig, und gewährleistet die Koordination zwischen den verschiedenen Abteilungen. 1981 wurde der Schwerpunkt auf Strahlenschutzmassnahmen gelegt, wie zum Beispiel die Verbesserung der Abschirmungen, die genauere Messung des Neutronenuntergrunds, die Handhabung von Schadstoffen, sowie das klarere Anzeigesystem, das über die Betriebssituation der Experimentiereinrichtungen Auskunft gibt.

Während des langen Reaktorstillstandes musste diese Gruppe eine beträchtliche Arbeitslast bewältigen, da Wartungsarbeiten durchgeführt werden mussten, die nur bei verlängertem Reaktorhalt möglich sind.

Der Gruppe Probenumgebung gelang es, die Standard-Kryostaten auf ein allgemein hohes Verlässlichkeitsniveau zu bringen. Dagegen ist es aufgrund von Lieferverzögerungen nicht möglich, den Mangel an supraleitenden Magneten auszugleichen. Daneben wurde eine verstärkte Nachfrage nach Probenumgebungen festgestellt, insbesondere nach Öfen.

Introduction

The Instrument Operation Department has overall responsibility for the operation and improvement of the instruments. It also provides necessary technical assistance to enable the visitors to carry out their experiments. The instruments are divided amongst four instrument groups which assure their operation and development. The other groups of the department provide facilities and expertise needed by all the instruments.

The Monochromator Group has ordered and is setting up a fourth γ -spectrometer. Associated with this instrument a crystal-growing furnace will be available early in 1982. Big crystals of Ge and Cu have been grown successfully in collaboration with the C.E.N.-Grenoble. Continuing effort is going into the construction of big focussing monochromators (30 cm in height, 20 cm in width).

The Central Group provides services on the instruments and ensures the coordination between the different departments. In 1981 emphasis was put on safety aspects like improving shieldings, measuring neutron background with higher accuracy, handling hazardous materials and making the information on the status of instruments more easily visible. During the long reactor shut-down the Group had to cope with a heavy work-load on maintenance of installations that are only accessible during extended shut-downs.

The Sample Environment Group succeeded in bringing the standard cryostats to a high level of routinely achieved reliability. On the other hand, due to delivery delays it was not possible to overcome the lack of superconducting magnets. Within the group an increasing demand for non-standard sample environments was observed. This is especially true as regards furnaces.

Introduction

Le Service Exploitation des Instruments a la responsabilité globale du fonctionnement et de l'amélioration des dispositifs expérimentaux. Il fournit en outre l'assistance technique nécessaire aux chercheurs invités, pour mener à bien leurs expériences. Les dispositifs expérimentaux sont répartis en quatre groupes qui assurent leur fonctionnement et mise au point. Les autres groupes du Service fournissent des prestations spécialisées nécessaires à l'ensemble des instruments.

Le Groupe Monochromateurs a commandé et installe actuellement un quatrième spectromètre γ . En association avec cet instrument, un four pour faire pousser les cristaux sera disponible début 1982. De grands cristaux de Ge et Cu ont été tirés avec succès, en collaboration avec le C.E.N.-Grenoble. La poursuite de ce travail va aboutir à la construction de grands monochromateurs convergeants (30 cm de hauteur, 20 cm de largeur).

Le Groupe Central assure les prestations sur les instruments et la coordination entre les différents départements. En 1981 l'attention a particulièrement été portée sur les aspects de sécurité, tels que : protection, mesures plus précises du bruit de fond neutronique, traitement des produits potentiellement dangereux et plus grande mise en évidence des informations concernant l'état des instruments. Pendant le grand arrêt du réacteur le groupe a dû faire face à une grande surcharge de travaux de maintenance sur les installations, qui ne peuvent être exécutés que lors de ces longs arrêts.

Le Groupe Environnement des Echantillons a réussi à porter les cryostats standards à un haut niveau de fiabilité en routine. D'autre part, en raison de retards de livraison, il n'a pas été possible de rattraper le retard en ce qui concerne les aimants supra-conducteurs. Dans ce groupe une demande croissante en environnements non standard d'échantillon a été notée, en particulier en ce qui concerne les fours.

instrument group fundamental and nuclear physics

| | | | | | |
|-----|---|---|-----|---|---|
| PN1 | : | Fission Product Separator (LOHENGRIN) on beam tube H9. | PN7 | : | Cold Polarized Neutron Beam on neutron guide H142. |
| PN2 | : | Beta Spectrometer (BILL) on the vertical beam tube V3. | PN8 | : | Fission Product Coincidence Spectrometer (COSI FAN TUTTE) to be installed at IH1. |
| PN3 | : | Three Curved Crystal Gamma Spectrometers (GAMS 1, 2, 3) on the through-going beam tube H6/H7. | H17 | : | Cold neutron guide: liquid helium UCN source (in preparation), magnetic storage of UCN. |
| PN4 | : | Ge(Li) Pair Spectrometer on the through-going beam tube H7. | H18 | : | Cold neutron guide: search for neutron-antineutron transitions. |
| PN5 | : | Ultra-Cold Neutron (UCN) Source on the inclined beam tube IH3. | H22 | : | Thermal neutron guide: neutron induced particle emission (H22D) γ - γ angular correlation (H22F); neutron induced fission (H22E). |
| PN6 | : | On-line Mass Separator for Thermally Ionized Fission Products (OSTIS) on neutron guide H23L. | IH1 | : | Very intense neutron beam: neutron-induced fission and α emission. |

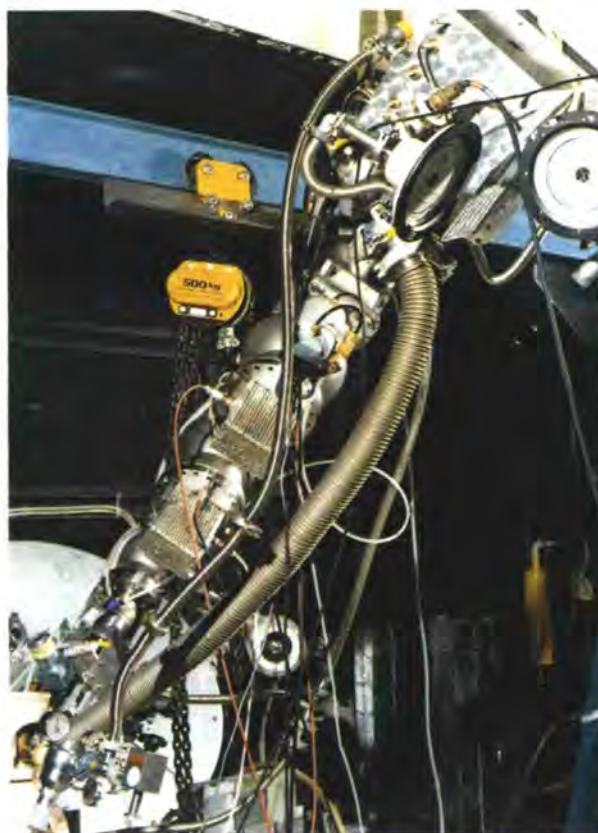
PN1 fission product spectrometer "LOHENGRIN"

(H.R. Faust, R. Brissot, J. Mougey, I. Gartshore, M. Taylor)

In 1981 the parabola spectrometer LOHENGRIN was operational for about 85% of the reactor time. More than 18 experiments have been carried out comprising mass and charge distribution from fissile isotopes, determination of angular momentum induced in the fission process, determination of masses of neutron-rich isotopes and nuclear spectroscopy.

In addition to this measuring activity important modifications were undertaken at the spectrometer to improve efficiency and reliability. During the three-month reactor shutdown the whole vacuum system was dismantled. An entirely new vacuum control system was installed and the pumps for the target changing facility were made accessible for maintenance during reactor periods.

The new, large ionization chamber for fission products, which uses 30 cm of the parabola, is now operational and first measurements are under way. The improvement of a factor of 10 in sensitivity achieved with this chamber serves essentially for the investigation of cold fission events and for fission spectroscopy following double neutron capture.



Experiment set-up for nuclear charge measurements at Lohengrin. In the picture are seen from left to right: exit flange of Lohengrin, absorber part, start detector, stop detector, ionization chamber.

In the absorber foil the fission product beam loses about 50% of its energy, the energy loss being different for different elements within one mass chain. Velocity and energy of the slowed-down fission products are measured through the TOF system and the ionization chamber, respectively.

The data acquisition system has been newly designed to allow for parametric data handling. A package of new instrument control and acquisition programs was installed. The instrument is now fully under the control of a PDP11.

Test measurements for the improvement of the high tension stability to 10^{-5} were performed successfully. The definitive modification of the high voltage units will start early in 1982. Finally the new calibration procedure for LOHENGRIN via the ${}^6\text{Li}(n,\alpha)t$ reaction was used for a readjustment of the condenser plates.

In December 1981 the instrument was shut down and the replacement of the beam tube projected for Spring 1982 was prepared.

PN2 beta spectrometer "BILL"

(K. Schreckenbach, H.R. Faust, G. Blanc)

In 1981 the beta spectrometer BILL was operational for about 90% of the reactor time. More than 15 different measurements were performed comprising nuclear structure physics and shapes of beta decays. Prompt and beta-delayed internal conversion electron lines in ${}^{116}\text{In}$ were carefully measured and can serve now as a convenient, absolute intensity calibration of the spectrometer in the range from 18 keV to 2.2 MeV. The neutron flux and neutron spectrum at the irradiation position were investigated by a combined method of ${}^{59}\text{Co}$ activation and ${}^{113}\text{Cd}$ burn-up. These values are important for absolute intensity calibrations in the (n,e^-) reaction via the generally known thermal neutron cross-section of the involved isotope.

An extended, low energy, multi-wire detector for electrons was constructed using twice as much of the focal plane of the spectrometer. A more important extension with better position resolution is under test. The target-changing facility, and in particular the hot cell for BILL targets, were improved. At the hot cell a safer depression control and a transfer lock were installed.

PN3 curved crystal gamma spectrometers "GAMS 1" and "GAMS 2/3"

(H.G. Börner, S.A. Kerr, G. Barreau, R. Brissot, M. Taylor)

The newly-installed GAMS 2/3 instrument control and data acquisition system is now fully operational. It allows an automatic photopeak stabilisation for the γ -ray detectors. Both hard and software were tested over an extended period,

resulting in a system with a high degree of automation and reliability, similar to that developed already for GAMS 1. In addition, two new $4 \times 6''$ NaI-detectors were installed on GAMS 2/3 to improve the efficiency in particular in the region above 1 MeV.

One measurement was postponed for several weeks during the reactor cycles 3 and 4 due to the change of the neighbouring beam tube IH13 which caused unacceptably severe mechanical vibrations at GAMS 1. This period was used for extensive maintenance of the instrument. Otherwise the crystal spectrometers were running for most of the reactor time.

PN4 Ge(Li) pair spectrometer

(S.A. Kerr, E. Monnard)

The pair spectrometer has been in operation throughout the year. The new data acquisition system (Camac + PDP11/23) has been installed and equipped with the required software. Advantage was taken of the long shut-down to provide the instrument with an improved intrinsic germanium detector of novel design, resulting in a considerable improvement in both resolution and efficiency of the spectrometer. Recent measurements, for example, of the ${}^{19}\text{F}(n,\gamma)$ and ${}^{23}\text{Na}(n,\gamma)$ reactions were able to detect, with an energy resolution of 3.1 keV in the 4.5 MeV region, γ -rays having partial cross-sections as small as 8×10^{-6} barns (3 times more sensitive than similar measurements with the earlier arrangement).

In addition, a 40% efficiency hyperpure Ge detector (peak-to-Compton, 70:1) has been purchased for complementary single measurements of γ -rays with energies intermediate between those measured by GAMS and the pair spectrometer.

PN5 ultra cold neutron source (UCN)

(P. Ageron, W. Mampe, A. Beynet)

All three available beam positions of PN5 have been used in 1981. Ultra cold neutrons were used for the neutron electric dipole moment experiment, for the study of UCN storage in material containers and for neutron optics. Very cold neutrons were used for development studies of new neutron guide systems, especially with regard to the vertical very cold and ultra cold neutron source to be installed in the present cold source.

The PN5 beam distribution system has been modified to enable two experiments to run in a time-sharing mode. In connection with this improvement the vacuum security system has been completely renewed.

PN6 on-line mass separator for thermally ionised fission products "OSTIS"

(B. Pfeiffer, G. Jung, E. Koglin, L.J. Alquist, B. Nief)

During 1980 the mass separator OSTIS was operational for about 85% of the reactor time. Beam time was greatly in demand and 15 experiments were performed. The installation of a new control panel has improved the operation of the instrument. A microprocessor-controlled timing unit built at the II. Physikalisches Institut der Universität Giessen was used for experiments running in a cyclic way. More experience was gained with the new indirectly heated high temperature ion source which has already been used for several experiments. The development of a negative ion source for halogens is in progress.

PN7 polarized neutron beam

(B. Heckel, R. Gaehler, B. Nief)

During July 1981 a super-mirror polarizer was fitted into the PN7 beam guide. This polarizer transmits roughly 30% of the full beam of the entire neutron spectrum at PN7 and gives a polarization of 95%-97%. The integrated polarized neutron flux of approximately 4×10^9 neutrons/sec over 15 cm^2 makes PN7 the most intense polarized cold neutron beam at present available.

The first experiment to make use of the new PN7 polarizer was the study of the rotation of the neutron spin due to the weak interaction (see College 3 section for more details). In November 1981, PN7 was adapted to the measurement of the γ -ray asymmetry in polarized neutron capture by protons (ISN-Harvard collaboration).

PN8 fission fragment coincidence spectrometer "COSI FAN TUTTE"

(A. Oed, P.E.J. Perrin, M. Manzel, J. Manning)

The set-up of the fission fragment spectrometer COSI FAN TUTTE, which is part of the modernization programme of the Institut, has progressed in keeping with the time schedule anticipated.

The in-pile part of the inclined beam tube IH1 on which the instrument is to be installed has been modified. The available neutron flux was increased and the installation of Si and Bi single-crystal filters is planned. The external part of the beam (including the collimation, the radiation protection and the beam-catcher) as well as the platform should be ready early in 1982. The mechanical parts of the spectrometer itself have been designed and manufactured, all the vacuum components are at hand and the data acquisition and handling system has been ordered and should become available by the end of 1981.

Further development work was put into the design of the velocity and energy detectors for fission fragments. For the velocity measurement by the time-of-flight technique, the time pick-off detectors for passing-by fragments have been further improved (c.f. Annual Report 1980). In particular, the sensitive area of these detectors was increased. Active diameters of nearly 40 mm were achieved with a time resolution below 180 ps, a figure which is well within the demands for the layout of the spectrometer.

The main emphasis, however, has been put towards the development of a high resolution ionization chamber determining the kinetic energies of fission fragments. The results obtained so far are encouraging. An energy resolution of better than 400 keV (FWHM) for typical light mass fission fragments and 500 keV for the heavy ones were achieved. The above figures are the highest resolution reported so far for electronic detectors on fission fragments. Furthermore, a new technique enabling the measurement of both the kinetic energy and the nuclear charge of ions entering the ionization chamber has been successfully tested. According to the present results adjacent nuclear charges of fragments can be separated at least in the light mass wing. More details on the performance of the ionization chamber are given elsewhere in the present Annual Report (see "New Experimental Techniques").

Special beam experiments

(G. Barreau, R. Brissot, R. Gaehler, S. Kerr, W. Mampe, E. Monnard, A. Oed, P.E.J. Perrin, B. Nief)

The neutron beams H17, H18, H22 were used continuously and successfully throughout 1981 for nuclear spectroscopy, fission and fundamental physics experiments. The neutron beam IH1 was used in the first half of 1981 for the study of (n,f) and (n,α) reactions before modifications were started to adapt the beam for PN8. During the long reactor shut-down the H17 beam position was adapted to the current needs: (1) a new beam position has been created for irradiations of biological materials with cold neutrons; (2) an additional guide section has been installed for the "BONN" experiment aiming at the magnetic storage of UCN produced in superfluid ^4He ; (3) the zone has been prepared for the new super-thermal UCN source arriving at the beginning of 1982.

The large cross-section cold beam H18 served in 1981 for the CERN, Padua, Rutherford, ILL experiment searching for baryon number nonconservation in a system of free neutrons.

A preliminary experimental arrangement in a search for reactor-produced axions has been built in the casemate of GAMS 2/3. The measured background (coincidence events of decaying particles) has been found to be very favourable for such an experiment.

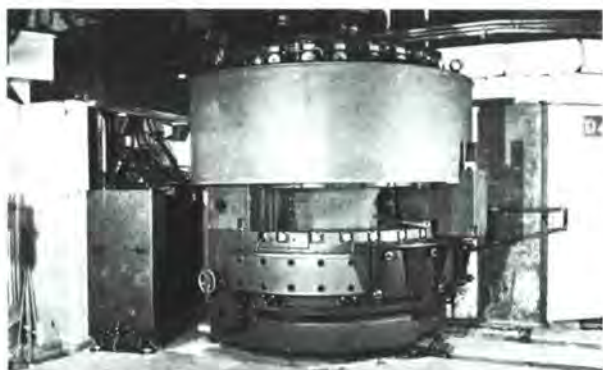
Co-Ordinator:
K. SCHRECKENBACH.

instrument group three axis spectrometers

| | | | | | |
|-----|---|--|------|---|---|
| IN1 | : | 3-axis with beryllium-filter option on the hot beam tube H8. | IN8 | : | 3-axis spectrometer on the thermal beam tube H10. |
| IN2 | : | 3-axis with a double monochromator on the thermal beam tube H13. | IN12 | : | 3-axis spectrometer on the cold guide tube H14. |
| IN3 | : | 3-axis spectrometer on the thermal guide tube H24. | | | |

Introduction

This year has been a period of change as far as the triple-axis instruments are concerned. IN1 was finally shut down at the beginning of March to make way for the new combined IN1/D4 hot-source instrument, the major modifications to IN8 were started at the end of March, and at the end of September IN2 was dismantled to allow removal of the H13 beam-tube for studies of possible radiation damage and corrosion. During the year design and construction of IN20 (thermal 3-axis spectrometer to replace IN2) has continued, although some confusion exists as to the final form and role of this instrument, following deliberations at the October Instrument Subcommittee.



The new monochromator block for IN1 and D4 with its shielding (state Nov. 1981).

For several years there has been a problem with the provision of high magnetic fields for inelastic scattering experiments. To overcome this, a 6 Tesla, vertical field, superconducting magnet cryostat has been ordered for the three-axis group. Delivery is expected in Summer 1982.

There have also been major changes in the personnel of the group. H. Jobic has joined A. Kollmar and H.J. Lauter on IN1, with a particular responsibility for Be-filter operation. On IN2, D. Cebula has replaced B. Renker as Second Responsible while D. McK. Paul and H.J. Lauter are now responsible for IN3. B. Renker has become Second Responsible of IN8, K.A. McEwen, Second Responsible of IN12, and D. Puschner is IN12 Instrument Technician. Finally, B. Dorner has rejoined the group after a year's absence and W.G. Stirling has become Instrument Group Coordinator.

IN1 hot source 3-axis spectrometer with Be filter option

(A. Kollmar, H.J. Lauter, H. Jobic, P. Cross)

For the first two months of the year, the "old" IN1 operated normally, but with only 30% of the beam time devoted to triple-axis experiments, the rest of the time being used for the beryllium-filter mode of operation. On the first of March the instrument was shut down for replacement by the hybrid three-axis/beryllium filter/liquids spectrometer.

During the long reactor shutdown a new beam tube was installed in the H8 tube and gold foil measurements subsequently showed that there has been a slight reduction in the flux of the "white" beam. The new monochromator drum was then installed on its rails — see photograph. At the time of writing, the cabling of the drum is almost complete and testing will soon be carried out. By the end of 1981, the drum with all its equipment in front of the monochromator was in position on the beam tube.

Considerable progress has been made on the preparation of the copper monochromator crystals. The (200), (220), and parts of the (331) monochromators have been cut and pressed. The modules for the secondary (3-axis) spectrometer have been cabled and their superstructure parts have been delivered. By the end of February 1982, a more or less complete secondary spectrometer will be installed. Final cabling of the electronics and tests of the complete spectrometer are planned for the end of Spring 1982.

A new Beryllium filter system to be attached to the IN1 monochromator consists of a dedicated sample table with the filter on a separate support. The filter detector will be on loan from A.E.R.E. Harwell and should give 4 or 5 times more signal than the old system, essentially because of solid-angle considerations. This should be installed some time in Spring 1982. A more sophisticated combined Be/pyrolytic graphite filter is planned for the future; this system should further increase the signal and provide improved energy resolution.

IN2 thermal beam 3-axis spectrometer with double monochromator

(R. Pynn, D. Cebula, B. Renker, P. Flores)

IN2 functioned normally until the removal of the H13 beam-tube at the end of September. No major modifications were made to the instrument in view of the imminent installation of IN20. At the time of writing (November 1981) the monochromator of IN2 has been reinstalled and the motors and coders successfully tested. The secondary spectrometer is to be attached before the end of the year and scheduled experiments will be carried out from the beginning of 1982.

During the year much of the design of IN20 was completed and the monochromator protection was ordered from the firm Cunnington and Cooper (U.K.). The fabrication of this protection, which has been specially designed to avoid the use of any magnetic materials, is proceeding according to the planned schedule. Delivery is expected in August 1982. Magnetic materials have also been avoided in other parts of the spectrometer in order to facilitate the tests of the spin-echo method which were originally planned for this instrument. These tests and the conventional (non-polarised) use of IN20 may, however, be jeopardised by a recent decision of the Instrument Subcommittee which in October 1981 recommended that the experimental programmes of IN20 and D5 should be combined. This may necessitate some modifications of the detailed design.

IN3 3-axis spectrometer on thermal guide

(D. McK. Paul, H.J. Lauter, J. Lefebvre, R. Arthaud)

IN3 operated satisfactorily throughout the year, with only slight modifications being made to facilitate operation. This spectrometer is very flexible and is often used in a complementary fashion to IN8 and IN12. The horizontally-curved analyser technique is particularly useful in the case of locally flat dispersion curves; intensity gains of a factor of 5 have been obtained without loss in energy resolution. Recently, the instrument has been completely recabled in preparation for the transfer to its own computer.

In 1982 several improvements are envisaged:

- 1) The instrument will be connected to a dedicated SOLAR 16-40 computer.
- 2) A new variable (vertical) curvature monochromator system will be installed, with both copper pyrolytic graphite monochromators permanently installed.
- 3) In addition to the existing multidetector, an optional single (5 cm) detector will be mounted.
- 4) The "tanzboden" will be replaced as subsidence has damaged the existing floor.

IN8 thermal beam 3-axis spectrometer

(R. Currat, B. Renker, A. Brochier)

In March, IN8 was stopped for an extensive rebuild as part of the CARINE replacement programme. The rebuilt instrument includes a new sample table and secondary spectrometer, updated control electronics, and a SOLAR 16-40 computer. The new mechanical design, which incorporates the standard "central-drive" modules, allows simultaneous positioning of all "tanzboden" units.

The photograph shows a general view of the reconstructed IN8.

As on IN12 the electronic hardware is built around a central MOTOROLA INTEL 8080 microprocessor which controls the various motors, coders and scalars. Some simplification of the interfacing between the microcomputer and the SOLAR has been achieved, mostly by suppressing CAMAC. Also, some of the functions of the microprocessor have been transferred to the individual motor control units.



The alignment of IN8B replacing IN8 (state Nov. 81).

All these innovations necessarily involve substantial testing and adjustment periods. As a result the final commissioning of the instrument has been postponed from August 1981 until the end of the year.

IN12 3-axis spectrometer an a cold guide

(W.G. Stirling, K.A. McEwen, J. Bouillot, D. Puschner)

IN12 continued to operate satisfactorily throughout 1981, with very little beam-time lost due to instrument malfunction. Very few modifications were required during the year. An examination of the existing sample table drive system ($2\theta_M$) showed that there was no apparent wear and that the module was working satisfactorily, so it was decided that it is unnecessary to replace this module. A decision has to be made about replacing the manual analyser blocks with an automatic (IN8 type) system. In practice, however, the existing blocks are not particularly inconvenient.

Some minor modifications and additions were made; for example, an automatic filling system was installed on the nitrogen-cooled beryllium filter. The fixed (programme) and removable (data) disc units have been replaced with discs of double capacity, while the computer memory will soon be extended from 48K to 128K thus allowing a simpler and faster use of the computer. Improvements and extensions to the data reduction programs have continued.

Co-ordinator:
W.G. STIRLING.

instrument group time of flight high resolution and diffuse scattering

| | | | | | |
|------|---|--|------|---|---|
| IN4 | : | Time-of-flight spectrometer on thermal tube H12. | IN13 | : | Backscattering spectrometer for short wavelengths on thermal guide H24. |
| IN5 | : | Multichopper spectrometer on cold guide H16. | D7 | : | Diffuse scattering spectrometer on cold guide H15. |
| IN6 | : | Focussing time-of-flight spectrometer on cold guide H15. | D11 | : | Small angle and diffuse scattering spectrometer on cold guide H15. |
| IN10 | : | Backscattering spectrometer on cold guide H15. | D16 | : | Four circle MK6 diffractometer on cold guide H16. |
| IN11 | : | Spin echo spectrometer on cold guide H14. | D17 | : | Low-q high resolution spectrometer on cold guide H17. |

Introduction

The year was marked by an exceptional instrument reconstruction activity in the group, timed to take advantage of the long reactor shut-down. D16, D7 and IN10 have been more or less completely rebuilt by incorporating substantial improvements such as a multidetector on D16, and a high performance composite monochromator set and a supermirror polarizer system on D7. All of the reconstructed instruments became fully operational by the end of the year, a remarkable performance by the technical services, instrument responsables and technicians.

In addition, there were two new instruments to become available for routine use this year, IN6 and IN13. Thus the experimental capacity of the group made an exceptional leap forward in 1981.

The experimental programme carried out was as varied as the types of instrument in the group. The major areas have been, as before, physical chemistry, metallurgy, biophysics and several other fields, in particular magnetism. In the latter case more and more advantage is taken of the wide spectrum of energy and momentum resolution offered by the various instruments in the group.

IN4 time-of-flight spectrometer

(A.P. Murani, H. Scheuer, H. Langel, H. Walter)

A total of 20 experiments have been performed on IN4 during this year. These comprised 8 experiments on magnetic materials, 8 from the chemistry College, 3 on liquid metals and one concerned with hydrogen in metals. The instrument performance has been satisfactory, on the whole. However, apart from minor breakdowns associated with the time-of-flight unit, the computer and the Camac controller which also occur from time to time on other time-of-flight instruments, there have been additional breakdowns associated with the monochromator drive electronics which is showing signs of wear and is in need of replacement. The single monochromator set-up has suffered a delay due to the non-availability of the background chopper from the source originally envisaged. As a consequence the chopper has had to be constructed in-house and it is hoped that it will be installed during the coming year.

IN5 "multichopper" TOF spectrometer

(F. Douchin, J.P. Beaufile, G. Kearley, S. Jenkins)

Despite the long reactor shutdown, 25 experiments and six tests have been performed on IN5 during 1981. About two thirds of the experiments were in the field of chemistry, as was the case in the preceding year.

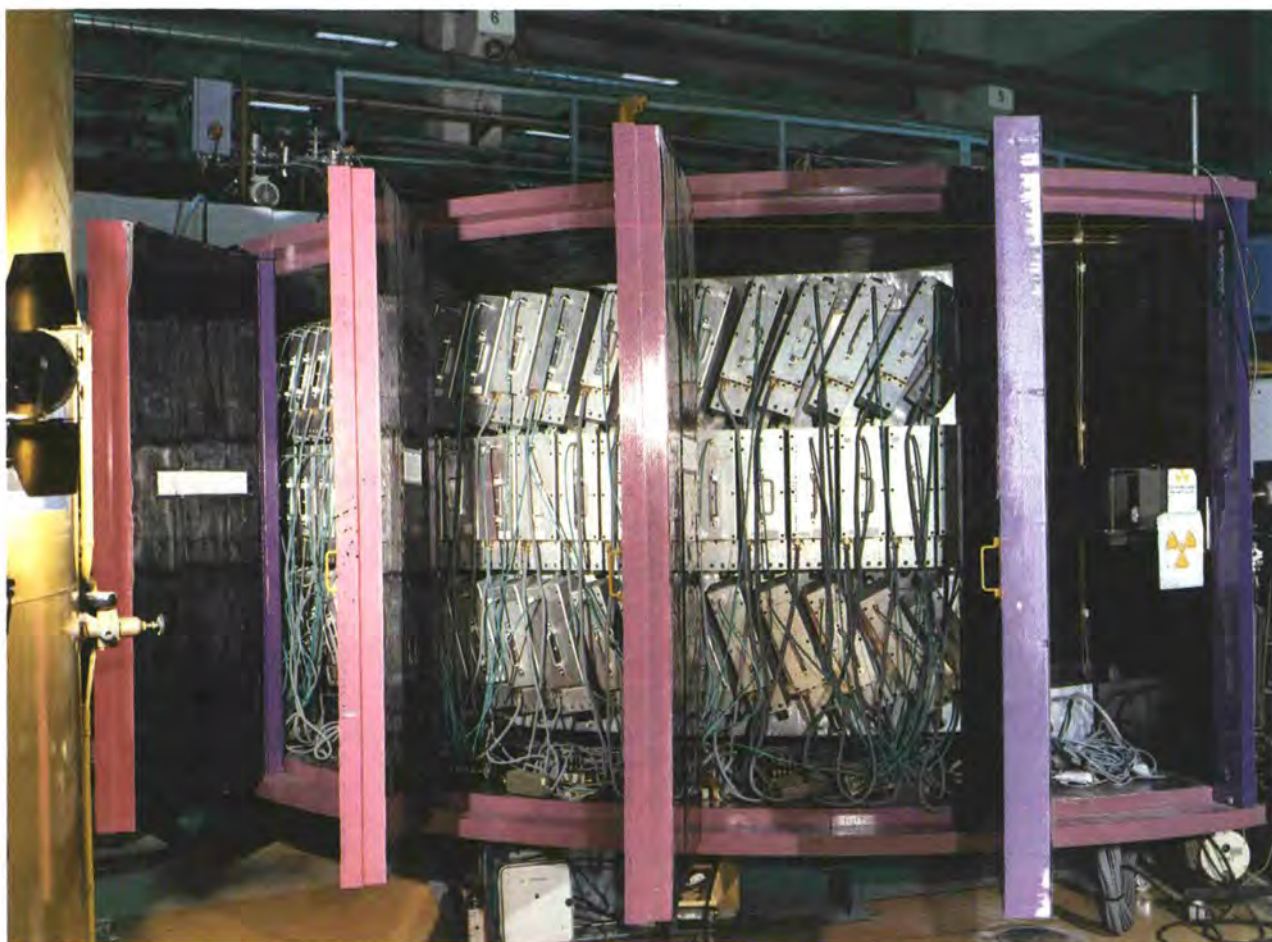
The continuity of available Q-range in the most sensitive region has been improved by the removal of a helium-box pillar which had given rise to a "dead angle" at ca. 20°. Sample alignment and detector-frame symmetry have been checked, and where necessary, the appropriate corrections have been implemented. A complete examination of the relevant electronics has resulted in greater detector efficiency and reliability, particularly for the fixed small-angle detectors. Further improvements have also been made to the software of the spectrometer's computer including a new network which will allow automatic data transfer to the new PDP 10 central computer.

IN5 has been used at a fixed chopper speed, since IN6 is used for medium resolution measurements, but nevertheless, the ball bearings of the choppers have given rise to more problems this year than in the previous years. However, it is anticipated that the prototype of the magnetic bearings, with an updated chopper-phasing system, will be tested and mounted on the instrument by the end of 1982. When installed, this system should allow considerable flexibility in the choice of resolution, the new higher limit being imposed by a maximum chopper speed of 20,000 r.p.m. This situation will probably be realized during 1983 since it must await completion of work currently being undertaken at K.F.A. Jülich.

IN6 focussing time-of-flight spectrometer

(A.J. Dianoux, M. Bee, Y. Blanc)

IN6 has been fully scheduled since the beginning of July. At the end of December, 14 experiments will probably have been performed.



A view on the detector bank of the TOF spectrometer IN6.

From January to March, 8 test experiments served to assess the performance of the instrument. All users have been impressed by the high counting rate and the low background. However, the flux at 5.9 Å is lower by a factor of 2 compared with the other wavelengths: this is due to a

bad vertical focussing of the monochromator at this long wavelength. Tests of the time-focussing property of IN6 have shown the great improvement in the inelastic resolution achieved by spinning the chopper faster than its focussing speed (fig. 5).

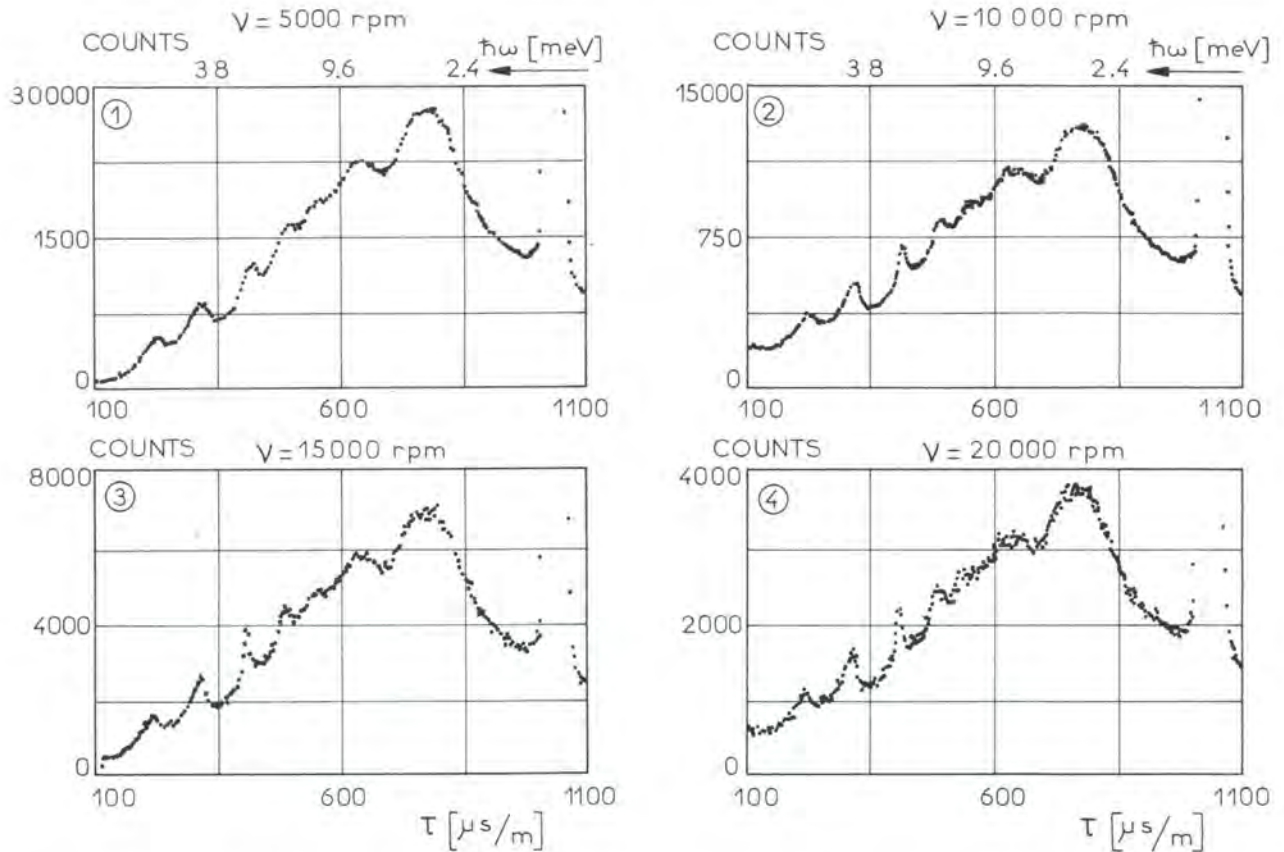


Fig 5: example of the time-focussing property of IN6. A considerable improvement of the inelastic resolution (between 10 and 40 meV) is achieved by spinning the chopper faster than its "focussing elastic frequency" (5000 rpm). The incident wavelength is 4.1 Å, corresponding to a TOF of 1036 μs/m (position of the elastic line). The sample was tropolone, a molecular crystal; the measuring time for each spectrum was ~ 1 h 45 min.

During the year, the control programme has been fully developed and is now in a fairly stable configuration. This control program enables the use to choose freely the regrouping of the detectors and gives some preliminary information on the data being accumulated, such as the position of the elastic peak and its width. To overcome the problem of overflows in the external memory, the spectra are periodically dumped onto the disk. Some preliminary data treatment can be carried out directly at the instrument, such as the subtraction of a background run. It is envisaged to develop some simple fitting programs.

A security rack permits the monitoring of the smooth operation of several vital devices: the temperature controller of the chopper cooling system, the vacuum pumps of the choppers, the level of liquid N₂ in the Be-filter, the temperature of the sample. Two more parameters could be controlled by this security rack.

Several items of ancillary equipment are now operational on IN6: a variable temperature He cryostat (1.5/300°K), a furnace (50/950°C), a heating and cooling loop (-20°C/+100°C), and a small heater (30°C/200°C). All these facilities can accommodate samples having diameters up to 69 mm.

IN10 backscattering spectrometer

(C. Poinsignon, A. Magerl, J. Bauchat)

The new secondary spectrometer of IN10 was installed during the long shut-down in 1981. It can now be rotated on a rail around the graphite deflector. The computer control of this movement enables a more precise and reproducible positioning of the instrument. In particular, the changing of the instrument configuration

(monochromator) has been considerably facilitated. The support of five analysers has been reconstructed. They are now connected with the sample table by arms. For that reason a rotation (also computer controlled) does not misalign the analyser orientation. In addition, the analysers can be translated towards the sample in order to optimize the backscattering condition according to various sample environments. We also note that the working conditions inside the spectrometer shielding have improved considerably due to the increased height of the cabin.

The wiring of the instrument and part of the electronics had to be updated, mainly because of the increased number of motors controlling the instrument. The software is being extended to take advantage of the increased flexibility of IN10. Although the instrument control by the present computer is not completely satisfactory, no major loss of beam time has occurred so far. A new dedicated computer PDP 11/23 has already been delivered. However, the installation has been postponed until the end of the test period of the instrument. We expect the new computer to be installed in the near future. Probably the RT11 system will be replaced by the RSX system. At present a new support for the Doppler drive is under construction which will finally enable a motorized positioning of the monochromator.

IN11 spin-echo spectrometer

(J.B. Hayter, F. Mezei and J.P. Varini)

Hardware improvements implemented during the year included upgrading the computer processor to a PDP 11/23, adding four new bipolar current supplies and improving the variable resolution capabilities of the velocity selector. The replacement of the H14 guide nose during the long shutdown led to a 15% flux improvement at 8 Å; accumulated small improvements to the machine now give a factor of 2 flux increase over the performance two years ago at the same resolution. The data collection sequence has been further optimised, and new data analysis software performs automatic phase correction so as to remove the effects of small magnetic perturbations due to the environment.

A full scientific programme was maintained, including continued studies of haemoglobin (Paris), polyelectrolytes (Saclay) and polymers (Jülich/Mainz/London). The polarisation analysis capability proved extremely useful in elucidating humidity-induced structural changes in *in vivo* deuterated phycocyanin (Edinburgh/London). The investigation of strongly interacting colloidal systems was extended to study the adsorption of aromatic and aliphatic molecules into charged micelles (RAL/ILL). A highlight of the year was a combined use of photon correlation spectroscopy

and neutron spin-echo to study the dynamics of μ -emulsions (Bristol, Malvern/ILL) and non-ionic micelles near a phase transition (EMBL/ILL).

The study of various problems in magnetism represents another eminent use of the instrument. Special advantage is offered by powerful polarization analysis capability, which makes it possible to single out and analyse magnetic cross sections as low as 10 mbarn/sterad. Spin glasses (ILL), magnetic critical phenomena (Saclay) and soliton spin dynamics (Berlin, CEN Grenoble) have been investigated. A particularly interesting achievement was the implementation of the Ferromagnetic Neutron Spin Echo method, which enables the spectrometer, in spite of its intrinsic sensitivity to magnetic fields, to be fully used with a high magnetic field applied to the sample (40 Kørsted). This opens up new areas of applications.

IN13 backscattering spectrometer for short wavelengths

(A. Heidemann, I. Anderson, J.F. Barthélémy)

After completion of the assembly of IN13 at the end of 1980, instrument tests were performed during the period from January to March 1981. Intensity, energy resolution and background were measured for different spectrometer configurations. The energy resolution varies between 5 and 25 μ eV (FWHM) (incident energy 16.2 meV) depending on the monochromator and analyzer Bragg angles and the sample size. The flux at the sample position (beam size 3×3 cm²) is of the order of $5 \cdot 10^3$ /s.cm². A careful comparison of the two detector sets — a "multidetector" consisting of 32 He³ detectors and a set of five single He³ detectors — was performed. As expected the single detectors have less background (about one to two counts/min) than the multidetector, but the latter permits measurements of 16 different Q values simultaneously. The change-over time from one set to the other is very short. During the test period a number of soft — and hardware problems showed up. The long reactor shutdown was used to improve the performance of the machine. The reliability of the monochromator furnace was increased by some small modifications. The monochromator cooling circuit was linked with the instrument computer.



The bank of analyser crystals on the new backscattering spectrometer IN13.

In August 1981 the first scheduled experiment was carried out studying the inelastic incoherent structure factor (IISF) of the tunnelling molecules in CH₄ in phase II up to high momentum transfer ($Q \leq 5.5 \text{ \AA}^{-1}$). A number of new tunnelling spectra were obtained in samples like Nitromethane, Manganese acetate and (NH₄)₂PdCl₆. The search for proton tunnelling in Lutetium at 100 mK was unsuccessful.

Future developments of the spectrometer which are in progress include a computerized survey of the instrument security, a spare monochromator furnace and the study of better monochromator and analyzer crystals (Cu and graphite). A test experiment with a graphite monochromator (006 plane) yielded an intensity gain of a factor of two with an energy resolution of about 20 μeV (the lattice spacing of the (006) planes of pyrolytic graphite differs from that of (422) planes of CaF₂ by only 0.25%).

D7 diffuse scattering spectrometer

(W. Just, O. Schärpf, R. Rebesco)

The instrument was used for tests of O. Schärpf's supermirror polarizers from January

until March, partly using the polarized neutrons for conventional magnetic disorder investigations and partly using them together with polarization analysis. Several test experiments were performed with polarization analysis to gain experience for a final design of multiangle analyser support mechanism. The results of these experiments were encouraging so that the final decision on the transformation of D7 into D7B (polarization analysis for 32 detectors simultaneously as routine option, instrument on tanzboden modules) was taken.

During the long reactor shutdown the marble floor was laid and a new monochromator axis and new shielding (restricting the available wavelengths to three discrete values: 3.1 \AA , 4.75 \AA and 5.7 \AA) were installed. A new monochromator (triple, variable curvature of focussing) was put into place increasing thus the monochromator surface by a factor of 5. The electronics was updated with new motor drives and the necessary modifications for D7B (second CAMAC-crate, additional disk, spin-flip module, 64 detectors).

D7 was put into service again on Nov. 23 for the users' programme.

D11 small angle and diffuse scattering spectrometer

(P. Timmins, R. May, R. Oberthür, P. Joubert-Bousson)

The long shutdown of 1981 was an opportunity to make major modifications to D11. The most important of these was a change of the PDP 11/40 operating system from RSX11D to RSX11M to be in line with a large number of other instruments in the house. At the same time the data acquisition program was changed and the electronics substantially simplified. A tekonix 4025 display terminal has been bought and we hope to have a hard copy unit in the near future.

The vacuum pumping system for the neutron flight path has been modified providing greater security. Modifications have also been made at the sample positions allowing the automatic position encoded sample changer to be installed at any position.

An operating manual for the instrument has been written and copies may be obtained from the Scientific Secretary. In a later edition of this manual will be included the results of a large number of instrumental calibrations (absolute intensity etc.) recently performed (Fig. 6).

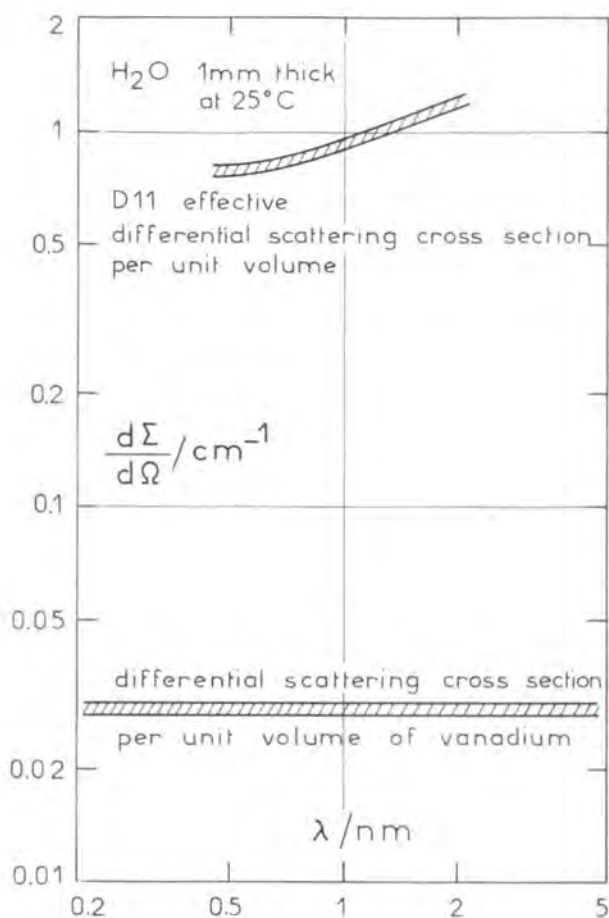


Fig. 6: Comparison of the differential scattering cross section per unit volume $\frac{d\Sigma}{d\Omega}$ of H_2O , the D11 standard mainly used uncorrected for multiple scattering and inelastic effects, as a function of the incident wavelength λ , with the corresponding corrected value of vanadium.

D16 four-circle MK6 diffractometer on a cold beam

(G. Zaccai, S.A. Wilson, D. Worcester, J.M. Reynal)

1981 has been the year of reconstruction for D16. It now has a new two-dimensional multi-detector with the appropriate shielding and collimation as well as new electronics and computer control. Data acquisition is controlled by a PDP 11/23 with a PDP 11/34 for on-line treatment and calculations. The assembly of mechanical parts, computers and electronics was finished in July, and the latter six months of the year were taken up by neutron beam tests to de-bug and optimize the performance of the instrument. A number of "typical" test experiments in different scientific areas, allocated by the Scientific Council, have been done in the same period. Routine operation is planned for 1982.

D17 low-q high resolution spectrometer

(A. Bentley, G. Bentley, M. Roth, H. Cruz)

D17 is now operating on a routine basis for classical small angle scattering and no major development has occurred in this field. The possibility of using polarized neutrons as a standard option would be one of the further developments for the next year as well as the automatic control by program of the multidetector rotation around the sample axis.

The main effort has been in software development

1. The change of operating system from RSX11-D to RSX11-M (H. Schwab, R. Ghosh, R. Hildebrandt)
2. The development of programs for diffraction experiments
3. The simplifying of time-of-flight experiments
4. The monitoring of experimental conditions (vacuum, beam shut, velocity selector, temperature) by warnings when starting a measurement or interruption of data acquisition during measurement.

The change of operating system has brought more flexibility in the programming of the instrument, especially for interacting programs.

Considerable progress has occurred for diffraction experiments: programs for peak-search, indexation, calculation of orientation matrix are now available. Automatic peak-search is made on-line after each data acquisition, giving a continuous record of the progress of the data acquisition and a basis for indexation and crystal orientation determination. In 1982 we will probably start the implementation of the data reduction program (reflection integration) which is operational on the PDP10.

The accuracy and ease of the experiments have been improved by a precise system of interchangeable diaphragms (from $\phi = 0.1$ to 5 mm) on the collimator. 1982 will see the installation of a new Eurlian cradle (HUBER) bought this year, which is adapted to the D17 experimental setting. Concerning the time-of-flight experiments, it is planned to introduce a mask memory to give more flexibility in the spatial resolution (for instance, for a finer X, Y time analysis of the primary beam).

Co-ordinators:
A. HEIDEMANN
F. MEZEI

Group-engineer:
F. DOUCHIN.

instrument group diffraction instruments

| | | | |
|-----|--|----------|--|
| D1A | : High resolution diffractometer on thermal guide H22. | D9 | : Four-circle diffractometer on hot beam H3. |
| D1B | : Two-axis diffractometer with multidetector on thermal guide H22. | D10 | : Four-circle three-axis spectrometer on thermal guide H24 (neutron spin-echo option). |
| D2 | : High flux 2-axis diffractometer with multidetector on thermal beam H11. | D12/T12 | : Neutron camera on thermal guide H23. |
| D3 | : Two-axis polarized neutron diffractometer with lifting counter on thermal beam H5. | D15 | : Four-circle MK6 diffractometer on inclined thermal beam IH4. |
| D4 | : Liquids diffractometer sharing hot beam H8 with IN1. | D18 | : Neutron interferometer on neutron guide H25. |
| D5 | : Three-axis polarization analysis spectrometer on hot beam H4. | D19A | : 2D multidetector for tests on thermal guide H24. |
| D8 | : High-flux four-circle diffractometer on thermal beam H11. | S21 | : Double crystal diffractometer. |
| | | L1 4/5/7 | : X-ray laboratories. |

Introduction

The instruments of the group have continued to function satisfactorily during the year. Parallel to this a large effort has been put into the development of the project H11, which will eventually partially replace D1A, D2 and D8 and relieve the load on D1B. The calculations of the common monochromator shieldings and beam tubes are nearly finished, and the detailed design study is under way. For D2B, which will further extend the range of D1A the Soller collimators have been ordered, and will be tested early in 1982. The instrument D19A, which is the prototype 2-dimensional detector which in due time replaces D8, has been used for a series of test measurements ranging from simple ferroelectrics to complex organo-metallic-coordination compounds. In parallel the software is being developed. Finally a prototype 128-cell multidetector has been fabricated for the powder instrument D20 which will replace D2.

The rebuild of the film cameras D12 continues, and it has been decided that in the future these will serve as instruments for crystal tests prior to other measurements. As such they will not be routinely scheduled, and for this reason the instrument is renamed T12.

The individual computers continue to function to satisfaction, and with the advent of the new

DEC10 computer and faster transmission of data from the instrument to the DEC10 better instant analysis of data is now possible, and is being developed.

Throughout the year the group has as usual had efficient and enthusiastic support from the technical services, for which the group is very thankful.

D1A high-resolution powder diffractometer

(A.W. Hewat, A. Wright, S. Heathman)

D1A has continued to perform a large number of experiments with few technical problems. In 1981, more than 200 complete diffraction patterns were collected for over 50 experiments. Temperature programming now works routinely and is used for many experiments, especially those involving phase transitions. Wavelength programming is also used routinely, for example to check on the crystal symmetry by performing a short scan at long wavelength (3 Å or 5.7 Å) followed by a longer scan at 1.9 Å or 1.4 Å for refinement of the crystal structure. In this way, a number of unexpected distortions have been observed in reputedly high symmetry structures. Automatic indexing of the diffraction patterns

from such distorted structures is also fairly routine using the long wavelength data; the subsequent deduction of the crystal structures remains largely a matter of trial and error, but the new central computer has helped speed up this aspect of the data treatment. Success in these areas, which is reflected by the appearance of new powder diffractometers of comparable resolution at other research centres, also underlines the limitations to future improvement of D1A. In order to maintain its superiority in this area, the ILL has therefore as mentioned above started the construction of two new powder diffractometers, D2B and D20, which will have both higher resolution and higher intensity.

D1B two-axis diffractometer with multidetector

(J. Pannetier, H. Haesslin, P. Mangin, A. Dorn)

The major technical modifications have been the rebuilding of the collimation system and the change in the gas of the multidetector from BF_3 to a $^3\text{He}/\text{Xe}$ mixture; the last feature will improve considerably the efficiency of the detector at 1.28 Å. Although the change of gas led to some difficulties in the first weeks of operation, the detector is now functioning well.

Some teething problems with the new D1B system of control and data acquisition were experienced during the last year and led to a partial shut-down of the instrument in September, but the system has performed well since then. A new ILL-standard cryostat (Vanadium tail) is now available and a dedicated furnace (up to 1600°C) is under test.

D2 high-flux two-axis diffractometer with multidetector

(J. Bouillot, G. Bomchil, J.L. Soubeyroux, P. Georges)

D2, with its new 64-cell multidetector and independent RT11 computer, has continued to carry out a normal experimental schedule. 154 days were allocated out of 361 requested. Time allocation was shared almost equally between colleges 5, 6, 7 and 9. The increase in the number of days requested is mainly due to college 6 (liquids and amorphous) which cannot use D4, presently dismantled for reconstruction. The situation should come back to normal in 1982. Experiments performed deal with magnetic alloys, electro-chemistry, intercalated surfaces, liquids and amorphous materials.

D3 two-axis polarized neutron diffractometer with tilting detector

(F. Tasset, S. Burke, K. Ben-Saidane)

D3 has worked well during the year using a new RT11 Fortran software. The change-over took place without difficulty, as a maximum effort was made to maintain all aspects of the old, user-interactive system. Additional features of the new system are handling of extinction rules and lattice symmetry during alignment and measurements. An addition of a dual disk system facilitates data handling, and a new PT100 terminal makes interactive use of the system easier.

During the 3 month shutdown the opportunity was taken to rebuild the 4.62 Tesla cryomagnet, which is normally in continuous use. The temperature is now continuously variable in the range from 1.4 to 300 K, and the helium autonomy has been doubled to 4 days. An interface for automatic control of the half-shutters used for alignment has been implemented, and a CAMAC module for automatic temperature control is under construction.

Finally it should be mentioned that two new polarizing CoFe monochromators have been ordered, and will be tested by the end of the year.

D4 two-axis liquids diffractometer

(P. Chieux, S. Cummings, A. Hawes)

D4 was dismantled in March 1981, after testing a new 64-cell multidetector. The reconstruction work is progressing smoothly. The monochromator shielding, which is common with IN1, is near completion. The spectrometer body is being assembled. Tests of the detectors and the data acquisition system are being made on a separate beam.

D5 three-axis polarization analysis spectrometer

(K.R.A. Ziebeck, J. Schweizer, A. Perkins)

The high demand for polarization analysis has continued throughout 1981 with the requested time exceeding the time available by more than a factor three. Effort has therefore been concentrated on improving the facilities for carrying out such experiments. An example of such improvements is the replacement of the r.f. flipper by a cryoflipper, which is essentially 100% efficient and wavelength independent. Unlike the original

cryoflipper mounted on D3 the superconducting screen on D5 is cooled by a closed circuit refrigerator. This reduces manual intervention to a minimum, namely to cooling down the foil at the beginning of each cycle. In addition improvements have also been made to the analyser mounting, to minimize backlash, and to the furnace enabling sample temperatures in excess of 1000°C to be obtained.

In August 1981 the PDP 11/34 was installed using programs based on the D3 package. The change-over from the Carine system was carried out without interruption to the D5 schedule.

D8 high-flux four-circle diffractometer

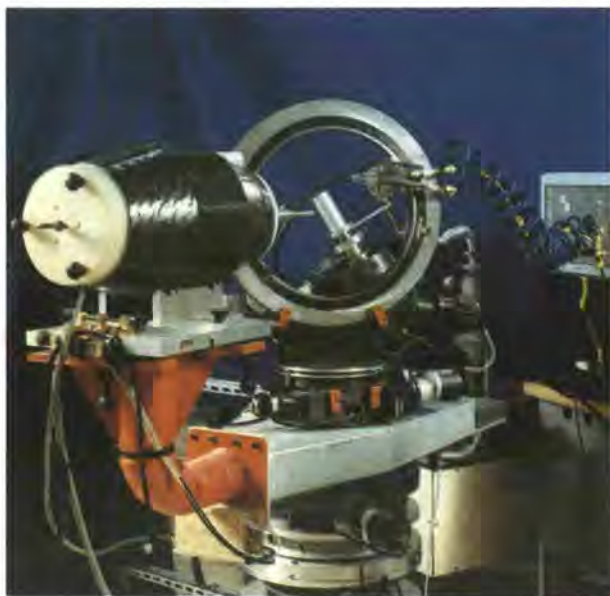
(S.A. Mason, J.-M. Savariault, J. Allibon, J. Archer)

D8 functioned well throughout the year. No substantial changes were made as the instrument will soon be replaced by the D19B multidetector instrument on the re-designed H11 beam position.

D9 four-circle diffractometer with short wavelength

(M.S. Lehmann, W. Kuhs, J. Allibon, J. Archer)

The instrument has continued to work satisfactorily. Further extensions have been made to the software, facilitating change of parameters during the measurement as well as the start-up procedure, and work has been done on cold transfer of the crystals to the cryostat.



A Displex cryostat mounted on the 4-circle instrument D9.

As a majority of the measurements are done at low temperature a study of the implementation of a two-stage refrigerator which can cool to approximately 15 K was carried out. It was found that this could only be done by using either an offset Φ axis on a Eulerian cradle or some completely different instrument geometry, and it was decided to go ahead implementing these changes. Towards the end of the year a first test was made of a small position sensitive detector constructed at the Rutherford laboratory.

D10 high-resolution four-circle three-axis spectrometer

(C. Zeyen, N. Lehner, R. Chagnon)

D10 continues to run smoothly with and without the analyser option. A new and much more flexible analyser protection was installed in December 1981. The corresponding software for the performance of energy-scans has been written and successfully tested. Thus (within the limitations imposed by resolution and neutron-flux) inelastic measurements are now possible on D10, even with the sample mounted in the Eulerian cradle. Some improvements have been implemented on the 4-circle cryostat so that sample changing is easier now. The former CLTS temperature sensor has been replaced by a more reliable rhodium/iron thermometer.

About 30 % of the available beam time was used for the D10 spin-echo test facility. While experiments on quasielastic scattering and filtering of inelastic scattering look very promising more experimentation is needed on the phonon lifetime side. (See separate report in the section New Experimental Techniques).

D12 neutron film camera

(A.F. Wright, S. Heathman)

The first of a series of test instruments to be introduced over the next 3 years, D12, will be reconstructed and renamed T12 during 1982. The new design which is intended to improve considerably the reliability and ease of use of the low temperature Weissenberg camera, is now completed, and detail drawings are well advanced. In readiness for installation, the monochromator protection has been improved, and fitted with pneumatically operated beam shutters.

D15 four-circle MK6 diffractometer

(P.J. Brown, G.H. Lander, S. Wilson, J.M. Reynal)

During the long shut down the control system for the D15 diffractometer was changed from the old PDP 8 shared with D16 to a new dedicated PDP 11/34 computer. The software package now running is almost exactly the same as for the D8 and D9 diffractometers, thus allowing a measure of standardization within the diffractometer group. Some new programs had to be implemented for the normal-beam option, but after relatively few troubles the new system has been in routine operation since mid-July.

D15 continues to be in demand for diffraction experiments requiring special equipment. This year the superconducting magnet, the high-temperature furnace, and special cryostat used with uniaxial stress equipment have been accommodated. For these complex pieces of equipment that usually have to rotate in a fixed plane, the normal beam geometry is particularly useful because with it one can obtain a component of the scattering vector in the vertical direction.

D18 neutron interferometer

(A. Freund, U. Kischko, G. Schmidt)

The instrument has continued to function satisfactorily during the year, being used for measurements of scattering lengths of gases, liquids, elements and isotopes, for imagery with photographic methods as well as for ultra small angle scattering.

The software has been extended to facilitate the user interaction, and the instrument can now also be used for experiments with polarized neutrons. A definite device for the variation of the wavelength is being installed, and will be available mid 1982.

D19A 2D-Multidetector test on H24

(M. Thomas, R.F.D. Stansfield, M. Berneron)

The first two data-collection experiments using the small area detector of 64×16 cells as a fly's eye detector (for single Bragg peaks in the equatorial plane) have been completed. The computer



The D19 set-up with the shielding of the multidetector (on the right).

system was upgraded between the experiments, with the addition of a floating point processor, a cache memory and a 63 Mbyte disk drive. The latter particularly has provided a dramatic increase in efficiency of use of the instrument.

Software development has included an analysis of the detector stability, which is found to be excellent over a period of several weeks. Precise evaluation of single peak intensities is well developed and has provided accurate data, particularly for weak reflections.

The shielding for the full 512×16 cell detector has been installed. Within this frame the small detector has been positioned out of the equatorial plane to study the resolution function for normal beam diffraction. Results show a significant worsening of the resolution with ν (the vertical angle), and a sensitive dependence on the vertical collimation of the beam.

S21 double crystal diffractometer

(C. Zeyen)

For the application of the method of Simmons and Balluffi together with high resolution neutron diffraction (simultaneous determination of lattice expansion $\frac{\Delta a}{a}$ and macroscopic dilatation $\frac{\Delta l}{l}$ to yield the equilibrium vacancy concentration $c_v = 3 \left(\frac{\Delta l}{l} - \frac{\Delta a}{a} \right)$ of a single crystal the S21 double-crystal device was upgraded and a laser interferometer as well as two high temperature furnaces added by W. Trost, MPI Stuttgart, in the framework of his thesis work.



The S21 Double Crystal Diffractometer with high temperature furnaces and laser interferometer.

Recent measurements have clearly shown that the required accuracy of 10^{-6} for both the neutron diffraction lattice parameter determination and the dilatation measurement via the laser interferometer can indeed be obtained reproducibly at high temperatures. Experiments on copper are presently underway and others planned.

It is expected that the S21 proposals previously accepted by the subcommittees and concerning problems related to phase transition studies will also be performed during 1982.

LI 4/5/7 X-Ray laboratories

(P.J. Brown, G. Schmidt)

The facilities continued to function in 1981. As the members of the group formerly in ILL1 have moved to the new computer building plans have been made for moving the equipment nearer to the group early in 1982.

Co-ordinator:
M. S. LEHMANN

monochromator group

| | | | |
|------|---|------|---|
| D13A | : Neutron double-crystal diffractometer on thermal guide H24. | L12B | : X-ray orientation unit for single crystals. |
| D13C | : Neutron single crystal orientation, testing and mounting facility on thermal guide H23. | L13 | : Gamma-ray diffractometer. Laboratory for single crystal preparation. |
| L12A | : X-ray double-crystal diffractometer. | | |

Instruments

D13A

(A. Bœuf, A. Freund, F. Rustichelli)

The instrument worked as usual during the year for single crystal and monochromator characterization and orientation. The installation of a Heusler alloy polarizer on D10 weakens the white neutron flux at D13A by up to a factor 8. This loss is compensated by increasing the beam cross-section and by using a less perfect monochromator crystal for experiments permitting lower resolution.

D13C

(A. Freund, B. Hamelin, R. Hustache, M. Hoecker)

Software and hardware of the instrument were further improved in connection with the better performance required in the monochromator production. Neutron topography is becoming more and more popular for the identification of subgrains in as-grown single crystals and has been widely used on D13C, also on samples other than monochromator materials. One of the six perfect Ge monochromators of this instrument has been replaced by a less perfect crystal in order to increase the flux and to shorten the exposure time. As before, D13C served for assembling focussing multicrystal monochromators and analysers, and crystal orientation and positioning is now fully automatic.

L13

(A. Freund, B. Hamelin, A. Escoffier, M. Hoecker)

The γ -ray diffractometer worked routinely on crystal testing and in-beam plastic deformation of monochromator crystals. Also on this instrument experiments were accepted and carried out on samples other than monochromator crystals which, however, were mostly related to ongoing studies with neutrons. The construction of a fourth diffractometer bench is under way for in-beam studies of crystal growth.

Single crystal laboratory

(B. Hamelin, R. Hustache, A. Freund, A. Rubio)

The high demand for metallic monochromators (Cu, Cu₂MnAl), in particular for projects in the modernization programme, necessitated a more efficient cutting facility. A new spark cutting machine has therefore been purchased which works ten times faster than the existing spark cutter. In addition to the monochromator production programme the crystal laboratory was used for preparing samples connected with in-house experiments and also for helping users with crystal orientation and shaping.

Basic studies of monochromator materials

Beryllium

The superiority of beryllium as monochromator material, and the feasibility of such monochromators with any desired mosaic spread produced by plastic deformation have been confirmed. Many samples have been studied with X-ray, γ -ray and neutron diffraction techniques including topography. The diffraction properties observed were correlated with the microscopic defect structure by means of electron microscopy (S. Joensson, Ph.D. Thesis, Institut für Metallkunde der Universität Stuttgart, July 1981). Whereas these basic studies on samples of typically 1 cm^3 have been terminated successfully, it is still difficult to grow big crystals with larger grain size. Most of the effort is currently devoted to solving this problem (in collaboration with Max-Planck-Institut für Metallforschung, Stuttgart).

Pyrolytic graphite

The studies of intercalated pyrolytic graphite as cold neutron monochromator have almost been terminated. In-beam experiments on the γ -ray diffractometer have shown that a considerable increase of the mosaic spread during intercalation cannot be avoided. The mosaic width reached 1.4° for the KC_8 compound (stage 1) starting from 0.3° . No significant change was observed when reducing the K concentration by going back to KC_{24} (stage 2). However, the initial width of 0.3° could be obtained by means of a uniaxial pressure of 1500 Kgcm^{-2} parallel to the c-axis. As this process is completely reversible, the application of intercalated graphite as monochromator will be limited to cases where a relatively large mosaic spread can be tolerated (A. Hamwi, Ph.D. Thesis, Institut National Polytechnique de Grenoble, November 1981).

At present there are several problems in the supply of high quality pyrolytic graphite. In addition to the increasing delivery time, the mosaic spread of Union Carbide top quality ZYA material has increased from 0.4° to about 0.7° . A common development project was therefore launched with the firm Carbone Lorraine, and a furnace is under construction for in-beam studies of PG on the γ -ray diffractometer. The best quality material available from Carbone Lorraine has at present a mosaic width of 0.9° and a reflectivity of typically 80% at $\lambda = 2.4 \text{ \AA}$.

Crystal growth

After hesitating for a long time it has finally been decided to undertake the growth of large single crystals at the ILL. Already in the past, we had difficulties of getting good quality as-grown ingots, in particular copper, and this year the situation became very difficult just at a moment of very high demand. In addition to the size and complexity, the quality standard of monochromators increased, i.e. high reflectivity, anisotropic mosaic spread for vertical focussing. This can only be achieved — with a success rate of currently 60% — if the crystal used for plastic deformation has a low and homogeneously distributed dislocation density. The crystal growth project combines the know-how from the neighbouring CNRS crystal growth laboratory with the facilities for crystal characterization at the ILL. A soft-mould Bridgman furnace has been designed for the oriented growth of copper single crystals in-beam controlled on the γ -ray diffractometer. We hope to start operating this facility in March 1982.

For germanium the problems have been solved by renting a Czochralski machine at the LETI Laboratory of the CEN-Grenoble. We were able to grow several big single crystals of a perfection which is adequate for our requirements.

Monochromator production

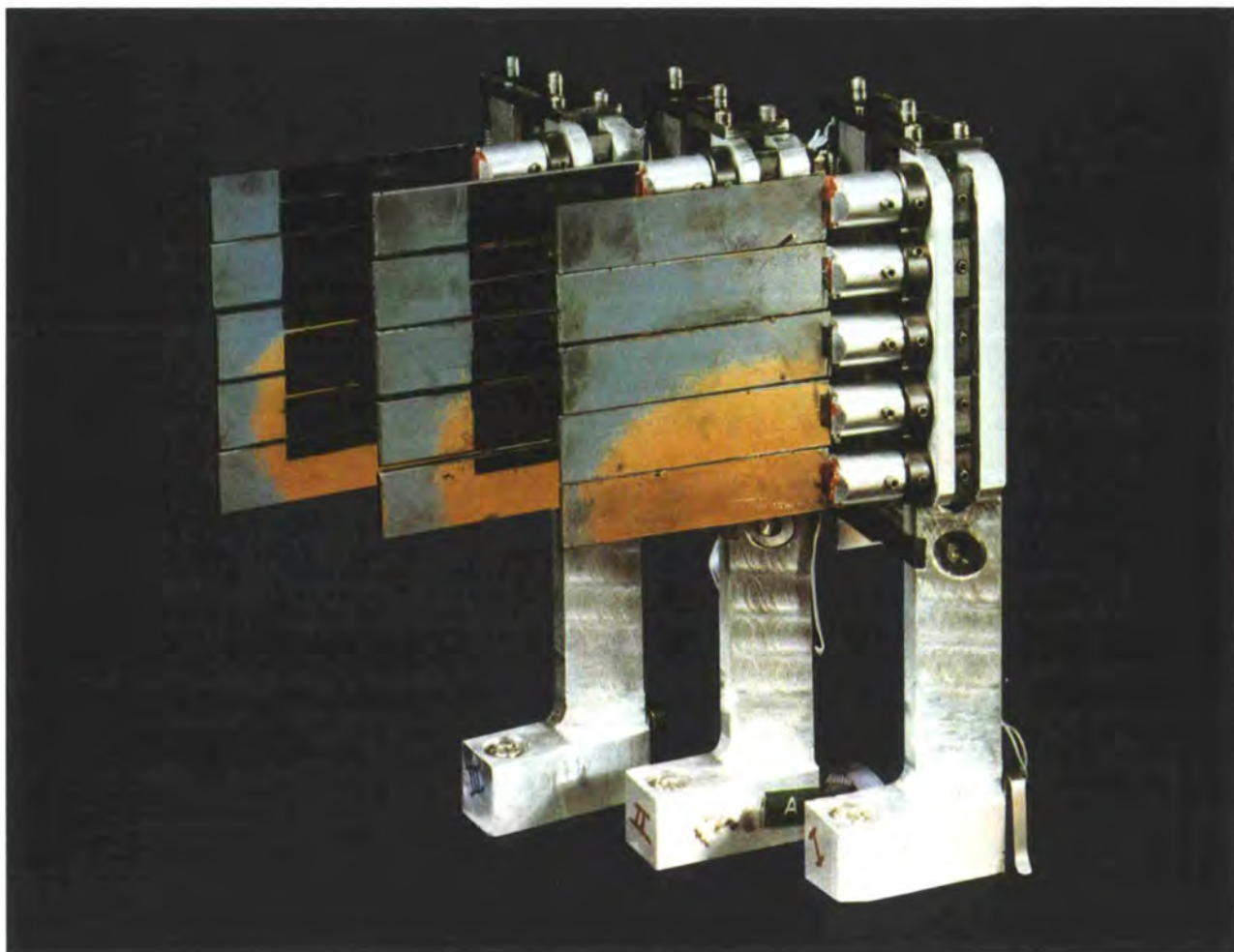
A $10 \times 15 \text{ cm}^2$ germanium (111) monochromator has been produced for D1B with fixed radius of curvature and anisotropic mosaic spread. The flat (220) copper monochromator of IN8 was replaced by a new vertically focussing composite system with variable radius of curvature. The instrument D7 has been equipped with a vertically focussing triple monochromator system, also with variable curvature (see photograph). D10 received a vertically focussing, variable curvature Heusler alloy monochromator-polarizer. A prototype of the vertically focussing four-monochromator-multicrystal system for IN1B/D4B has been constructed and half of the copper crystals are ready for mounting. About 3000 CaF_2 crystals have been glued on the IN13 analyser supports.

General remarks

As can be seen from this and previous reports monochromator production is a delicate and lengthy process needing experience and know-how as well as patience and a lot of special equipment. For these reasons complete monochromators are in general of only limited commercial interest and cannot simply be purchased. Therefore, the question arose whether the ILL

could not produce monochromators for other reactor centres. This is, of course, impossible because of the very intense in-house programme and staff limitations. However, our know-how and equipment may also be made available to guests from other reactor stations for mounting monochromators. This possibility was utilized this year by a guest from Karlsruhe (H. Bühnen).

Co-ordinator:
A. FREUND.



The horizontally and vertically focussing triple monochromator with variable curvature produced for the instrument D7.

central group

The Group has continued, in direct collaboration with other Departments, to provide technical assistance and services in the experimental halls for the regular scientific programme, for analysis and coordination of hazardous experiments, and for the installation, modification and improvement of the instruments.

An engineer and two technicians from the Group have been detached for special development work in the areas of multidetectors, production of supermirrors and preparation of chemical experiments.

The period of the long reactor shut-down was one of particularly intense activity in the experimental halls. Almost without exception, the radiation shielding was at least partially dismantled on each instrument, to allow access for maintenance work. Major work was involved in the changing of the neutron guides, the complete dismantling of IN1 to allow the changing of the beam liner and the modification of IN10 and D7. The opportunity was taken to modify the shielding around a number of beam shutters, to improve its efficiency and ease of dismantling for rapid interventions, to make repairs to the floor of the reactor experimental halls, and to modify the lorry access to the guide hall building.

A detailed analysis of the safety aspects of each experimental zone led to a number of modifications including:

- The definition of the basic safety configuration ('Etat fondamental').

- The modification of all beam warning lights, to give a positive indication of the closed position.
- The installation of fixed lighting within each primary shielding, an interlock with the beam shutter and a visual warning, activated whenever work is being carried out within the shielding.
- A campaign to uniformly label all pipework and valves.
- The production of new instrument information panels, regrouping all essential information concerning the instrument, the persons responsible, the experiment in progress, the 'Etat fondamental', and by means of colour coding the position of all services and their emergency cut-off positions.

Neutron background measurements have been continued, to assist in the design of new instruments, and to reduce the general level of background. Extra cylindrical protection was fabricated for D12 by hot forming of 5 cm thick sheets of polyethylene, instead of the usual technique of machining, which is very wasteful.

In collaboration with the Reactor Department, a microprocessor system has been defined, and is currently being installed, which will allow the Reactor control staff to survey several hundred instrument functions (eg vacuum pressure in the neutron guides, temperature in the instrument cabins, leak detectors, etc.). The system will be fully operational in 1982

D.A. WHEELER.

sample environment group

Vacuum

Maintenance of the 450 Institute pumps:

- 680 routine interventions.
- 130 major repairs.

Commissioning of the following new equipment:

- Primary pumping sets.
- Turbo-molecular pumping sets.
- 1 Helium leak detector.
- High pressure vacuum groups.

Approximately 600 tests for vacuum leaks have been performed using the helium leak detectors.

Cryogenic fluids

Liquid Nitrogen:

338 900 l (- 5%) at cost .40F/l.

Liquid Helium:

- Consumption: 37 231 l (- 19%).
- Average cost per litre: 18.33 F (+ 24%) including gas losses.
- Gas losses: 5 060 m³ (i.e. 19% of consumption), (22% in 1980).
- The main reason for the reduction in Helium consumption is the reduced operation time of the reactor.

Cryogenics

This year the number of experiments requiring low temperatures has not changed significantly (278 in 1981, 288 in 1980), however the number of cryostat-days has considerably decreased to 1878 (- 35%).

Standard cryostats

Owing to specific requirements of individual instruments only 5 new cryostats built to the ILL standard have been put into service.

Owing to the heavy demand to supply these cryostats to external establishments, the ILL has signed an agreement with a British manufacturer to sell them under licence.

Very low temperatures

8 experiments were conducted with the dilution refrigerator, 6 of which were completely successful.

3 small angle scattering experiments were provided with a superconducting magnet (mounted in vacuum) which gave a field of .4 Tesla within one minute.

2 He³ systems have been designed and put into service.

One of these provides temperatures down to .5 K and is used for gas adsorption measurements. The other, being an insert for use with standard cryostats, provides rapid sample changes and temperatures down to .7 K.

Superconducting magnets

Delivery problems of the 10 T, vertical H magnet have caused a delay of two years. The manufacturer now informs us that it is working to specifications and will be delivered before the end of 1981. We thus expect to have it in routine use within the next few months.

Another 10 T, vertical H, system has been ordered from another company. Although the required field specifications have been well met (11 T), there still remain other details to be verified. Thus delivery of this system cannot be expected before another 3 months.

Furnaces

- 62 (- 25%) experiments using furnaces, i.e. 556 furnace-days (- 16%).
- The very high temperature (2 500° C) furnace has been brought into operation for a number of experiments with varying degrees of success. These experiments have entailed some modifications to improve both the reliability and the ease of operation (but for specialist users only).
- Two furnaces of special geometry adapted to IN6 and D1B have been built and put into routine service.
- The special S6 furnace has been remodified in an attempt to meet the stringent requirements of this instrument.

Temperature measurement and control

The project to replace the old temperature controllers by a microprocessor-controlled instrument particularly adapted to the special needs of the Institute is well advanced and making progress as planned. We will shortly be ready to test the prototypes on running instruments as soon as all the known 'bugs' in the hardware and software have been ironed out.

In order to improve the precision of temperature measurement for cryostats the silicon diode sensors are being replaced by platinum and carbon resistances. 51 of these new thermometers have been calibrated and mounted on cryostats. The absolute precision is < 0.01 K for T < 10 K and < 0.2 K for 10 K < T < 300 K.

D. BROCHIER.

3

colleges

Introduction

All the internal scientific activity of the Institut is grouped into "colleges" with particular scientific interests.

The following is the current list of colleges:

College 2: Theory

College 3: Fundamental and Nuclear Physics

College 4: Excitations in crystals

College 5: Crystal and magnetic structures

College 6: Liquids, gases and amorphous materials

College 7: Imperfections

College 8: Biochemistry

College 9 : chimie

Each College corresponds to a Subcommittee of the Scientific Council of the ILL, which advises the Directors on the scientific programme. New research proposals submitted to the ILL will first be examined by the Colleges with respect to their technical feasibility and then be presented to the Council Subcommittees. A further task of the College is to contribute to a smooth carrying-out of the experiments by appointing local contacts and by advising the instrument responsible as well as the Scientific Secretary on the time schedules for the various instruments. The College Secretaries are normally elected for a 2 year term and have regular meetings with the Directors and Senior Scientists to ensure the flow of information on all matters concerning the scientific activity of the Institut.

Einleitung

Die gesamte wissenschaftliche Tätigkeit des Instituts ist in Kollegien mit spezifischen wissenschaftlichen Interessen aufgeteilt.

Zur Zeit sind folgende Kollegien am Institut tätig :

Kollegium 2 : Theorie

Kollegium 3 : Grundlagen- und Kernphysik

Kollegium 4 : Anregungen in Kristallen

Kollegium 5 : Kristallographische und magnetische Strukturen

Kollegium 6 : Flüssigkeiten, Gase und amorphe Substanzen

Kollegium 7 : Fehlorderungen in Festkörpern

Kollegium 8 : Biochemie

Kollegium 9 : Chemie.

Jedes Kollegium entspricht einem Unterausschuss des Wissenschaftlichen Rates des ILL, der die Direktion für das wissenschaftliche Programm berät. Die Kollegien prüfen als erste dem ILL unterbreitete Vorschläge zu neuen Forschungsvorhaben im Hinblick auf ihre technische Realisierbarkeit. Daraufhin werden sie den Unterausschüssen vorgelegt. Eine weitere Aufgabe der Kollegien ist es, zu einem reibungslosen Ablauf der Experimente beizutragen : Sie stellen den Gastforschern wissenschaftliche Hilfe vor Ort und beraten den Verantwortlichen der Experimentiereinrichtung und den Wissenschaftlichen Sekretär über die Zeiteinteilung für die Experimente an den verschiedenen Instrumenten. Die Sekretäre der Kollegien werden normalerweise für 2 Jahre gewählt, und halten mit der Direktion und den "Senior Scientists" regelmässig Sitzungen ab, um den notwendigen und alle wissenschaftlichen Tätigkeiten des ILL betreffenden Informationsfluss zu gewährleisten.

Introduction

L'ensemble de l'activité scientifique de l'Institut est réparti en collèges avec des intérêts scientifiques spécifiques.

La liste actuelle des collèges se compose comme suit :

Collège 2 : théorie

Collège 3 : physique fondamentale et nucléaire

Collège 4 : excitations dans les cristaux

Collège 5 : structures cristallographiques et magnétiques

Collège 6 : liquides, gaz et substances amorphes

Collège 7 : imperfections

Collège 8 : biochimie

Collège % : chimie

Chaque collège correspond à un sous-comité du Conseil Scientifique de l'ILL, qui conseille la Direction en matière de programmes scientifiques. Les collèges examinent d'abord la faisabilité technique des propositions de recherche soumises à l'ILL. Elles sont ensuite présentées aux sous-comités du Conseil Scientifique. Les collèges contribuent également au bon déroulement des expériences en proposant des collaborateurs locaux aux chercheurs invités, et en conseillant le responsable d'instrument ainsi que le Secrétariat Scientifique de la répartition du temps d'expérience sur les différents instruments. Les Secrétaires de Collège sont normalement élus pour 2 ans et se réunissent régulièrement avec la Direction et les "Senior Scientists" dans le but d'assurer une bonne circulation de l'information dans tous les domaines d'activité scientifique de l'Institut.

college 2 theory

Membership 1981

I. ILL members

P. Nozières
F.D.M. Haldane (-Aug.)
R. Hasse (Sept.-)
V. Vieira
A. Griffin (-Aug.)
H.-J. Schulz (Oct.-)
T. Burkhardt (-Aug.)
K. Fischer (-Aug.)
T. Ziman (Sept.-)
H. Capellmann
J.P. Hansen (-Sept.)
M. Roger (Mar.-)
P. Quentin (-Oct.)
B. Desplanques (Sept.-)
P. Schuck (Heisenberg fellow)
P. Becker (Oct.-).

II. Thesis students

C. Comte
J. Bartel

III. Long term visitors

M. Warner (4 months)
W. Hess (2 months)
H. Glyde (1 month)
D. Saint James (~ 2 months)
A. Hewson (1 month)
E. Eisenriegler (1 month)
T. Choy (1 month)

General

During the year 1981 the composition of the Theory College changed quite markedly: Haldane, Griffin, Burkhardt, Fischer, Hansen and Quentin left to either return to their home institutions (Griffin, Fischer, Hansen) or to take up new university positions (Haldane, Burkhardt, Quentin). Newcomers to the college during the year are Roger, Schulz, Ziman and Becker (condensed matter theorists), and Hasse and Desplanques (both nuclear theorists). The nuclear physics group also includes P. Schuck as a long term guest (Heisenberg fellow), Bartel as a thesis student, and P. Quentin, who, after taking up his university position at Bordeaux, is still spending part of his time at the ILL. The larger proportion of the college activities is in the field of condensed matter theory. These activities may be divided into (A) Magnetism and low temperature physics (Fischer, Capellmann, Vieira, Griffin, Roger, Nozières); (B) Low dimensional (1-D and 2-D) physics (Griffin, Burkhardt, Schulz, Hansen, Haldane, Ziman). The remaining activities range from work on critical properties (Burkhardt, Ziman) and exciton condensation (Comte, Nozières) to liquid crystals (Warner), colloids (Hansen, Hess), and diffraction theory (Becker).

The diversity of activities in the theory college is reflected in numerous collaborations and scientific exchanges with the various experimental colleges at the ILL. The (probably incomplete) list of topics of common interest includes nuclear fission and spectroscopy, spin glasses, itinerant magnetism, helium, liquids, colloids, polymers, molecular crystals, metallic glasses, and diffraction phenomena.

Scientific activity in 1981

Magnetism and low temperature physics

K. Fischer worked on spin glasses, giving descriptions of transport properties, electrical resistivity, thermopower, and ultrasound. Itinerant magnetism of transition metals (Fe, Co, Ni) was studied by Capellmann and Vieira. They developed a theory for the paramagnetic phase, characterized by unusually strong short range magnetic order even far above the transition temperature. Capellmann collaborated with J. Brown and K. Ziebeck (ILL, College 5) and Deportes and Givord (CNRS) to shed light on the characteristic differences between itinerant and localized magnetism through paramagnetic neutron scattering. Work on liquid and solid helium was carried out by Roger, Griffin and Nozières. Roger discussed the nuclear magnetic properties of solid ^3He , establishing the four particle exchange dominating the magnetism. He also studied the strong similarities between solid and liquid ^4He , a topic also of interest to Nozières in collaboration with Castaing for a discussion of the melting process. Griffin developed a theory for neutron scattering and Raman scattering of thermally excited rotons in superfluid ^4He .

Low dimensional physics

2 dimensions: Griffin gave a quantitative analysis of finite size effects on the static structure factor. He also did work on surface critical expo-

nents. Burkhardt and Vieira developed a theory for localization and delocalization of interfaces in pinning potentials. Schulz investigated commensurate-incommensurate phase transitions. Hansen studied the one-component two-dimensional Coulomb plasma. He developed a theory for the pair correlation function and calculated the free energy in the hypernetted chain approximation. The results were tested in computer simulations. Crystallization was found for couplings $\Gamma = \beta e^2 \approx 140$.

1 dimension: Haldane continued work on 1-D quantum systems, developing a unified picture of the low-energy spectrum and correlations of 1-D quantum fluids. A description of planar spin chains showed intrinsic differences between half-integral spin systems (gapless, power law correlations) and integer spin systems (gap in excitation spectrum). Schulz investigated quasi-one-dimensional superconductors. He showed that low concentrations of "short circuits" between adjacent chains strongly suppress fluctuations, raising the transition temperature. Ziman is working on localization of excitations in incommensurate and random chains.

Further activities in condensed matter physics

Nozières and Comte continued work on exciton condensation in semi-conductors. In particular they studied screening effects, the spin structure of condensed excitons, and internal symmetry (e.g. band degeneracy) breaking. Nozières and Saint-James investigated the competition between condensation of particles or pairs of particles with attractive interactions. They also studied clustering effects in random fields.

Burkhardt wrote several chapters for a book on "Real-Space Renormalization", which he is to edit together with J.M.J. van Leeuwen. Ziman worked on multicritical phase diagrams in pure and random systems. Of particular interest were the effects of quenched disorder on critical properties. He also studied the thermodynamics of spin models in a restricted geometry.

Work on colloids was carried out by Hansen and Hess in collaboration with J. Hayter (College 9).

Hansen and Hayter developed a theory for the structure factor of colloidal suspensions. This work was the basis for a calculation of viscoelastic and transport coefficient carried out by Hess and Hayter. Warner studied liquid crystals, in particular the orientational fluctuations in nematics. He also investigated nuclear transition lines of iron in haemoglobin to interpret the anisotropy in fluctuations.

P. Becker is working on the determination and interpretation of electron distributions in solids. He developed theories of scattering cross-sections by distorted crystals and models of structure factors. Together with P.J. Brown and M.J. Cooper he is writing a book on "Electron Distribution in Solids".

Vieira also worked on transport properties of metallic glasses. Griffin collaborated with J. Jobic to develop a theory for an effective Debye-Waller factor in neutron scattering from high frequency molecular modes.

Nuclear physics

One of the main topics pursued was nuclear fission. Hasse applied nuclear fluids dynamics to the energies and widths of giant resonances. He studied the energy distribution in low energy fission. Bartel and Quentin used Hartree-Fock calculations to investigate nuclear ground states and deformation properties, and low energy nuclear motion. Fission barriers and giant resonances were studied. Among the collective nuclear modes particular attention was focussed on low energy quadrupole modes. Particular nuclei studied with respect to their low energy spectroscopic properties were the odd actinide nuclei.

Desplanques is studying the effects of parity non-conservation in nuclear forces and electromagnetic processes in nuclei. Furthermore, Hasse has been seeking a quantum mechanical description of friction, and studying mathematical physics problems such as solitons.

Secretary:
H. CAPELLMANN.

college 3 fundamental and nuclear physics

Members of the college

I. Internal members

Avenier M.
Barreau G.
Blakeway S.
Blönningen F.
Brissot R.
Desplanques B.
Faust H.R.
Gähler R.
Gönnenwein F.
Heckel B.
Hasse R.W.
Hüsken H.
Kerr S.A.
Koglin E.
Mampe W.
Mougey J.
Oed A.
Pannicke J.
Perrin P.E.J.
Pfeiffer B.
Quentin P.
Schreckenbach K.
Schuck P.
Snelling M.
Weikard H.

II. External members

Jewell K. (Lancaster)
Jung G. (Giessen)
Liaud P. (Compiègne)
Monnard E. (CENG)
Ristori C. (CENG)
Dahmani H. (CEN Alger)

III. Visiting members

Alquist L. (Giessen)
Armbruster P. (Darmstadt)
Baldo Ceolin M. (Padua)
Botty C. (Rutherford)
Byrne J. (Sussex)
Chauvin J. (ISN)
Clerc H.G. (Darmstadt)
Fidecaro G. (CERN)
Fidecaro M. (CERN)
Golub R. (München)
Green K. (Rutherford)
Hamilton W.D. (Sussex)
Hermann P. (München)
Krüger E. (PTB Braunschweig)
Kügler K. (Bonn)
Leroux B. (Bordeaux)
Mheemeed M. (ISN)
Morse J. (Rutherford)
Nifenecker H. (CENG)
Nistler W. (Braunschweig)
Oliver R. (ILL)
Paul W. (Bonn)
Pendlebury J.M. (Sussex)
Pugliezin G. (Padua)
Ramsay N. (Harvard)
de Saintignon P. (ISN)
Smith K. (Sussex)
Styerl A. (München)
Theobald G.P. (Darmstadt)
Tokunaga Y. (Jülich)
Vignon B. (ISN)
Weirauch W. (PTB Braunschweig)
Wilson R. (Harvard)

General summary

In 1981 research work in College 3 comprised the following subjects:

1. **Fission studies** following thermal neutron capture were performed on the parabola spectrometer LOHENGRIN, on the cold neutron tube IH1 and on the thermal neutron guide H22. These measurements included the determination of mass and energy distribution of fission products from different fissionable actinides, the observation of fine structures in the nuclear charge distribution and the inspection of the cold fission region. Angular momentum in the fission process was determined from the probability for populating isomers, as measured by γ and β spectroscopy. Light particles emitted in ternary fission have been observed up to mass number 20 at

the parabola spectrometer and their energy distribution has been determined. On the external beam tubes the gross features of thermal neutron induced fission of isotopes with very small fission cross-sections were measured.

2. **Nuclear structure** research was performed on the high resolution devices BILL and GAMS. The use of the non-selective (n, γ) reaction allowed the construction of rather complex level schemes for ^{114}Cd (near the $Z = 50$ closed shell) and several deformed nuclei in the actinide region. The internal target arrangement of both instruments yields a high sensitivity, permitting the study of weak γ -branches between different bands. Moreover small admixtures of collective

or qp degrees of freedom in distinct levels of nuclei in the deformed region of the rare earths have been determined. The measurement of such quantities has been proved crucial for the understanding of nuclear structure in terms of model descriptions. Studies of the structure of nuclei far from stability continued on OSTIS and LOHENGRIN, where n-rich nuclei stemming from the fission process are available for investigation. The work was concentrated on the transitional region around $N = 60$ and $N = 90$. Also, the determination of masses via the measurement of Q_{β} -values continued on both fission spectrometers.

3. **Electromagnetic interaction** was studied using the through tube of the GAMS facility and the β -spectrometer BILL. At the former instrument, photonuclear reactions such as Delbrück and Rayleigh scattering were investigated. On BILL, the studies on the polarization of electrons following inner shell photoeffects at different incident energies have been completed.

4. **Parity violation in the weak n-n-force** has been examined at the PN7 site by looking into the rotation of the neutron spin after passage through nuclear matter and by the measurement of γ -ray asymmetry following capture of polarized neutrons by protons.

5. Other **fundamental physics problems** such as the search for an electric dipole moment of the neutron, the measurement of the n-lifetime using magnetic storage devices and the determination of the fundamental constant h/m_n were approached on different beam positions of the college (PN5, H17, H22).

6. The search for **$\bar{N}\bar{N}$ oscillations** was continued on the beam position H18. The installation of a new detection system has considerably reduced the background due to neutron cosmic ray interactions by employing track recognition techniques.

7. On the different instruments and beam positions of College 3 **technology** has been advanced in the detection of charged particles (ionization chambers, TOF devices), in the production and storage of ultra cold neutrons (He-cryostat, material containers) and in the development of an ultracold neutron microscope.

8. In **theoretical physics** the problem of cold fragmentation in the fission process has been studied. In nuclear structure research, low lying spectra of open shell nuclei have been calculated.

In 1981 a total of 110 proposals were submitted, of which 96 were accepted.

Table 7

Collaboration of College 3 with institutes and universities in 1981.

| Fission | Nuclear spectroscopy | Theoretical physics |
|------------------------------------|--|------------------------------|
| Darmstadt GSI | Köln | Bordeaux |
| Darmstadt TH | Belgrade | München |
| Grenoble CEN | Sussex | Lyon |
| Grenoble University | Glasgow | Grenoble CENG |
| Geel JRC | München | Grenoble ISN |
| Gent | Manchester | Orsay IPN |
| Bordeaux | Orsay | Orsay CSNSM |
| Mainz | Giessen | Regensburg |
| München | Fribourg | |
| ISPRA | Braunschweig | Fundamental constants |
| Tübingen | Göttingen | Braunschweig PTB |
| Lyon | Buenos Aires CNGA | Washington NBS |
| | Brookhaven Nat. Lab. | |
| Electromagnetic interaction | Grenoble CEN | n-microscope |
| Manchester | Livermore LL | München |
| Göttingen | Leningrad | |
| | Jülich KFA | n-lifetime |
| EDM-experiment | | Bonn |
| Sussex | $\bar{N}\bar{N}$ transitions | |
| Harvard | Cern | |
| Oak Ridge Nat. Lab. | Padua | |
| Rutherford Lab. | Rutherford Lab. | |
| UCN storage | Weak-nucleon-nucleon force | |
| Lancaster | <i>Spin rotation:</i> | |
| Sussex | Rutherford | |
| | Ispra | |
| | Sussex | |
| | <i>$\bar{n}p$ capture:</i> | |
| | Grenoble ISN | |
| | Harvard | |

Scientific trends and highlights in 1981

Thermal neutron induced fission

At LOHENGRIN the study of mass, charge and energy distribution in the fission process continued. After the measurement of ^{235}U and ^{233}U fission, where the investigation of the light mass groups have been finished using physical methods (ionization chamber, TOF techniques), the mass, charge and energy distribution from ^{239}Pu fission was investigated. Furthermore the determination of the same quantities in the heavy mass wing of ^{235}U , which at present can only be performed via γ -spectroscopic methods, has been completed.

It was found that, similar to the fission of the U-isotopes, the charge distribution of Pu-fission products shows a striking proton odd-even effect, which amounts to about 15% of the most probable energy. The odd-even effects observed give insight into the dynamical aspects of the fission process at a stage where the nucleus descends from the saddle to the scission point. The probability of pair breaking due to friction, the coupling of collective to qp degrees of freedom and nuclear superfluidity is examined.

The determination of angular momentum induced in the fission process was continued via the measurement of the population of isomeric states. On LOHENGRIN the dependence of the population probability on the kinetic energy of the fission fragments and thus on the temperature created in the fission process was measured. It has been seen that besides the aligned angular momentum appearing in nuclear fission due to bending modes at the scission point, a considerable amount of non-aligned angular momentum is created, which depends strongly on the temperature.

On LOHENGRIN the study of ternary fission products was extended to the detection of heavy light particles up to mass 20. Besides the determination of the emission mechanism in tripartition, the measurement of ternary fission events leads to questions regarding the clustering of neutrons in the neck region in the latest stage before scission and the observation of odd-even effects in light particle emission.

The further investigation of cold fission events, where the available Q-value is exhausted by the kinetic energy of the fission products such that n-emission becomes impossible, was prepared by the construction of a big ionization chamber covering 30 cm of the available parabola on the exit slit of LOHENGRIN.

Furthermore technological problems were examined as a preliminary step to the search for ultra-cold events where the fission process may lead to the population of discrete nuclear states.

Symmetric fission, which for some masses is marked by large variances in the energy distribution, was studied on LOHENGRIN. These experiments allow insight into the potential landscape in fission, where a turning point in the deformation of fission fragments occur.

At IH1, fission fragment energy correlation measurements have been carried out for the fissionable isotopes ^{229}Th and ^{238}Pu . Such measurements are the basis for testing models where the static properties in the fission process, like shell and pairing corrections, are described.

On the H22E beam position, high precision time-of-flight measurements for n-induced fission of $^{233,235}\text{U}$ and ^{239}Pu were run, aiming at reliable figures for the mean kinetic energy release of fragments in nuclear fission.

Starting in Autumn in 1981 a big ionization chamber with different sections was set up at H22E, which will serve for coincidence measurements in ternary fission. A special interest goes into the angular distribution of ternary light particles as a function of the heavy mass fragmentation.

At LOHENGRIN the highly monochromatic beam of fission products was used for the development of new detection devices and techniques. With an axial ionization chamber, an energy resolution below 400 keV ($\Delta E/E \leq 4 \times 10^{-3}$) was achieved. Bragg curve spectroscopy and the time-of-flight technique have been examined to improve the charge resolution with the aim of employing these techniques for nuclear charge distribution measurements in the heavy mass region.

Nuclear structure work

At the high resolution devices BILL and GAMS, nuclear structure research was continued using the (n, e^-) and (n, γ) reaction. For the nucleus ^{114}Cd near the $Z = 50$ proton shell an almost complete low spin level scheme has been established up to ~ 3.6 MeV and decay properties have been examined. Beside the well known vibrational modes additional states have been investigated. These intruder states have been interpreted as proton two-particle two-hole excitations coupled with spherical quadrupole vibrations. Within this model the strange decay pattern of the quintuplet of states near $E_\gamma \cong 1.2$ MeV in ^{114}Cd could be explained by constructive and destructive interference between two strongly collective E2 modes (vibrational, quasi-

rotational). The model shows that the idea of two separate types of excitation modes (shape isomerism) is not valid in this nucleus (fig. 7).

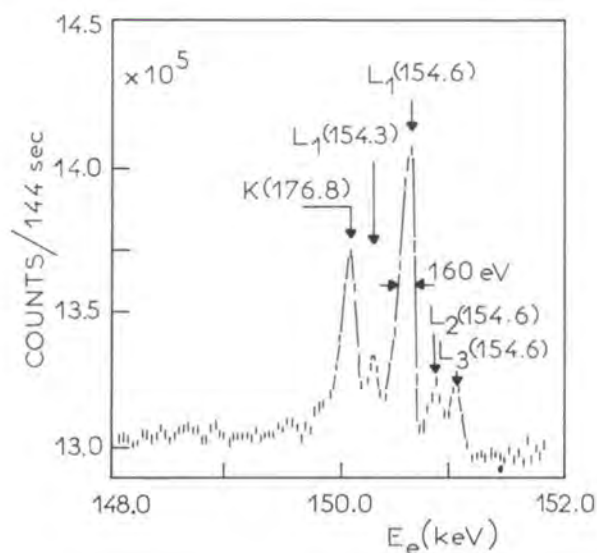


Fig. 7: investigation of the decay branches from intruder states in ^{114}Cd with the GAMS and BILL spectrometers. The illustrated part of the internal conversion electron spectrum together with the γ intensities allowed to disentangle the various multipolarity admixtures for the 154.6 keV, $2_1^+ \rightarrow 2_2^+$ transition. The L_3 atomic shell is only converted for E2. The E0 part is forbidden for γ 's. Thus the value $\delta^2 = I(E2)/I(M1) = 3.8^{+3.0}$ and $I_e(K, E0) = 0.14(2)$ relative to $I_e = 0.67(5)$ per 10 000 captured neutrons were obtained.

In the deformed region of the rare earths the nuclei ^{168}Er , ^{156}Gd and ^{162}Dy have been studied with the special emphasis on the decay pattern of γ and β bands. In ^{168}Er a dominance of the decay branch from the β to the γ band over those to the ground band was observed. Such a pattern is predicted by the Interacting Boson Approximation, where the β and γ bands belong to the same representation whilst the decay from these bands to the ground state band should be completely forbidden in the SU(3) limit.

The systematic study of odd nuclei in the rare earths and the actinide region with the aim to study single particle degrees of freedom and their coupling to rotational and vibrational motion of the nucleus was continued by studying the nuclei ^{161}Dy and ^{245}Pu . An extensive investigation on ^{177}Lu was carried out to search for fermion-boson symmetries as predicted by the Interacting-Boson-Fermi-Approximation.

On GAMS, measurements have been performed which attempted to observe the production of ^{180}Ta following the $^{179}\text{Hf}(n, \gamma)$ reaction. A positive result would indicate that ^{180}Ta , nature's rarest stable isotope, originates from the s-process in stellar nucleosynthesis.

Finally, the light odd-odd nuclei ^{20}F and ^{24}Na have been investigated to permit the construction of

rather complete level schemes for the low spins. In addition, the very precise γ -energies obtained serve as ideal capture γ -ray calibration standards. On the H22F beamtube $\gamma\gamma$ angular correlation measurements have been performed on ^{60}Co and ^{146}Nd . Level schemes up to 3.5 MeV and 2.5 MeV respectively could be constructed. The study of magnetic moments in ^{57}Fe using time integral and time differential perturbed angular correlations was started.

Neutron-rich nuclei produced in the fission process have been investigated on the mass separators of the ILL. On OSTIS nuclear structure work was concentrated on the transitional regions around $N = 60$ and $N = 90$. For the first time a rotational band built on the ground state was observed in the $A = 100$ region, namely in the nucleus ^{99}Y . Higher members of this band have been found at LOHENGRIN. On OSTIS detailed decay schemes could be established in the mass chain $A = 147$. On this spectrometer the measurement of n - γ angular correlations in β -delayed neutron decay of ^{95}Rb led to the determination of the top part of the β strength function and to the establishment of $(I_n + 2)$ admixtures in I_n waves.

Nuclear masses

The determination of nuclear masses far from the valley of stability continued on OSTIS and LOHENGRIN. β - γ coincidence work led to the determination of the Q values of ^{99}Rb , ^{146}Cs and ^{90}Br . Tests to improve the stability of the high tension facility on LOHENGRIN to 10^{-5} proved to be successful. After the implementation of the additional components in 1982 direct mass measurements on LOHENGRIN will be possible.

Electromagnetic interaction

On BILL the investigation of the transversal polarisation of photoelectrons have been completed. The correlation function describing the polarization probability of photoelectrons from the K shell ejected by an unpolarized photon have been examined for different energies and have been found to agree with theoretical predictions.

On GAMS, photoscattering experiments in the energy region above 3 MeV have been continued. These investigations deal with high precision studies of electronic Rayleigh, nuclear Thomson, Delbrück and nuclear Rayleigh scattering. Data have been collected for targets in the range of mass number 100 to 238. Due to the fact that the nuclear resonance fluorescence contribution to the total scattering cross section shows a strong proportionality to the density of nuclear levels statistical information about levels has been obtained.

Special experiments

At BILL the measurements of the integral β -spectrum from fission products of ^{235}U and ^{239}Pu were completed. In converting these spectra into the complementary ν spectrum and experimentally based primary ν_e spectrum from both research reactors with ^{235}U core and power reactors with a core containing ^{235}U and ^{239}Pu is now available. Such spectra serve as a basis for experiments searching for ν oscillations (fig. 8).

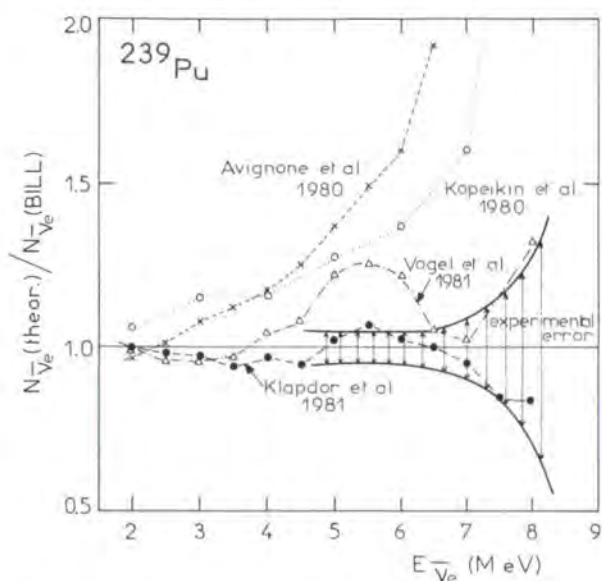


Fig. 8: antineutrino spectrum from thermal neutron induced fission of ^{239}Pu . The experimental data deduced from the complementary β -spectrum as measured on BILL are compared to theoretical calculations of various authors.

At the H22 beam tube the systematic study of (n,α) reactions has been continued. Some long-standing errors in the ^{32}S , ^{40}Ca (n,α) cross sections could be removed from the data tables. New results were also obtained for the (n,α) cross sections in ^{33}S , ^{41}Ca , ^{97}Mo and ^{177}Hf . Furthermore an upper limit for the fission cross section in ^{238}U was obtained.

Neutron activation was used for the determination of trace elements in French Alpine Hercynien granites. Especially the determination of the abundance and distribution of rare earth elements, although only present in the rocks at around the ppm level, lead to the understanding of the origins and modes of alteration of geological formations. The measurements led to evidence that the Alpine rocks from different massifs within the same province have a different genesis.

At S50 a monochromatic polarized n-beam was prepared to determine the fundamental constant h/m_n with an accuracy of 10^{-6} . This will be achieved by the simultaneous measurement of

the wavelength and the velocity of the neutrons and the application of De Broglie's law. The velocity is measured by a special time-of-flight method in which the direction of the neutron spin is modulated via a frequency of 750 kHz. The wavelength of the neutrons will be determined via their back reflection from a silicon single crystal.

Parity violation in the weak nucleon-nucleon interaction

At the PN7 polarized beam the study of the rotation of the neutron spin due to the weak interaction was continued. The weak nucleon-nucleon force endows matter with a handedness of which one consequence is the rotation of a neutron beam polarization vector upon passage through matter. The spin rotation in ^{117}Sn was determined and the results have shown that the rotation is about 4000 times larger than expected from theory. Measurements on natural lead showed again a value which was 2000 times larger than predicted.

The second experiment at the ILL to study the weak nucleon-nucleon force, namely the determination of γ -ray asymmetry in polarized n-capture by protons, was started in Autumn 1981. The neutron proton system is the most fundamental system in which the poorly understood hadronic sector of the weak interaction can be studied. Theory predicts an asymmetry of roughly 10^{-8} to 10^{-7} between γ rays emitted parallel and anti-parallel to the neutron beam polarization vector. The goal of the experiment is to reach a sensitivity of approximately 2×10^{-8} .

Properties of the neutron

On PN5 the search for an electric dipole moment of the neutron has been advanced to the stage of data taking. After incorporation of numerous improvements, it is expected to achieve a sensitivity of approximately 2×10^{-24} e cm per day on the actual beam position and up to a factor of 10 better on the helium ultra cold neutron source which will soon be installed. The sensitivity would allow to verify the predictions of some recent theories for the electric dipole moment.

At PN5 the investigation of storage of ultra cold neutrons in bottles of different materials led to the conclusion that anomalous UCN reflection loss rates are mainly due to surface impurities containing hydrogen.

A first version of a neutron microscope for ultra cold neutrons has been designed and installed on PN5. The microscope will operate with a magnification factor of 50.



View of the PN5 site. The picture shows the distribution box for providing UCN for the different beam positions (on the left). The UCN microscope can be seen on the right.

Extensive guide transmission studies with very cold neutrons have been completed on PN5 and the results have been compared with theory. These experiments serve for the preparation of a vertical ultra cold neutron source at the ILL.

At the beam line H17 a magnetic hexapole sphere was installed with the aim of an improved measurement of the neutron lifetime. In the magnetic sphere cold neutrons are downscattered in superfluid Helium and prevented by the magnetic field from interacting with the walls.

At H18 the beam of cold neutrons was used in the search for neutron-antineutron oscillations. For this purpose the neutron beam propagates through a zone with vanishing magnetic field where the n-n transitions are expected to take place. The creation rate for antineutrons depends on a characteristic mixing amplitude and mixing angle. The detection of antineutrons tests the conservation of baryonic number.

The violation of this conservation law is predicted by grand unification theories which treat quarks and leptons on the same level. In

Spring the first phase of the experiment was finished giving a lower limit of 10^5 sec for the n-n oscillation time. Since then important improvements have been made for background reduction which is expected to increase the sensitivity by a factor of 10.

Theory

Theoreticians Schuck, Quentin, Hasse and Bartel work in collaboration with nuclear experimentalists on fission and spectroscopy. The problem of cold fission is attacked by computing semiclassical potential energy landscapes with shell effects and running quantum mechanical wave packets from saddle to scission. A fraction of the probability tunnels through the ridge and results in compact and cold fission fragments. Kinetic energy distributions are then compared with data. Odd-even effects in the fission product mass distributions are explained on the basis of a semiclassical pairing theory for largely deformed nuclei.

In the field of nuclear spectroscopy, low lying spectra of open shell nuclei are computed with Dyson's Interacting Boson Approximation.

Seminars

In 1981, 31 seminars dealing with nuclear structure, fission, heavy ion collision, atomic and fundamental physics and new experimental developments were given.

Conferences

The ILL and the ISN jointly have organized the "4th International Symposium on Neutron Capture Gamma-Ray Spectroscopy and Related Topics" which was held at Grenoble from 7 till 11 September, 1981. The conference was highly successful with more than 160 participants from 20 different countries attending the lectures. The proceedings comprising the 150 submitted papers will be issued in Spring 1982 and published by the Institute of Physics, Bristol, U.K.



A souvenir picture from the 4th International Symposium on Neutron Capture Gamma-Ray Spectroscopy and Related Topics on 7-11 September 1981, organised by the ILL and the ISN (Institut des Sciences Nucléaires), Grenoble.

Secretary:
H. FAUST.

college 4 excitations in crystals

Members of the college

Bernard L.
Bouillot J.
Burke S.
Cebula D.
Currat R.
Dorner B.
Gerlach P.
Ghosh R.
Griffin A.
Capellmann H.
Kollmar A.
Lander G.
Lauter H.

Lefebvre J.
Lehner N.
Murani A.
Osborn R.
Paul D.
Pynn R.
Quilichini M.
Renker K.
Scheuer H.
Stirling W.
Vettier C.
Ziebeck K.
Zeyen C.

General summary

During 1981 the experimental activity in College 4 has been somewhat lower than usual due partly to the long reactor interruption during Spring and partly to the rebuild of IN1 and IN8. In addition, the exchange of the H13 beam-tube has forced IN2 out of operation for the last 1 1/2 cycles of the year. The situation should definitely improve in 1982 as IN2, IN8 and possibly IN1 resume normal operations.

Apart from the incidental shortage of beam-time, experimental conditions are steadily improving with time. Progress is particularly noticeable in so far as standard cryostats, pressure cells and data reduction programs are concerned. Also, several experiments have been successfully performed where very low or highly stabilized temperatures were required (1, 2). In general, however, users' demand for sophisticated sample environment is difficult to meet. In particular the shortage of dilution refrigerators and cryomagnets has led to the rejection or cancellation of several important experiments.

Scientific trends and highlights in 1981

On the average, the scientific activity in College 4 is split equally between phonon and structural phase transitions on one hand, magnetic excitations and magnetic phase transitions on the other.

Phonons: Although the interest in ordinary lattice dynamics is not as widespread as in past years a number of proposals have been accepted, dealing with phonon measurements, mostly in new classes of materials. In uranium rocksalt (3) compounds for example, unusual dispersion curves have been measured, with transverse optic frequencies larger than longitudinal ones. These anomalous features can now be reproduced by means of ordinary shell models, but with unphysical values of the parameters. Intercalated graphite compounds (4) appear as another promising class of systems, particularly when the current difficulties in preparing large homogeneous samples can be overcome.

Other experiments have been concerned with the effect of disorder, chemical or structural, on collective lattice modes. In mixed alkali halides, such as $K_{.5}Rb_{.5}I$, the observation of dispersive optic branches (5) has confirmed the persistence of collective excitations in the face of configurational disorder, thus lending added support to the pseudo-unit-cell approach. The detection of librational modes in orientationally-disordered molecular solids is a long-standing experimental challenge. Recent work on the adamantane derivative (6) $C_{10}D_{15} - C \equiv N$, has yielded complex spectral response functions, characteristic of a mixture of reorientational and damped librational motions.

Structural phase transitions : The study of soft lattice modes associated with structural phase transitions continues to be an active field of research.

In ionic crystals of the fluorine perovskite-type (7) for example, the study of the pressure dependence of soft zone-boundary modes provides a direct test on current ideas concerning the respective rôles of Coulomb and short-range interactions in ferro- and antiferro-distortive phase transitions.

In metallic alloys, evidence for lattice-dynamical anomalies associated with martensitic transformations (8) has been examined. Peierls transitions and charge-density wave (CDW) systems such as $K_2Pt(CN)_4Br_{.3}$, $3D_2O$ (KCP) continue to be topical. A renewal of interest in KCP was recently spurred by the discovery that hydrostatic pressure tended to destroy correlations between CDW's on adjacent Pt strands. Results at 17 kbars (9) suggest that under sufficient pressure the highly conducting quasi-one-dimensional state of KCP may be stable down to the lowest temperatures. At the moment this result appears to contradict existing transverse conductivity data.

Strong emphasis is put on modulated structures, commensurate-incommensurate transitions and excitations in the incommensurate state. Fig. 9 shows the (P,T) phase diagram of thiourea $[SC(ND_2)_2]$ as obtained from accurate determination (10) of satellite peak positions measured on IN2. The figure shows a mosaic of commensurate and incommensurate phase, corresponding to rational and irrational values of the modulation wavevector δ (expressed in units of the parent structure reciprocal cell). Due to the high wavevector-resolution required and the low signal-to-background ratios involved, this type of measurement is best performed on an instrument with energy analysis, i.e. a 3-axis spectrometer.

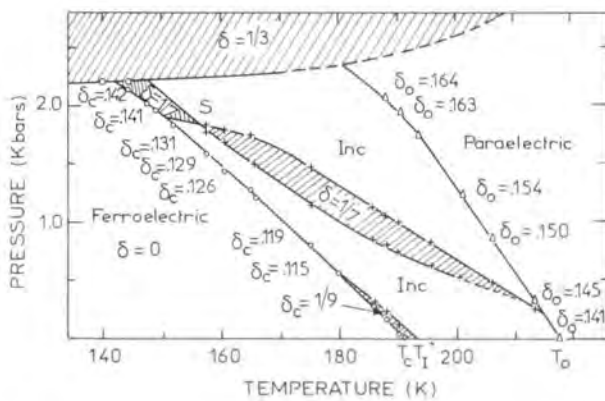


Fig. 9: the phase diagram of $SC(ND_2)_2$. All phases may be generated from the paraelectric ($Pnma$) parent-phase via a distortion of wavevector δb^* .

A truly incommensurate modulation-wave can slide with respect to the underlying atomic lattice without experiencing any restoring force,

except those due to imperfections. This continuous symmetry of the incommensurate ground-state with respect to the phase of the modulating wave, gives rise to an additional, gapless (i.e. acoustic-like) excitation branch which, in principle, should be observable by light and neutron scattering. While Brillouin results are still inconclusive, propagating "phason" branches have been observed by means of neutron inelastic scattering in two systems: biphenyl (11) and $ThBr_4$ (12). Fig 10 shows the type of spectrum observed on IN3 in incommensurate $ThBr_4$ in the vicinity of a strong satellite reflection. The two branches shown in the figure are believed to correspond to amplitude (upper branch) and phase fluctuations (lower branch) of the static modulation.

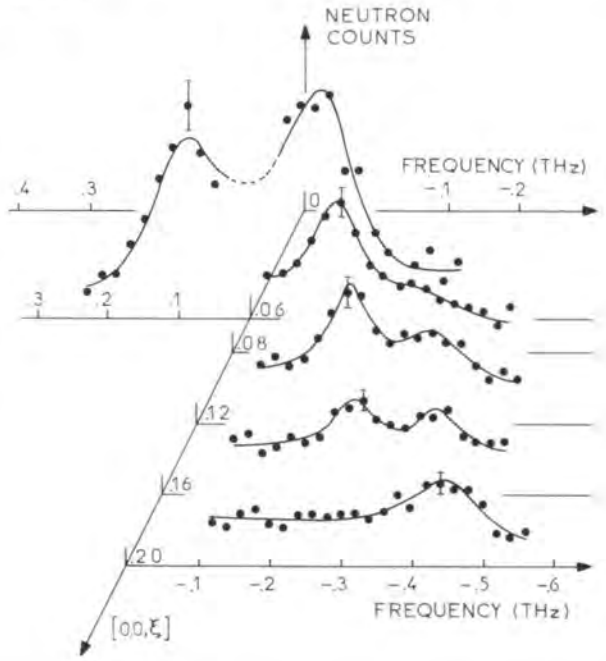


Fig. 10: inelastic spectrum in incommensurate $ThBr_4$. The origin of the wavevector scale corresponds to the (2, 3, 0.69) satellite peak.

Magnetism: The field of magnetic excitations covers a wide range of experiments and materials: conventional spin-wave measurements in 3d-intermetallic compounds, studies of magnetic excitons in singlet ground-state systems, studies of non-linear excitations in one-dimensional ferro- and antiferromagnets, the search for a magnetic equivalent to the phase-mode in spin density wave systems, etc.

Current work (13) on incommensurate chromium is a typical example of the latter kind. High resolution measurements on IN12 have shown well-defined low energy excitations in both the longitudinal- and transverse-polarised phases. The nature of these excitations is presently under investigation. For part of these measurements the IN12 polarisation-analysis facility proved to be very useful.

A number of experiments have been performed with magnetic systems in which the dominant exchange interaction is sufficiently strong to effectively restrict the dimensionality of the system. Measurements on the one-dimensional ferromagnet CsNiF_3 were started as the ILL nearly ten years ago, long before there was any suggestion that non-linear, "soliton" excitations might be present. Such excitations have been confirmed by recent work (14) at ILL, in spite of the difficulty of separating them unambiguously from other contributions to the fluctuation spectrum.

Recently, two one-dimensional "magnetic" materials with singlet ground-states have been investigated (15). One of these (TlFeCl_3) has been found to order magnetically as the temperature is lowered and the behaviour of the soft exciton associated with the transition has been studied. In the second material (CsFeCl_3) ordering can be achieved at 1.7 K by the application of a 4.7 T magnetic field along the hexagonal axis.

The rare-earth monpnictides offer many examples of singlet ground-state systems. A few which have been recently studied are TmSb, PrSb, PrBi and TbP. Fig. 11 shows the exciton dispersions observed (16) in PrBi, using IN8. The large splitting between the two branches is due to anisotropic exchange interactions, the physical origin of which is not well understood. The lowest frequency X-point mode is expected to show soft-mode behaviour under applied pressure, leading to antiferromagnetic ordering at low temperatures.

Finally, the usefulness of a high-resolution 3-axis spectrometer such as IN12 in unravelling complicated magnetic structures has been illustrated in a series of very low temperature measure-

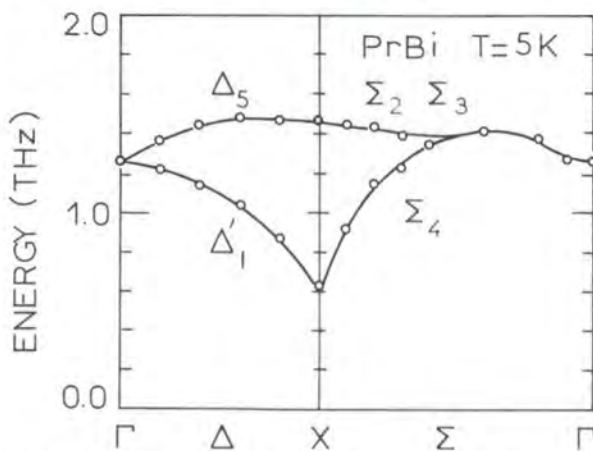


Fig. 11: excitonic dispersions in paramagnetic PrBi.



The curved analyser of IN3 (March 81).

ments (1) on praseodymium metal, another well-known Van Vleck paramagnet. At the lowest temperature achieved (30 mK) an array of twelve magnetic satellites around each (100)-type reciprocal lattice point was found. Since the maximum intensity of these satellites was more than three orders of magnitude smaller than a weak Bragg peak, energy analysis of the scattered neutrons was indeed essential. The results have been interpreted in terms of two triple-q structural domains within each of which the three modulation wavevectors are rotated slightly away from the symmetry directions.

Secretary:
R. CURRAT

References

- (1) K.A. McEwen and W.G. Stirling, J. Phys. C 14, 157 (1981) and Proc. LT16, Aug. 1981, Los Angeles, U.S.A. (in press).
- (2) Exp. 04-02-146 (D. Durand, F. Denoyer, M. Lambert, L. Bernard and R. Currat).
- (3) Exp. 04-03-159 (G.H. Lander and W.G. Stirling).
- (4) F. Batallan et al., Proc. Int. Conf. on Phonon Phys. Aug. 1981, Bloomington Ind., U.S.A. (in press).
- (5) Exp. 04-01-197 (B. Renker, N.M. Butt and N.E. Massa).
- (6) Exp. 04-02-141 (J.L. Sauvagol, J. Lefebvre, J.P. Amoureux and M. Bee).
- (7) Exp. 04-02-139 (M. Rousseau, C. Ridou, J. Bouillot and C. Vettier).
- (8) Exp. 04-02-145 (G. Guenin, P.F. Gobin and R. Pynn).
- (9) Exp. 04-02-156 (B. Renker, L. Bernard, C. Vettier, R. Comes and B.P. Schweiss).
- (10) Exp. 04-02-114 (F. Denoyer, A.H. Moudden, R. Currat, C. Vettier, A. Bellamy and M. Lambert).
- (11) H. Cailleau, F. Moussa and C.M.E. Zeyen, Solid State Comm. 33, 407 (1980).
- (12) Exp. 04-02-151 (L. Bernard, R. Currat, P. Delamoye, and C.M.E. Zeyen).
- (13) Exp. 04-03-185 (S. Burke, W.G. Stirling, K.R.A. Ziebeck and J.B. Booth).
- (14) Non-linear phenomena at phase transitions and instabilities, T. Riste: ed. (Plenum 1981) R. Pynn, M. Steiner, W. Knop, K. Kakuri, J. Kjems.
- (15) Exp. 04-03-193 (P. Day, M. Steiner, R. Pynn).
- (16) Exp. 04-03-180 (C. Vettier and J. Voiron).

college 5 crystal and magnetic structures

Members of the college

I. ILL and external members

Aimé J.P.
Bernard L.
Boucherle J.X. (CEN - Grenoble)
Bouillot J.
Brown P.J.
Burke S.K.
Convert P.
Croset B. (Marseille)
Fender B.E.F.
Filhol A. (CNRS - Grenoble)
Fitch A.
Freund A.
Fruchart D. (CNRS - Grenoble)
Gardner P.
Gillon B.
Givord D. (CNRS - Grenoble)
Gregson D.
Hewat A.W.
Kischko U.
Kuhs W.
Lander W.
Lartigue C.

Lehmann M.S.
Lehner N.
Mason S.
Mueller R.
Pannetier J.
Pynn R.
Schlenker M. (CNRS - Grenoble)
Schweizer J. (CEN - Grenoble)
Stansfield R.
Soubeyrou J.L. (Bordeaux)
Tasset F.
Thorel P. (CEN - Grenoble)
Timmins P.
Tran Qui Duc (CNRS - Grenoble)
Trost W. (Stuttgart)
Vettier C.
Vicat J. (CNRS - Grenoble)
Wilson S.
Wright A.
Zeyen C.
Ziebeck K.

II. Visiting scientists

Becker P.

Table 8

College 5 — Experiments accepted for execution in 1981.

| Instrument | D1A | D1B | D2 | D3 | D5 | D8 | D9 | D10 | D15 | Other | Total |
|--------------------|-----|-----|----|-----|-----|-----|-----|-----|-----|-------|-------|
| No. of experiments | 34 | 20 | 8 | 12 | 10 | 14 | 14 | 7 | 14 | 4 | 137 |
| No. of days | 149 | 74 | 47 | 155 | 116 | 160 | 152 | 55 | 155 | 23 | 1086 |

General summary

College 5 is seen to be one of the colleges which functions well in terms of having an active membership with common interests and experience covering the whole area of crystallography and overlapping into other areas such as inelastic scattering, small angle diffraction, diffuse scattering and liquid physics. This activity and cohesion is reflected in good attendance at College seminars, and a consensus on most subjects touching the interests of the College. It has been reinforced in 1980 by many members regrouping in the new building ILL 19.

Contacts with other colleagues have, however, been strengthened: for example with College 4 in the physics of structural phase transitions, with College 8 in the study of biologically important molecular structures, and with College 9 in the study of the structure of chemical adsorbates and catalysers. The interest of knowing the crystal structure and the structural changes in a material being studied by more "sophisticated" means is generally recognized, and the number of proposals to College 5 in 1981 has been a record.

The decision to continue with the same central computer operating system, and the opening of the powerful new computer, also sited in ILL 19, has been of great importance to a College which is the largest user of ILL computing resources. Even more important has been the decision to implement the H11 renewal project as quickly as possible. Three new diffractometers, all using the most advanced and well tried multidetector techniques, are being built to replace in 1983 three existing machines. Unfortunately, this policy of a one-for-one improvement program has not been universally honoured, and College 5 regrets the future loss of one of its beam positions to make way for a second cold source in which the College itself will have no direct interest. The resulting loss of D5, one of the most overdemanding diffractometers serving the College, will only partly be compensated by access to the new IN20.

Scientific highlights and trends in 1981

Magnetic phases

It is difficult to find a unifying theme to cover even a small percentage of the diverse magnetic structures and phase transitions investigated over the past year. Materials studied varied from the very long period (2 300 Å) helimagnetic phases of $\text{Fe}_x\text{Co}_{1-x}\text{Si}$ alloys to the antiferromagnetic cluster compounds RuF_5 and OsF_5 . Similarly, phase transitions under study ranged from the "Verwey" transition in Fe_3O_4 to quadrupolar ordering in YbCo_2 and commensurate-incommensurate transitions in rare earth dihydrides.

Magnetic short range order above the critical temperature

The investigation of the paramagnetic response of metallic systems has continued to attract considerable interest. The controversy concerning the existence of short range magnetic order in iron above the Curie temperature has been resolved by a definitive measurement using the neutron polarization-analysis technique. Ferromagnetic short range order centred on the nuclear Bragg positions and having a correlation range of ~ 10 Å at 1 000 °C, was observed at temperatures as high as $1.6 T_c$. This experiment, which was proposed by H. Capellman from the Theory College, is of great importance in establishing a realistic model for 3d metallic magnetism. At the other end of the temperature spectrum, the puzzling short range order peaks in Praseodymium (which orders antiferromagnetically at below 0.4 K) were shown to be magnetic in origin. A full understanding of this incommensurate magnetic short range order is still lacking.

Coexistence of magnetism and superconductivity

A number of materials which exhibit both magnetism and superconductivity have been the subject of measurement. The proposition that superconductivity may destroy ferromagnetic order in the intermetallic compound Y_4Co_3 was recently examined using polarized neutron diffraction. This study established that Y_4Co_3 above the superconducting transition is a strongly correlated paramagnet but does not order ferromagnetically. This is a striking example that superconductivity need not be totally suppressed by 3d electron magnetism. Certain members of a new class of rare earth Rhodium-Tin compounds also show remarkable superconducting and magnetic properties. In the case of the Er compound, magnetic order has been reported below the superconducting transition temperature. The magnetic structure of this "reentrant" superconductor (which in contrast to Y_4Co_3 owes its magnetic properties to localized 4f moments) has been studied by powder diffraction.

Magnetization density

As in previous years, the study of magnetization density has followed two main themes: convalency and spin transfer in metal complexes and salts, and induced magnetization in paramagnetic metals and intermetallic compounds. There has been an increasing tendency toward variable temperature measurements. For example, the temperature dependence of the c-axis susceptibility of the cubic and hexagonal sites of paramagnetic Praseodymium has been determined over the range 4.2 K to 200 K. And, as in previous years, there is at least one experiment which tests the limits of sensitivity of the polarized neutron diffraction technique. In this case, the induced magnetization density in Vanadium metal. This study has yielded precise data for this weakly paramagnetic metal. An important aspect of this work was the determination of the V scattering length (-0.0463×10^{-12} cm) from absolute nuclear intensities. The Vanadium experiment forms part of an Int. Union of Cryst. project which brings together a number of techniques to measure the charge, spin and momentum density in this selected metal.

The question of localization of 5f electrons in Actinide compounds continues to be studied. One of the fundamental questions here is to determine the extent to which the 5f electrons are involved in chemical bonding, as they are in a sense intermediate between the 3d and 4f electron cases. The compounds UNi_2 , UGa_2 and NpAs_2 have been the subjects of investigation. The magnetization density in the vicinity of Uranium in UNi_2 and UGa_2 appears to be well localized, with little anisotropy.

Structural transitions and incommensurable phases

Structural phase transitions have always been a major field of activity in College 5, especially for relatively simple inorganic materials. However, with new techniques for constrained profile refinement of powder data, more difficult problems, with simple organic materials such as s-triazine (Exp. No. 5-22-136), CF_4 (Exp. No. 5-22-177) and butyl bromide (Exp. No. 5-22-180) have been successfully attempted. Many such materials are liquids or gases at standard temperature and pressure, and undergo structural rearrangement at low temperature. They are then interesting systems for the study of intermolecular interactions.

In addition to the study of materials which form differently ordered lattices depending on the temperature and pressure, the investigation of incommensurably ordered phases is becoming increasingly important. For example, in β -ThBr₄ (Exp. No. 5-15-179), single crystal experiments on D10 revealed the appearance below 92 K of satellites with non integer l -indices of the type $l = n \pm \frac{1}{3}(1 - \delta)$ where $\delta = 0.063$ is almost temperature independent down to 4 K. This discovery of an incommensurable phase in such a simple structure should facilitate the study of the physics of such systems.

The incommensurable charge-density wave which develops in α -uranium at 43 K was also studied with single crystals on D15 (Exp. No. 5-15-187). These measurements produced a detailed model at the atomic displacements which occur along all three orthorhombic axes of the basic structure. Measurements with stress applied along both the a and b axes were designed to test whether the incommensurable structure is single or multi- q .

Ionic conductors, zeolites and intercalates

There has been an important renewal of interest in the structures of materials which can accept and release ions or small molecules. Apart from the academic interest of how such structures can incorporate foreign materials, there are obvious practical applications, often related to new energy technology. Such materials can be used for solid state gas storage, solid state batteries and fuel cells, and for catalysers and ion-exchangers (which reduce energy consumption). Related environmental applications include repositories for radioactive wastes and gas purifiers and cleansers.

For example, if radioactive waste is to be stored in geological formations, it may be wiser to choose a crystalline host material similar to natural mineral structures, rather than an "unnatural" glassy material. Neutron diffraction has therefore been used to investigate the stability of such synthetic minerals, with high temperatures being used to accelerate any possible decomposition (Exp. No. 5-22-192).

Again, the performance of metallic hydrogen storage materials such as LaNi₅ can be modified by partial substitution with other metals such as Fe, Cu, Si, Ag, Sn and Al. To understand the mechanism of these effects, the structures of such substituted materials were studied on D1B (Exp. No. 5-21-114).

Zeolites occur naturally as metallic silicates, and are remarkable for the fact that water of crystallization can be removed and replaced by a large number of other simple molecules without changing the large but simple silicate structure. They have long had important industrial applications, but have recently acquired interest as selective catalysts in petroleum cracking and the synthetic production of gasoline. Detailed examination of how the foreign molecules are incorporated into the cages in the crystal structure is needed to understand this solid state chemistry, but there have always been technical problems in obtaining even the basic zeolite structures to sufficient precision. High resolution neutron powder diffraction on D1A has contributed to the solution of these problems, and has incidentally shown that the simple cubic zeolite structure can be subtly distorted depending on the silicon/aluminium ratio. This ratio can also effect the ordering of these metallic atoms with direct consequences for the chemical reactivity of the zeolite cages (Exp. No. 5-21-124 and Exp. No. 5-21-136).

Such studies are related to a field of surface chemistry which has been pioneered at the ILL, namely the study with neutrons of the structure of atoms or small molecules adsorbed or intercalated into materials such as graphite. For example, with the D1B multidetector on the high flux reactor it has been possible for the first time to study the kinetics of the intercalation of potassium into a single crystal of graphite. The growth and decay of the different "stages" of the structure can be followed as the potassium diffuses into its final ordered form (Exp. No. 5-25-139). Most of this work is now collected into College 9, but we may also cite the examples of NiCl₂ and FeCl₃ intercalated into graphite (Exp. No. 5-23-241 and 5-23-277). Small two dimensional islands are formed which have interesting magnetic properties.

Very high temperature crystallography

With the development of a furnace capable of reaching about 2500 K, experiments with both powders and single crystals have been attempted on materials undergoing order-disorder transitions before melting at high temperature. The λ transition in UO_2 (Exp. No. 5-22-187 and 5-11-106) and the high temperature transition in LaF_3 (Exp. No. 5-15-160) were investigated, and some preliminary results obtained even though problems were experienced with sample sublimation and softening of tungsten sample supports.

High resolution of disordered structures

The very short wavelengths available only at the ILL on the D9 machine have been shown to be of great advantage in resolving disordered structures with the help of powerful new computer programs such as PROMETHEUS. For example, the order-disorder transition in AuCu_3 (Exp. No. 5-15-183) and the ionic conduction mechanism in RbAg_5I_5 (Exp. No. 5-15-162) have been studied in this way. One of the most basic studies has been made on ordinary ice (Ih). Although several studies have established its nearly perfect oxygen arrangement and the statistical distribution of hydrogen between two symmetrically equivalent sites (the half hydrogen model), several fundamental problems still remain unsettled. The O-H bond length found in ice Ih is considerably larger than in other polymorphs of ice determined with precision, and many arguments have been advanced against the observed value. As well, the tetrahedral H-O-H bond angle in ice Ih differs considerably from the value observed in the vapour phase, and this has led to proposals of a bent hydrogen bond model which further splits the atom positions. Finally, the mean shape of the double potential governing the atom distribution and the barrier governing the mobility still remained to be evaluated.

A D9 experiment (Exp. No. 5-13-117) confirmed the long O-H distance at 1.01 Å, but there was no evidence for bent hydrogen bonds. Indeed, the hydrogen atom density distribution is well described by a librational motion of the hydrogen atom around the oxygen. The mean barrier height between the half hydrogen atom positions was obtained from the scattering density as 0.012 eV, which implies that the zero point motion is of high importance for proton exchange at low temperature. Figure 12 shows a section through the probability density of the half hydrogen positions obtained using a Gram-Charlier expansion. The disorder along the

oxygen-oxygen direction is clearly resolved, but there is a finite probability of finding the hydrogen atom between the two sites. Further measurements are planned to analyse this as a function of temperature.

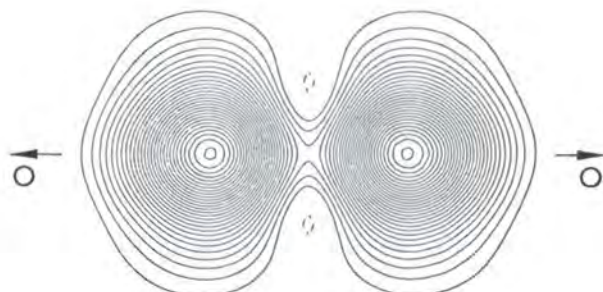


Fig. 12: Section through the probability density of the half hydrogen positions in ice obtained by using a Gram-Charlier expansion.

Hydrogen bonding

Of course, neutron diffraction continues to be much used for the study of hydrogen bonding, which is obviously more difficult with X-rays. For example, an intramolecular $\text{H}\cdots\text{H}$ distance found in tetracyclodecyl dinitrobenzoate (fig. 13) with D9 data is one of the shortest non-bonded hydrogen contacts known. Force field calculations predicted 1.90 Å compared to the neutron measurement of 1.756(4) Å ($R = 2.5\%$), which can now be used to improve the models used for such calculations.

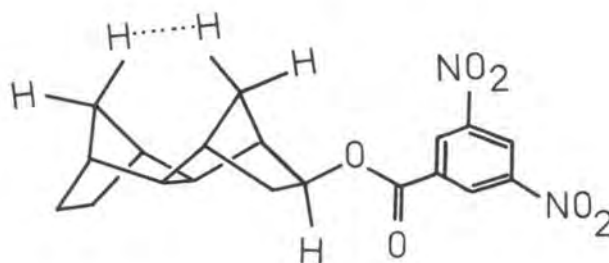


Fig. 13: One of the shortest non-bonded hydrogen contacts known is the intramolecular $\text{H}\cdots\text{H}$ distance found in tetracyclodecyl dinitrobenzoate (D9 data).

Materials research

Diffraction experiments have also been performed to look at the bulk properties of materials. For example, neutrons, being more penetrating than X-rays, have been used to map lattice strains in stressed steel bars (Exp. No. 5-25-142): a high resolution diffractometer (D1A) is necessary to follow the resulting small shifts in the diffraction line positions. In stress bearing bones, the apatite crystals grow with preferred orientations for best withstanding the applied load; such orientations have been mapped on D1B for a better understanding of the mechanical properties of bones (Exp. No. 5-21-108).

Another such application has been the study on D1A of stressed Nb_3Sn filaments in superconducting wires (Exp. No. 5-22-191). The stress, which is due to differential contraction in the Cu-Sn Bronze wire matrix and the Nb_3Sn filaments, was found to introduce a phase transition in Nb_3Sn . The preferred orientation of the c-axis of the new tetragonal phase was studied as a function of the stress, as was the stress gradient and the effect of adding stainless steel stiffeners to the wire. Further experiments were designed to see how the phase transition might be avoided and hence to increase the electrical current that might be carried by such superconducting wires in fusion reactor magnets.

Secretaries:
A.W. HEWAT
S. BURKE

college 6 liquids, gases and amorphous materials

Members of the college

Burke S.
Cebula D.
Chieux P.
Cummings S.
Dianoux A.-J.
Langel W.
Lauter H.-J.
Maret M.
Pynn R.

Stirling W.G.
Wright A.F.
Cyrot F. (CNRS Grenoble)
Volino F. (CNRS Grenoble)
Dupuy J. (Univ. Lyon)
Jal. J.-F. (Univ. Lyon)

General summary

In the past year the college has maintained an active interest in all forms (both elastic and inelastic) of neutron scattering from liquids and amorphous solids. No experiments were performed on gases.

The main areas of interest were aqueous solutions/molecular liquids and amorphous solids, these two fields accounting for over half of the proposals submitted during 1981. In this respect however, the activities of College 6 have been severely curtailed, during the past year, by the closure of D4, which is currently being rebuilt (D4 is the instrument on which a large proportion of College 6 experiments are carried out).

In April 1981, 36 experiments were proposed of which 7 were continuations, 9 were re-submissions and 20 were new proposals. Of these, 20 were accepted.

In October 1981, 38 experiments were proposed, comprising 5 continuations, 16 re-submissions and 17 new proposals. Of these, 24 were accepted, several of which had requested D4 but were scheduled for the D2 diffractometer.

Scientific trends and highlights in 1981

Quantum liquids

The linewidths of phonon excitations in superfluid ^4He have been studied using the high resolution spectrometers IN11 (spin echo) and IN12 (3-axis). The linewidth is expected to be dominated by three-phonon decay processes up to a critical momentum transfer $\hbar Q$ where $Q = 0.55 \text{ \AA}^{-1}$ at which point three phonon decay processes become kinematically forbidden and four phonon decay processes dominate the linewidth. According to numerical calculations, this cross-over should manifest itself as a decrease of the phonon linewidth from about $15 \mu\text{eV}$ to $2 \mu\text{eV}$. Even though the IN11 spectrometer was set up for a resolution of $1 \mu\text{eV}$, no spin-echo signal was detected, implying that the phonon linewidth is greater than $20 \mu\text{eV}$. The IN12 experiment yielded linewidths which increased strongly as the temperature was raised, but not by the same amount at different wavelengths. These surprising results have been ascribed to an unknown Q-dependence of the phonon-phonon interactions in this region.

In ^4He films (~ 5 layers) adsorbed on a graphite substrate not only was a bulk roton observed, using the IN12 triple axis spectrometer, but also two other excitations at lower energies. These other excitations were thought to originate from the liquid/solid boundary, one due to a two-dimensional roton and the other due to a melting-solidification wave set up at the liquid-solid interface in the ^4He (the first two layers are solid).

Monatomic liquids

Preliminary experiments have been carried out using the IN4 time-of-flight spectrometer with a view to determining the inelastic incoherent scattering function $S_s(Q, \omega)$ in the region of small ω for liquid sodium. The results show a marked dip in the region $Q = 1.5 \text{ \AA}^{-1}$ of the graph of $\omega_{1/2}/DQ^2$ versus Q ($\omega_{1/2}$ is the full width at half maximum of $S_s(Q, \omega)$ and the quantity $\omega_{1/2}/DQ^2$ is known as the reduced half width). This dip which may be a precursor to particle localization is currently being investigated.

Binary alloys

The temperature dependence of $S(Q_0, \omega)$, where Q_0 is the magnitude of the scattering vector corresponding to the first maximum in $S(Q, 0)$, has been investigated in SnBi alloys. The results suggest that the behaviour of $S(Q_0, \omega)$ is determined by a simple diffusion process rather than a special collective dynamics at this wavevector, as proposed by the various instability theories of the transition from the supercooled state to the crystalline phase, in this material.

A small angle scattering study of liquid AuSi was undertaken in order to investigate the existence and disposition of clusters within this alloy. No such clusters were found.

A small angle scattering study of liquid AgGe has been undertaken, employing the method of isotopic substitution, in order to study the clustering process. This represents the first time that the method of isotopic substitution (except for H/D substitution) has been combined with the technique of small angle scattering and the results, when fully analysed, should shed considerable light on the process of clustering in this alloy.

Aqueous solutions

As has been stated, very little work on aqueous solutions has been done due to the non-availability of D4.

One of the experiments carried out on D4 prior to its closure was the determination of cationic hydration in 1 molal CaCl_2 solution. The results essentially confirm the results of experiments carried out several years ago on 4.49 molal CaCl_2 solution, the only difference being the large increase ($6.5 \rightarrow 10.5$) in the hydration number.

Further progress has been made on the inelastic (quasielastic) studies of the dynamics of hydrated ions in aqueous solution. Measurements of the quasi-elastic broadening, which may be related to the existence of a second hydration shell, have been extended to MgCl_2 , LiCl and CsF solutions. On the timescale of the experiments, no second hydration shell was observed for CsF solutions while MgCl_2 and LiCl solutions both showed second hydration shell effects (stronger in the case of LiCl solutions). It was also shown that, in these solutions at least, the anion has no effect on the motion of the cation.

Molecular liquids

As for aqueous solutions, the field of molecular liquids has suffered a severe setback, due to the non-availability of D4B. It was found possible, however, to carry out one experiment on formic acid before its closure in February of this year. This was an experiment to determine the nature of short-range order in liquid formic acid using the technique of H/D substitution.

Using the D2 diffractometer the structure of liquid methyl alcohol was studied, using the technique of selective deuteration. The results, although qualitatively interesting, have not yet been fully analysed.

Amorphous metals

The recent trend towards an increase in the number of proposals concerning amorphous metals has continued. Once again the structural work is usually done on D4 and many interesting experiments have had to await the availability of D4B.

Of the other proposals involving amorphous metals, no results have yet been reported.

Glasses

Controlled precipitation from amorphous LiCl solution has been studied using S.A.N.S. neutron diffraction. The diffraction pattern at 140°K is consistent with the formation of cubic ice (I_c) and not hexagonal ice as might be expected.

There is no evidence of liquid/solid immiscibility from these studies nor of any major change in the structure of the amorphous phase during the nucleation stage. However, during the growth stage of the ice (I_c) crystals a marked shift in the diffraction maximum, to higher Q , was observed.

Secretary:
S. CUMMINGS

college 7 imperfections

Members of the college

Anderson I.
Bley F. (CNRS Paris)
Burke S.
Cenedese P.
Freund A.
Heidemann A.
Hewat A.
Jahnel Franz (T.U. München)
Just W.
Kiese G. (Univ. Marburg)
Lassailly Y.
Magerl A.

Mezei F.
Murani A.P.
Pynn R.
Roth M.
Schaerpf O.
Scheuer H.
Stirling W.
Trost W. (MPI Stuttgart)
Wright A.
Zeyen C.
Ziebeck K.

General summary

The field of research covered by College Seven is very large. It includes all kinds of disorder and imperfections in solids leading to varying degrees of overlap with the fields of other colleges. The proposed experiments always require many different instruments ranging from a simple powder diffractometer to the high resolution spin-echo spectrometer. "Exotic" demands for the sample environment, for example temperatures from 50 mK to 2 500 K occur quite often. Unfortunately both temperature limits are not yet satisfactorily covered by the ILL equipment.

A considerable impact on the future development of neutron scattering in disordered systems can be expected from the successful test experiments concerning polarisation analysis (PA) on D7 carried out in 1981. The combination of TOF and PA with a multiangle analyser will stimulate reflection and the submission of proposals for experiments which have not been feasible hitherto, such as the separation of magnetic and nuclear scattering or of nuclear coherent and nuclear spin flip scattering for example in the study of the dynamics in liquids.

Scientific trends and highlights in 1981

Dynamics in spin glasses

The time fluctuations of the spin pair correlations in the amorphous non-metallic spin glass $\text{Al}_2\text{Mn}_3\text{Si}_3\text{O}_{12}$ were investigated by quasielastic

neutron scattering on IN4 and on IN10 from room temperatures down to 1.3 K covering a range of more than five decades of the time constant (see fig. 14). At low temperatures a spectrum of exponential relaxations shows up (1).

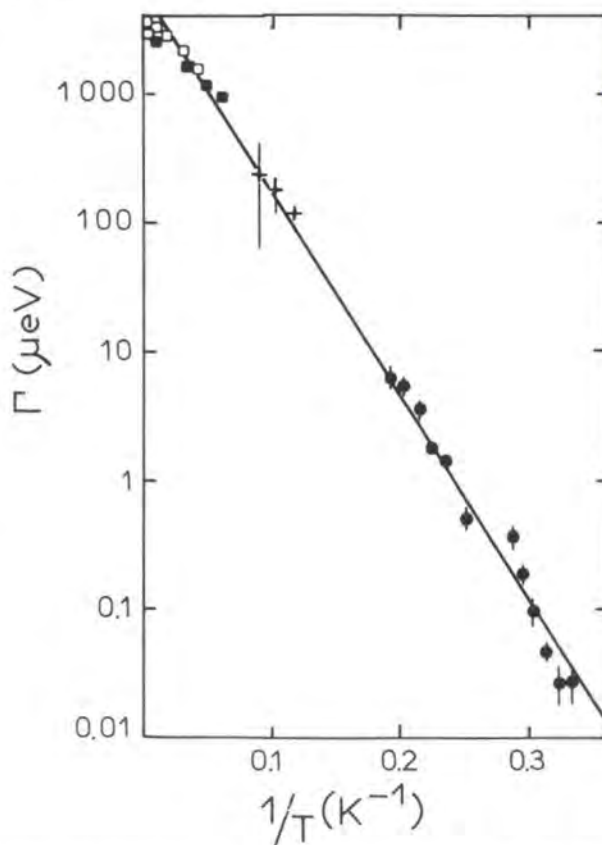


Fig. 14: Temperature dependence of the quasielastic line width of neutrons scattered in the amorphous spin glass $\text{Al}_2\text{Mn}_3\text{Si}_3\text{O}_{12}$. (IN10 (•), IN4 (□) and TAS (Karlsruhe) data.)

Neutron spin-echo and three dimensional polarization analysis experiments on IN11 were extended to several metallic spin glasses. The results combined with A.C. susceptibility data provide a full picture of the spin relaxation as it proceeds in real time over a large time domain of 10^{-12} to 10^{-2} sec, as can be seen in fig. 15. A relaxation spectrum spread over several orders of magnitude in time, as opposed to the usual single relaxation time behaviour, was found to be a most general, characteristic feature of spin glasses (2).

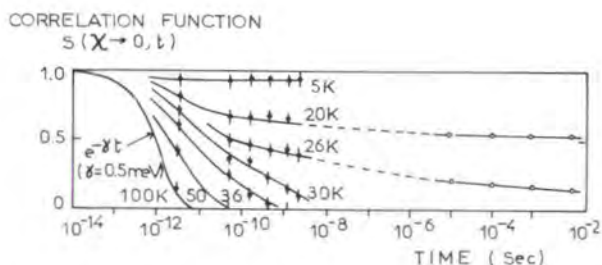


Fig. 15: Slowing down of the spin relaxation in Cu - 5% Mn spin glass around the freezing temperature of 27.5 K. IN11 (*) and A.C. susceptibility (O) data.]

Co-existence of superconductivity and long-range magnetic order

Progress in this field of research is quite rapid. After the successful experiment with HoMo_6S_8 (3) on D11 new data were obtained e.g. on DyMo_6S_8 which becomes superconducting at $T_c = 2.05$ K and is antiferromagnetic below $T_M < 0.4$ K. Magnetic fields applied at low temperatures cause the suppression of antiferromagnetism and the appearance of correlations of the ferromagnetic type which show a marked change at T_c . Future studies are planned on the non magnetic Chevrel phase YMo_6S_8 .

Single particle motions in superionic conductors and of hydrogen in metals

Incoherent quasielastic scattering experiments were performed on IN12 to study the diffusive motions of Cl^- ions in a single crystal of SrCl_2 at high temperatures. The energy width of the quasielastic line was measured as a function of the momentum transfer \bar{Q} in different symmetry directions (see fig. 16). By a comparison of the data with different jump diffusion models detailed information was obtained on the diffusion process on a microscopic scale (4).

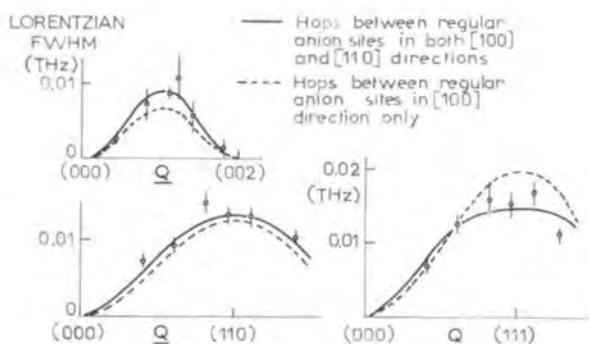


Fig. 16: Lorentzian width variation with \bar{Q} in SrCl_2 at 780 °C.

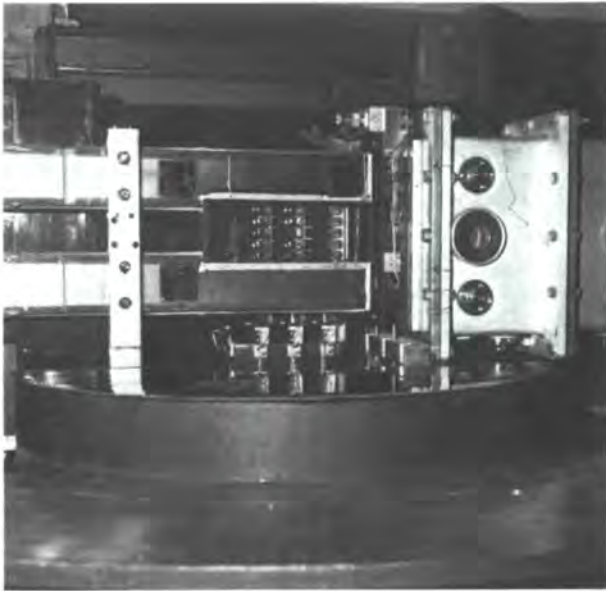
A continuous scientific activity exists in the study of the diffusion mechanism of hydrogen in metals and alloys like LaNi_5H_6 using the instruments IN5, IN10 and IN13 (5, 6, 7). In order to be able to understand the data and to draw conclusions about the dynamics of motions, detailed knowledge of the structure of the compounds is always required.

Several attempts were made to search for tunnelling motions of protons in metallic systems like $\text{NbX}_{0.01}\text{H}_{0.01}$ ($X = \text{O}, \text{Ti}$) and $\text{LuH}_{0.01}$ using incoherent inelastic scattering. The starting points for these studies were specific heat data which exhibit anomalies at temperatures below 3 K and one neutron experiment carried out in Brookhaven (8). Despite a great effort (sample temperatures between 1.5 K and 100 mK) only negative results were obtained so far at the ILL (9). No satisfactory explanation of this failure has yet been found. Additional experiments are in preparation.

In-beam NMR spectroscopy

Comparative studies of nuclear spin relaxation in Li-silicate glasses on ^8Li by β -radiation detection and on ^7Li by conventional NMR have been accomplished. The measurements cover temperatures from 4 to 300 K and, in the case of ^8Li , magnetic induction from 14 to 800 mT. The ratio of the ^8Li -to ^7Li -relaxation rates indicates a quadrupolar relaxation mechanism. The marked magnetic field dependence of the ^8Li relaxation rate, however, cannot be explained by models currently used for amorphous solids (Marburg-Münster co-operation).

By double-frequency irradiation the nuclear dipole-dipole line broadening can be suppressed by a factor of about 100 for a very diluted spin species. The method was used to narrow the β -radiation detected ^{20}F NMR signal in a CaF_2 single crystal to about 100 Hz. Application of 100 bar static pressure along the $\langle 111 \rangle$ direction resulted in a just detectable small quadrupole broadening of the ^{20}F NMR line due to pressure induced crystal electric field gradients (Marburg-Heidelberg co-operation).



New monochromator of D7 on the guide H15. Horizontal and vertical focussing with variable radius of curvature; 15 slabs of ZYA graphite ($75 \times 17 \times 2 \text{ mm}^3$).

Seminars

Several seminars were given during the year, one at the October meeting of the Subcommittee by Mr. Loewenhaupt on "Neutron studies on the dynamics of magnetic moments in metals".

References

- (1) W. Nägele, Z. Phys. B 42, 135 (1981).
- (2) F. Mezei, A.P. Murani, J.L. Tholence, Physica 108B, 1283 (1981).
- (3) J.W. Lynn, A. Ruggazoni, R. Pynn, J. Joffrin, J. Physique Lettres 42., L45 (1981).
- (4) Exp. 07-07-51 (W. Hayes, P. Schnabel, M.T. Hutchings, R.E. Lechner).
- (5) Exp. 07-06-113 (J.C. Achard, A. Percheron-Guegan, F. Tasset, C. Lartigue).
- (6) Exp. 07-06-126 (R. Hempelmann, D. Richter, L.A. Vinhas).
- (7) Exp. 07-06-128 (D. Richter, K. Kehr, H. Wipf).
- (8) H. Wipf, A. Magerl, S.M. Shapiro, S.K. Satija, W. Thomlinson, Phys. Rev. Lett. 46, 947 (1981).
- (9) Exp. 07-06-129 (H. Wipf, K. Neumaier, A. Magerl).

Secretary:
A. HEIDEMANN

college 8 and e.m.b.l. grenoble: biochemistry

Members of the college

I. At ILL

Bentley G.
Chenavas P.
Dianoux J.
Ibel K.
Jacrot B.
Lehmann M.
Lewit-Bentley A.
Mason S.
May R.
Oberthür R.
Roth M.
Timmins P.
Wilson S.
Worcester D.
Zaccai G.

II. At EMBL

Berthet C.
Borras F.
Cuillel M.
Cusack S.
Foote A.
Jacrot B.
Jesior J.C.
Leberman R.
Perkins S.
Schoot B.
Zulauf M.

III. ILL visiting scientists

Li Zong (Institute of Biochemistry,
Shanghai)
Devaux C.

Table 9

Instrument usage for biochemistry. The table shows the number of proposals and days (in brackets) requested and accepted at the two subcommittee meetings in 1981. *test time.

| No. of proposals (days) | D11 | D17 | D16 | D1B | D8 | IN5 | IN6 | IN10 | IN11 | IN13 | Special beam |
|-------------------------|---------|---------|---------|-------|--------|-------|--------|--------|--------|--------|--------------|
| April 1981 requested | 30 (87) | 12 (53) | 6 (107) | 1 (6) | — | 1 (5) | 2 (10) | 1 (5) | 3 (33) | 1 (8) | 1 (30) |
| April 1981 accepted | 16 (39) | 9 (36) | 4 (27) | 1 (3) | — | — | 1 (6) | — | — | 1 (5) | 1 (30) |
| October 1981 requested | 23 (66) | 8 (121) | 6 (58) | — | 1 (46) | 3 (5) | 3 (7) | 2 (16) | 3 (39) | 2 (10) | 1 (30) |
| October 1981 accepted | 15 (34) | 4 (47) | 4 (38) | — | 1 (6)* | — | 2 (5) | 2 (9) | 2 (18) | 2 (10) | 1 (30) |

General summary

The close co-operation between the ILL biology college and the Grenoble outstation of the European Molecular Biology Laboratory (EMBL) has now found a material expression in the joint EMBL/ILL building which was finished in time by the end of October. The new building accommodates the scientists of both groups plus some ILL chemists. The outstation's extensive biochemical equipment, X-ray and light scattering cameras, a brand new electron microscope, and a deuteration laboratory which can supply isolated deuterated molecules as well as deuterated micro-organisms, are now concentrated close to the neutron scattering facilities and the ILL central computer. The basic approach of the EMBL and ILL staff towards visitors is different, the former providing support to prepare and characterise

samples with other methods than neutron scattering, the latter offering their know-how in neutron diffraction and small-angle scattering, and the efficient operation of the neutron scattering facilities. An important part of the duties of the scientists of both groups is to perform their own experiments — in many cases in collaboration between the two laboratories. Nearly all of the biological neutron experiments at the high flux reactor are carried out with the scientific participation of one or several ILL or EMBL scientists. The success of the ILL in the application of neutron scattering in biology is mainly due to the scientific competence of both groups, which can only be maintained and developed by in-house programs. As far the EMBL outstation is concerned, this report refers only to work directly connected with neutron experiments.

Scientific trends and highlights

The constant disproportion between the number of days requested for experiments worth being carried out and those available according to the pro rata distribution of measuring time persists. Consequently, the Subcommittee of the Scientific Council preferred to select a number of research fields rather than to dissipate the rare time amongst all the proposals. Thus interest was focussed on several topics, which can be regarded as long term projects: the triangulation of the 50S subunit of the *E. coli* ribosome, the investigation of water in the structure of macromolecules, low resolution crystallography and the structure determination of viruses. In addition, a few other studies of particular interest have been given measuring time. Even with this hard selection, which eliminates very interesting fields of research, the time available for each experiment remains far too small and control experiments are unfortunately limited to a minimum.

Water and the structure of macromolecules

A number of experiments designed to probe the nature of interactions between biological macromolecules and solvent have been performed this year. A pressure apparatus is being developed and, in preliminary experiments, the pressure dependence of haemoglobin stability, virus capsid formation and tRNA-protein complexes has been examined up to 1.5 kbars, with positive and unexpected results (ILL, EMBL). Studies on tRNA and DNA have shown dense hydration layers surrounding these molecules, which vary with the nature and concentration of the salt in the solvent (Strasbourg, ILL, EMBL). Referring to previous work by other techniques, the neutron experiments have provided structural data to correlate with thermodynamic behaviour. Structural studies of hydration in different solvents are also under way on small well-characterized proteins, papain and ribonuclease (ILL).

Virus research

Research on virus structure is now concerned mainly with large spherical viruses having diameters greater than about 500 Å. Work has continued on inactivated native influenza virus and neuraminidase depleted particles (EMBL and Leiden). The project on adenovirus has expanded with the neutron scattering studies being complemented by X-ray studies on isolated "groups of nine" hexons and on nucleo-protein cores

(ILL, EMBL and Lille). Neutron data have recently been collected from Cauliflower Mosaic Virus (CAMV), the first DNA containing plant virus to be studied by neutron scattering.

An interesting aspect of the results is the re-determination of molecular weights. This applies to Influenza Virus (200×10^6) and Semliki Virus (43×10^6), where the published MW and composition have proved to be incorrect and have had to be revised. Also, the penton of Adenovirus has proved to be a trimer instead of a pentamer, as previously thought.

Ribosomes

The investigation of the spatial arrangement of proteins of the large subunit of the *E. coli* ribosome is now running smoothly. The molecular weights and radii of gyration of four proteins *in situ* and three distances have been determined, data for three further proteins and four further distances are collected (Berlin; EMBL Grenoble and Hamburg; ILL).

Low resolution crystallography

The use of contrast variation in low resolution crystallography has accounted for 88 % of the D17 beam time given to College 8 this year (i.e. 67 days). Three projects have been under study of D17: the Nucleosome Core Particle, Satellite Tobacco Necrosis Virus and the tRNA^{Asp}/tRNA synthetase complex. A total of four contrasts of the Nucleosome Core Particle have been collected to 16 Å d-spacing giving a total of four contrasts to this resolution (Cambridge; ILL). For STNV there is now a set of data at four different contrasts up to 30 Å d-spacing. Later in the year, a short test experiment on STNV showed that by using the 5 % velocity selector, significant well-resolved data could be obtained up to 16 Å d-spacing (Uppsala; ILL). Following a preliminary test early in the year on the tRNA^{Asp}/tRNA synthetase complex, data were collected at two contrasts. Significant data can be seen up to about 2 Å d-spacing (Strasbourg; ILL).

Membrane proteins solubilized by detergents

E. Coli outer membrane proteins:

Interactions of 3 proteins with nonionic detergents of the octyl-oligo-oxyethylene type have been studied by photon correlation, neutron scattering and 4 conventional binding techniques. Amounts of detergents bound to protein depend on temperature and total detergent concentration (see figure 17) and exceed the equivalent mass of a single micelle. The following concept has been developed: in cooperative binding, the detergent coats hydrophobic protein surfaces in a monolayer: the complex so formed can attract surrounding detergent micelles in dependence on concentration and temperature (Basel; EMBL).

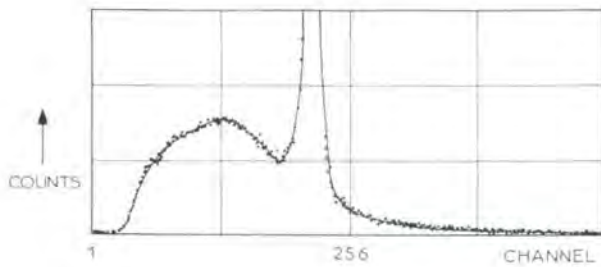


Fig. 17. TOF spectrum of unligated yeast hexokinase in D_2O buffer at $15^\circ C$ (after subtraction of background). The spectrum shows a maximum at an energy transfer of about 10 meV .

Cytochrome reductase and cytochrome B

Studies on cytochrome reductase were extended to the core complex after completion of the data collection for the other cleavage product, the bc_1 complex. Preliminary experiments were made on the cytochrome B-Cemulsol complex (EMBL Grenoble and EMBL Heidelberg).

Inelastic scattering

One of the first experiments to be performed on the new time-of-flight spectrometer IN6 was designed to detect changes in the vibrational spectrum of the enzyme hexokinase accompanying the binding of its substrate glucose. The increased flux available on IN6 compared with IN5 permitted the inelastic spectrum of a protein to be measured with reasonable statistics for the first time (see Figure 18). Although no significant difference was found in the spectra of unligated and ligated hexokinase at $15^\circ C$, the spectrum of the unligated protein at $37^\circ C$ showed marked changes (EMBL, Yale University).

Other research topics

A neutron scattering study aiming at the *in vivo* architecture of chromosomes (ILL and Universität München) which completes other work with chromatin in solution, has revealed a striking difference from electron microscope studies. Native metaphase chromosomes remain compact in the neutron beam whereas the samples prepared for EM are disintegrated. A detailed interpretation of the neutron data is under way.

The cause of lipid asymmetry in the myelin membranes of rat sciatic nerve was studied using "in vivo" deuterium of the choline groups and of all lipids, respectively. The changes of the neutron diffraction pattern due to proton/deuterium exchange and under a variety of physiological conditions are being studied to establish the changes in lipid distribution (ILL).

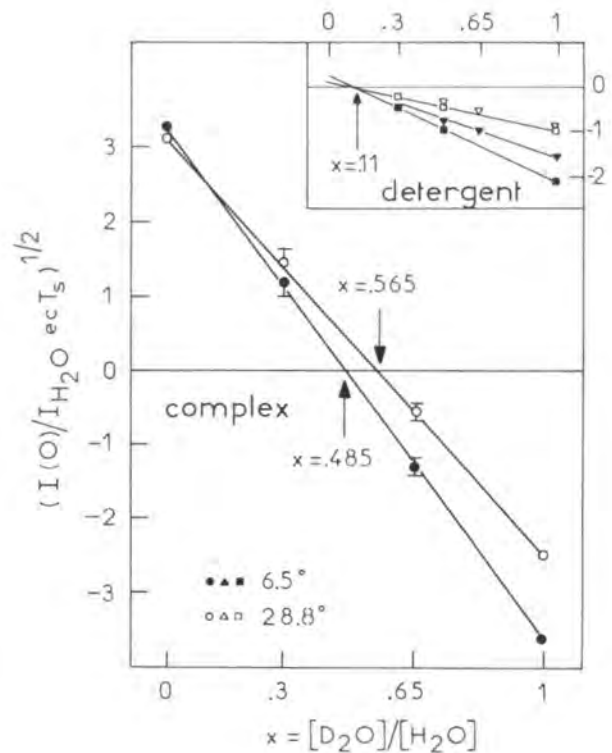


Fig. 18: Contrast variation of the forward intensity for deuterated matrix protein (complexed with the detergent C_8E_4) at two temperatures. Insert: detergent at two concentrations and temperatures.

Based in part on neutron results, a model has been proposed for the structure of the lac-repressor protein from *E. coli* (Orleans, ILL). It shows the tetrameric core to be slightly elongated with the DNA binding head pieces extending in pairs on the extremities of the long axis. This structure has interesting consequences for the interaction with DNA, including the possibility of binding two operator segments. In recent experiments with operator sequence DNA, large complexes were in fact observed.

A complete set of data has been obtained on phenylalanyl tRNA synthetase hybrids reconstituted from protonated α and deuterated β subunits or *vice versa* (Palaiseau; ILL).

Head of EMBL Outstation:

B. JACROT

College Secretary:

R. MAY

college 9 chemistry

Members of the college

I. Internal members

Beaufils J.P.
Bee M.
Cebula D.
Chenavas P.
Chieux P.
Croset B.
Dianoux J.
Douchin F.
Fender B.
Ghosh R.
Hässlin H.
Hayter J.
Heidemann A.
Ibel K.
Jobic H.
Kearley G.
Langel W.

Lauter H.
Lehmann M.
Lindner P.
Magerl A.
Oberthür R.
Pautrot G.
Poinsignon C.
Rawiso M.
Saubat B.
Wright A.

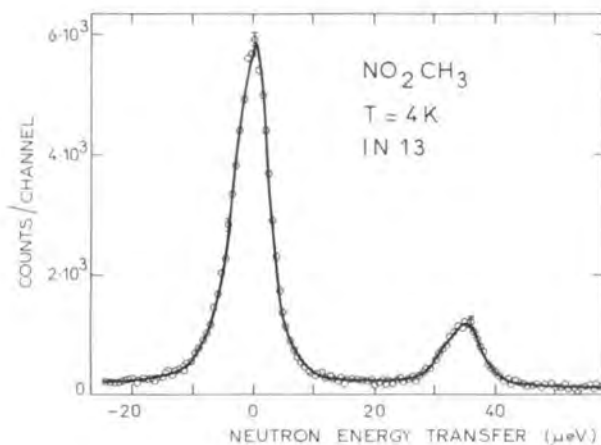
II. External members

Thorel P. (CNRS)
Volino F. (CENG-CNRS)

Table 10

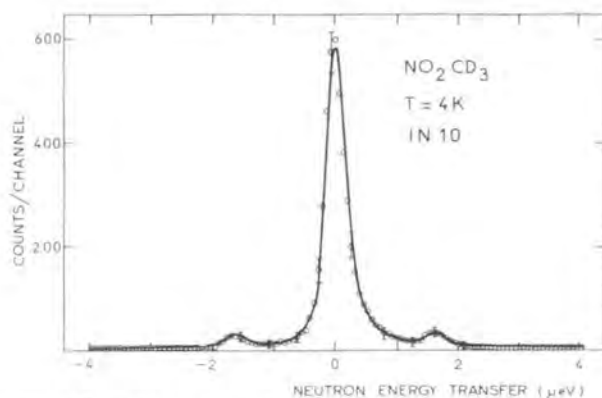
Instrument usage by College 9

| Instrument | Time requested (days) | Time allocated (days) | Number of experiments |
|------------|-----------------------|-----------------------|-----------------------|
| D1B | 147 | 65 | 14 |
| D2 | 58 | 32 | 5 |
| D11 | 162 | 77 | 53 |
| D16 | 119 | 47 | 7 |
| D17 | 160 | 82 | 53 |
| D18 | 21 | 14 | 2 |
| IN1 | 123 | 10 | 1 |
| IN4 | 142 | 87 | 11 |
| IN5 | 238 | 121 | 20 |
| IN6 | 130 | 88 | 13 |
| IN10 | 191 | 86 | 14 |
| IN11 | 208 | 94 | 13 |
| IN13 | 75 | 63 | 6 |
| Total : | 1774 | 866 | 212 |



General summary

During 1981, two new spectrometers of special interest for chemistry, IN6 and IN13, have been scheduled and another one, IN10, rebuilt. Although with these new instruments the energy gap between IN5 and IN10 is now filled (cf. fig. 19a + b), now allowing for a *continuous* exploration of molecular motions with neutron spectrometers on a time scale up to 80 nsec (IN11), and although both new instruments will certainly take some of the pressure from IN5, nevertheless a great excess of requested vs. allocated beamtime on the neutron spectrometers persists.



(Fig. 19a + b): Isotope effect of tunnelling of the methyl group in Nitromethane (IN10 and IN13 data).

The same is true for the small angle scattering instruments D11 and D17, where half of the experiments of College 9 have been performed, due to the very rapid data collection of these machines. However, more sophisticated experiments, like the observation of the time dependent relaxation of an isotope labelled anisotropic scatterer (cf. fig. 20) need much more beam time than the usual isotropic equilibrium experiments and will greatly increase the pressure on these instruments in the future.

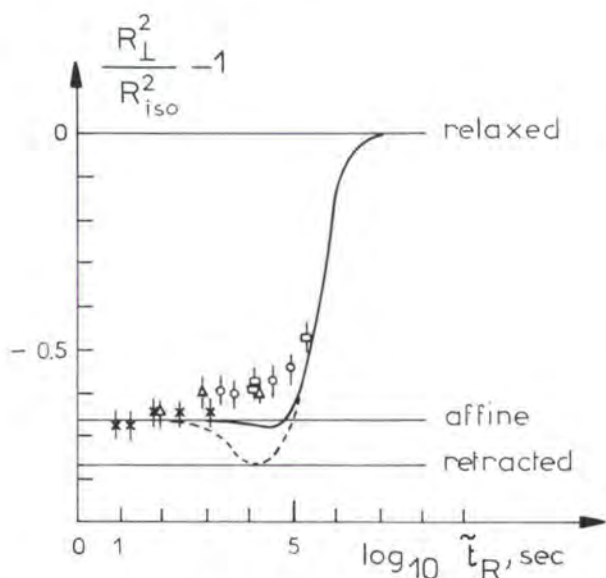


Fig. 20: Representation of the reduced mean square radius in the transverse direction, $R_{\perp}^2/R_{iso}^2 - 1$ at different relaxation time \tilde{t}_R and at temperature $T = 117^\circ\text{C}$. Calculated time dependences, from the affine deformed to the isotropic states, are given for a disengagement time $\tau_{dis} \cong 6 \times 10^5\text{s}$ and for equilibrium times $\tau_{eq} = 10^{-2}\tau_{dis}$ (broken line), $\tau_{eq} = 10^{-1}\tau_{dis}$ (continuous line).

On the other hand, the reconstruction or modification of several instruments such as D1B, D16 and IN1 has substantially reduced the allocated beam-time on these machines. This is most regrettable in the case of IN1, where only one test experiment has been performed in 1981.

Due to the increasing diversity of subjects treated within the limits of the chemistry college, a subdivision into College 9a and 9b has been agreed, which will become effective for the scientific council in April 1982:

9a = Spectroscopy of small molecules, physisorption, chemisorption and intercalation.

9b = Liquid crystals, colloids and polymers.

For this reason two college secretaries were elected as early as January 1981. At the same time, J.P. Beaufilet, whose main interests are in the physical chemistry of adsorption, was appointed to succeed B. Jacrot, the new head of the EMBL outstation, in his post as senior scientist. With the inauguration of the new biology

and chemistry building in December 1981 better laboratory facilities for chemistry will be provided. The sharing of the new building with the EMBL outstation and the biology group at the ILL may also lead to a better collaboration between the biologists and chemists on closely related subjects.

Scientific trends of 1981

Physisorption

Adsorbate structure determination and the construction of bidimensional phase diagrams benefit particularly from the use of neutron diffraction. As phase diagrams of H_2 , D_2 and CH_4 on graphite or NiCl_2 are now well documented, new systems with competitive adsorption of rare gases are examined. The phase diagram of Ne adsorbed on graphite has been investigated up to a most densely packed monolayer. It resembles that of a 2-dimensional classical Van der Waals gas with first order transitions, whereas the melting of ^{36}Ar submonolayers on graphite can be well described by a liquid crystal region between the solid and fluid phase, possibly connected to higher order transitions between the phases (Halpern-Nelson theory). This behaviour, different from Ne on graphite, is due to adsorbate-substrate interaction.

Quasi-elastic scattering from diffusion, tunnelling

There have been important developments in tunnelling spectroscopy this year. The effect of isotopic substitution was observed both in rotational tunnelling of H_2 , HD, D_2 on graphite and in $\text{CH}_3\text{NO}_2/\text{CD}_3\text{NO}_2$ as shown on figure 19. The spectra illustrate the complementarity of IN10 and IN13 for these investigations. Numerous experiments also use tunnelling as a probe of electric charge distribution, crystal field and intermolecular forces at surfaces.

Chemisorption and catalysis

As previously mentioned, the temporary shut-down of IN1B has stopped part of the investigations in this field-hydrogen chemisorption on Ni or Pt powders, hydrocarbon chemisorption on metals. The same situation is observed for Ni or Pd in zeolites and H_2O -chalcogenide interactions.

Nevertheless an interesting result has shown that the Debye-Waller factor at large energy transfers has less importance than originally expected.

Molecular crystals and lamellar compounds

The continuation of vibrational spectroscopy studies of transition metal carbonyl complexes containing aromatic ligands gives a better understanding of the chemical binding and confirms models deduced from optical spectroscopy results.

Investigations of the dynamics of liquid crystals remain of great interest. New studies on molecular crystals enable complex rotations to be analysed in relation to phase transitions (fig. 21), leading to the development of new models, favoured by a large energy transfer range now available in T.O.F. and diffuse scattering spectroscopy (Lille - ILL).

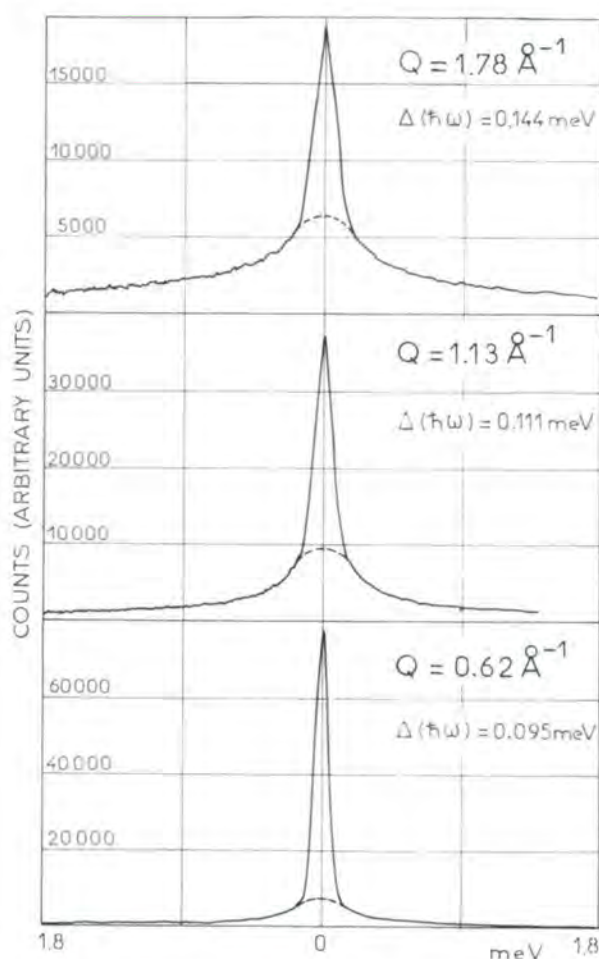


Fig. 21: Trimethylacetic acid (partially deuterated) $(CH_3)_3CCOOD$ at $T = 303K$, $\lambda = 5.2\text{\AA}$, measured on IN6 (counting time: 90 min). The quasielastic broadening shows evidence of complex uniaxial rotations of both methyl and tertiary-butyl groups. The dotted line separates the purely elastic scattering. Resolution values are also indicated (FWHM).

Numerous lamellar compounds have been investigated — ion dynamics in different stages of intercalated graphites, water dynamics in chalcogenides and clays. In the first two layers

adsorbed on a clay surface water appears to be structured by cations and a "bidimensional dynamical structure" must be described midway between free water and ion shell hydration (Orléans - ILL).

The experimental work on water motion in Nafion membranes has now led to a qualitative analysis. The neutron incoherent scattering law for diffusion inside a cylinder has been calculated. The results shows that in these membranes the water molecules are diffusing practically as fast as in bulk water within thoroughly isotropic volumes having about 10\AA diameter (CENG - ILL).

Information about the forces between charged lamellae, have been obtained from a study of the acoustic phonons in a highly crystalline clay (Oxford, ILL).

Colloids

Polymer latex suspensions, which have a concentration independant single particle structure factor and which can be prepared with both charged and uncharged surfaces, have continued to be investigated by small angle neutron scattering (SANS) to obtain more information on the forces between colloidal particles in solution and the phase transitions due to these forces (Bristol, ILL).

For charged micellar systems (formation of micelles above a critical micellar concentration) the intra- and inter-particle structure factor had been obtained from a combined use of SANS and neutron spin echo (NSE) together with theoretical calculations. This method has been extended to water in oil microemulsions (Bristol, Malvern, ILL) and nonionic micelles (EMBL, ILL).

Growing interest is in the internal structure of micelles (Orsay, Strasbourg, Saclay) and in microemulsions with non-spherical micellar organisation (Nancy, Bristol, Bayreuth). More complicated systems with amphiphilic molecules forming a liquid crystalline phase were investigated after orientation in a magnetic field (Orsay, ILL)

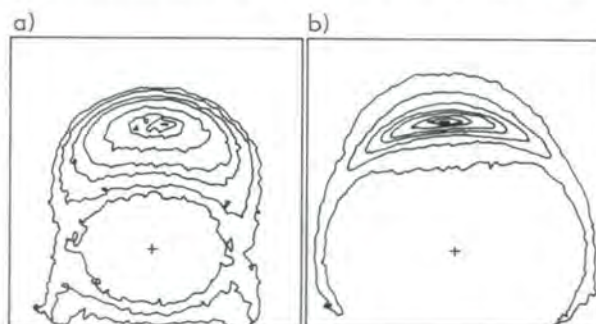


Fig. 22: D17 detector contour plot of the scattered intensity from a mixture of small amphiphilic molecules with water, organized into a) a nematic lyotropic phase and b) a hexagonal phase with long range order, both oriented in an external magnetic field (sample-detector distance 140 cm, $\lambda = 8\text{\AA}$; the cross denotes the point of the primary beam impinging on the detector plane).

New fields of activity have been started with the study of magnetic colloids in external magnetic fields by SANS (Bangor, ILL) and with the study of colloid systems in a shear gradient (Mainz, Paris, ILL).

Polymers

Basic work on isotropic polymer solutions has continued with the investigation of partially labelled polystyrene chains (Strasbourg, ILL) and polyoxyethylene chains (ILL) in order to establish with simple systems a well defined treatment of the experimental data in the whole accessible Q-range of diffuse scattering.

In the same period, for the first time the refractive index increment (scattering contrast) of a dissolved polymer was measured directly, using the neutron interferometer D18 (Dortmund, ILL).

All this work, in conjunction with the absolute calibration work, done on D11, will be essential for the handling of the diffuse scattering of more complicated systems.

Polymer solution dynamics have now been investigated in the cross-over region from dilute to semi-dilute solution (Jülich, Mainz), and the investigations were extended to rings, networks and gels of various types (London, Jülich, Mainz, Saclay, Strasbourg). Work on polymer melt, has confirmed that the simple Rouse model is valid for these systems over a wide Q-range, in contradiction to several current reptation theories. This has stimulated further activity on both experimental and theoretical fronts.

In the field of polyelectrolytes a first step has been reached with the interpretation of the polyion conformation in simple salt solutions (Mainz, ILL), whereas for the highly interacting system of polyelectrolyte in pure water the investigations using the isotope labelling of individual chains are in progress (Saclay, Strasbourg).

An increasing number of SANS experiments is being performed on anisotropic polymer samples. These include stretched rubbery networks (Strasbourg) as well as plastic materials (Saclay) using the well established deuterium labelling of individual chain molecules to follow their conformational change during deformation. Allowing the deformed plastic material (polystyrene) above its glass transition temperature to relax a definitive time \bar{t} , before quenching to room temperature made it possible for the first time to follow the relaxation process of polymer molecules as a function of momentum transfer and real time $t \geq 10$ sec.

Another experiment permitting the simultaneous observation of time and space dependent conformational behaviour of polymers has been installed at D11 (Mainz, ILL). Here a polymer solution is subjected to a constant shear gradient, allowing relaxation times to be observed as low as $t \approx 300 \mu\text{sec}$.

In the field of semicrystalline polymers the optical phonons in oriented and polycrystalline polyethylene have been studied by neutron inelastic scattering (ILL), and the structural changes in conjugated polymers upon doping with electron acceptors leading to electrically conducting systems could be followed with an in-beam kinetic experiment on D1B (Stuttgart, ILL).

Polymer containing systems of increasing complexity, including polymer mixtures (London, Mainz), block-co-polymers (Glasgow), polymers interacting with micelles (Orsay, Strasbourg) and polymers on various supports (Glasgow, Bristol) are now being tackled by SANS using isotope labelling of the parts of interest. However, the complete interpretation of the experimental data for some of these systems where superstructures occur has turned out to be still rather difficult.

Seminars

Several seminars on specialized topics of interest to College 9 have been given within the last year in the field of polymers and colloids by Prof. Lechner (Osnabrück), Dr. Ewen (Mainz), Dr. Pusey (Malvern), Dr. Cabane (Orsay) and Dr. Picot (Strasbourg); on absorption in metals by Dr. Lengeler (Jülich) and about water dynamics by Prof. Sponsito (Riverside, U.S.A.).

ILL contributors for seminars were J.P. Beaufils, J. Hayter, H. Hässlin, M. Rawiso, F. Volino.

Workshop

On October 12-13, 1981 a joint workshop of College 8 and 9 devoted to the dynamics of "water at interfaces" was organised by R. Otte-will, C. Poinignon and P. Timmins, showing great similarities in the dynamics of water at organic and mineral surfaces.

Secretaries:
C. POINSIGNON,
R. OBERTHÜR

4

sections with special tasks

project office

The Project Office is responsible for technical and financial coordination in the field of scientific capital investment projects, and for all investments under the modernisation programme. The workload has increased considerably since 1980, although the small staff (5 persons) has remained constant.

In 1981 the Office was responsible for a budget of 37 MF instead of 10 MF in normal years.

Number of different projects requiring more or less regular budget control: 15 to 20.

Average cost of a project: 5 to 6 MF.

Average duration of a project to completion: 3 years.

The rapid increase in costs due to inflation makes it difficult to keep the project budgets in balance.

The introduction of a computerised handling system is therefore being prepared, which should be operational early in 1982.

At the technical level:

1) to take account of the legitimate desires for more flexible operation and in view of the increasing obstruction of the experimental areas, a considerable effort has been made with the help of the Health Physics Group to optimise the shielding of the new instruments.

2) all the design studies for modifications are carried out by the Project Office:

instruments completed and accepted: IN6, IN10, IN13, D16;

preliminary projects for IN20, PN8, IN4B, D19B;

monitoring progress of the construction of IN1B, IN8B, D4B, IN20, PN8, D7, D19B, D20, D2B and some special instruments.

safety and health physics group

The group has continued its normal work, consisting essentially of:

- monitoring of radioactivity around the experimental instruments and reactor installations;
- dosimetry for all staff;
- support of experimentalists by providing radioactive sources and the alpha-ray laboratory;
- improvement of health and safety conditions at individual working positions following requests by the Committee on Health and Safety (CHS).

Special work in 1981 consisted of:

- the study by the Internal Safety Committee of special experiments such as: NN on H18, PN7 on H14 and fundamental safety facilities at the experiments;
- calculations of shieldings for IN20 and D19 in the framework of the Project Office;
- radioprotection of the work associated with the modernisation during the exchange of the thimbles H8 and H13, and the neutron guide noses H1 and H2.

office of the scientific secretary

Reactor Users Programme

In 1981, 1062 proposals were submitted to the April and October meetings of the Scientific Council and 733 were accepted. During the reduced period of reactor operation (planned shut-down March to June) some 620 experiments were routinely carried out, highlighting the increasing through-put on the instruments and the attendant pressure on both scientific and technical staff who have to work to strict time schedules. Acknowledgement is also made here to the visiting scientists (over one thousand, for experiments during the 9 months reactor period), without whose help and understanding such an intense programme could not be envisaged.

Demand for instrument time is now 2 - 3 times greater than that available and the scientific sub-committees, who have the difficult task of adjudication, are becoming increasingly impatient with submitted research proposals containing insufficient information on which to base an assessment. Proposals requesting a continuation of work already accepted are still increasing and must be accompanied by a report on the use of the previous beam-time.

Organisation of Workshops and Conferences

On September 7 - 11, 1981, the Office organised an "International Symposium on neutron capture Gamma-ray spectroscopy and related

topics" in collaboration with F. Gönnerwein and T. von Egidy (TU-Munich). The conference was attended by about 170 participants and was a considerable success. The conference proceedings are being processed and are expected to be issued by February 1982.

Mme Touret-Poinsignon and the Office organised a workshop on "Water at Interfaces" on October 12 and 13, 1981. About 50 experts discussed new developments in this field.

The Office has started preparing the following meetings in 1982:

- a workshop on "Dynamics of Polymers" (29-30 March 1982);
- a workshop on "Multidetectors" (October 1982);
- an International Conference on "Polarized Neutrons" (October 1982).

Public Relations

The first two issues of the News Letter for Reactor Users appeared in January and July 1981, respectively. The response from the users has been very encouraging.

In December 1981 a new general brochure of the ILL was issued by the Scientific Secretary. It is available from the Office on request.

5

technical
department

Introduction

Les grands axes directeurs de l'action menée par le Département Technique en 1981 ont été :

— Le suivi de la réalisation des nouveaux bâtiments Rechenzentrum et Chartreuse et des installations techniques correspondantes.

— L'étude générale par la "Commission Locaux" des meilleures conditions techniques et financières pour résoudre l'ensemble des projets de locaux :

- transferts des équipes dans les nouveaux bâtiments,
- rénovation du Service Médical,
- réinstallation des ateliers d'entretien,
- regroupement des activités à nuisances.

— L'étude de l'installation d'un nouvel autocommutateur téléphonique.

— Un effort considérable sur le plan des études et des montages des instruments financés par le programme de modernisation IN1 - D4 - PN8 - IN20 - lancement du projet H11, ce qui correspond sensiblement à un doublement des actions avec un personnel d'appoint temporaire limité (2 dessinateurs).

Introduction

The main fields of activity of the Technical Department in 1981 were:

— The follow-up of the construction of the new Rechenzentrum and Chartreuse Buildings and of the associated technical installations.

— The general study by the Committee on Offices of the best technical and financial conditions for dealing with all the plans for offices:

- transfers of groups to the new buildings,
- renovation of the Medical Group,
- work on maintenance workshops,
- reorganisation of decontamination work.

— Studies for the installation of a new telephone switchboard.

— A considerable effort as regards design studies and assembly of instruments financed under the Modernisation Programme - IN1, D4, PN8, IN20, initiation of project H11 - which corresponds roughly to a doubling of the work with a limited temporary additional staff (2 draughtsmen).

Einleitung

Die beiden Hauptziele, die die technische Abteilung 1981 verfolgte, waren folgende:

— Überwachung der Bauarbeiten für das Rechenzentrum und das Gebäude Chartreuse und der dazugehörigen technischen Einrichtungen.

— Allgemeine Untersuchung durch die "Räumekommission", zur Optimierung der technischen und finanziellen Bedingungen mit dem Ziel, alle Probleme der Raumverteilung zufriedenstellend zu lösen:

- Umzug der betroffenen Abteilungen in die neuen Gebäude,
 - Renovierung der Räume für den Sanitätsdienst und den Betriebsarzt,
 - Neueinrichtung der Werkstätten,
 - Zusammenfassung der mit Schadstoffen verbundenen Arbeiten.
- Studie zur Installation einer neuen Telefonanlage.

— Für Untersuchungen und Montage der im Rahmen des Modernisierungsprogramms finanzierten Experimentiereinrichtungen - IN1 - D4 - PN8 - IN20 - Beginn des H11-Projekts - wurden grosse Anstrengungen unternommen; die Aktivität der Abteilung hat sich dadurch mit einer begrenzten Anzahl von Aushilfspersonal (2 Zeichner) etwa verdoppelt.

mechanical construction

Main Mechanical and Sheet-Metal Workshops

As in the past, these have dealt with:

- the construction of a considerable part of the experiments and their infrastructure,
- the construction of new instruments based on design studies by the Construction and Maintenance Department, and part of the associated technological developments,
- a major contribution to the maintenance work on the Reactor, laboratories and general technical installations.

In 1981, with the usual staff of 10, the main workshops dealt with 512 requests for work (274 mechanical engineering and 238 sheet-metal work). The most important jobs were: construction of IN1B (1600 hours), analyser IN8B (610 hours), 8 small non-magnetic goniometers D10/IN1B (540 hours), monochromator D7 (500 hours), ionisation chamber for PN1 (585 hours), 5-wire detector for IN1B (126 hours), goniometer D9, cryostat D3, polariser PN7, the support structures and platforms for D18 (668 hours) and D16/D17 (680 hours), tritium degazification units (360 hours), installation of IN10 (280 hours), a frame to reinforce the H21 casemate (230 hours), platform for PN8 (in progress), reactor beam tube liners (180 hours).

In addition, approximately 1/3 of the potential available is always reserved for small urgent and non-recorded jobs, which form the second main function of the main workshops.

The "Self Service" Mechanical and Sheet-Metal Workshops

The machines in these workshops are used daily by 12 to 15 technicians doing small items of mechanical work of a very high quality alone, with the advice or assistance, as necessary, of two permanent employees.

The "Special Products" Workshop

One part-time employee is responsible for the production and installation of health physics material and the normal neutron absorbers. A considerable reduction in the use of Li^6F has been noted, resulting from the effort to use more convenient and less expensive replacement materials.

The "Primary Materials" Store

This store is operated by one employee from the production section controlled by the Administration and Finance Department, and supplies materials in sheets and profiles to the (non-finished) dimensions requested by the users. Number of requests satisfied each week: approximately 30, representing about 120 items and more than 300 kg.

design studies and construction project group

This group deals with new constructions and major changes to the general infrastructure and buildings. It does parts of the associated design studies, deals with invitations to tender, selection of suppliers and supervision of the work mainly carried out by outside firms.

The main jobs in 1981 were:

— liaison with the architect and consulting engineers on the construction of the "Rechenzentrum" (ILL 19) and "Chartreuse" (ILL 20) buildings, handed over in June and October,

— studies, coordination and follow-up of the internal equipment of the buildings and work on the associated services,

— construction of the decontamination building (ILL 21),

— reconstruction of the offices of the physicists' secretariat and the Administration Department, extension and refitting of the Medical Group,

— design study to improve the site entrance,

— selection of and preparation for the installation of the future telephone switchboard at the ILL.



The new computer building completed (right) and the joint biology/EMBL building.

building and instrument maintenance equipment group

Description of Duties

At its name indicates, the Group has three main fields of work:

Maintenance of the Technical Installations and the ILL's Furniture and Structures

The work in this field is essentially curative and preventive; the information collected during repair work contributes to the planning of preventive maintenance and stock control for replacement parts. A number of contracts are in progress with external firms for the maintenance of specific equipment which does not justify employing a full-time specialist at ILL, such as: air-conditioning equipment, handling equipment, regulation of heating, lighting, cleaning, maintenance of roads and sewers, etc. A considerable part of the work of the Group consists of regulating and modifying old installations or equipment.

Important jobs in 1981:

- modifications to the heating system and controls,
- installation of a cable winding drum on the overhead crane in level C of the Reactor,
- renovation of the lighting in the Amphitheatre.

Equipment of Buildings

In conjunction with the design studies and construction group and the other workshops in the Department, the Group is called in when there are particular problems or conditions in connection with the various rooms or instruments. It deals with some of the design studies, the preparation of technical specifications and the follow-up of work in the field of fluids, air-conditioning, handling, electricity and furniture.

Principal jobs in 1981:

- reequipment of the general stores (goods lift, storage equipment, ventilation),
- supply of fluids and electricity to ILL 21,
- provision of fluids, electricity, furniture for ILL 19 and ILL 20,
- assistance with the equipment of the new premises for the Medical Group and the Physicists' Secretariat,
- temporary installation of the Maintenance Workshops,
- modifications to the access doors in ILL 7.

Modification to Instrument Positions

As a function of the requests from the Instrument Operation Department and the Project Office, and in conjunction with the Reactor and the Construction and Maintenance Group, this group organises the preparation and assembly of the shielding and other facilities (electricity, handling, infrastructure) on new or existing instruments.

Principal jobs in 1981:

- D7, assembly of the new monochromator shielding and infrastructure,
- IN10, IN1, infrastructure, floor,
- PN8, S50 experiment (n, p), infrastructure,
- H8, H13, preparatory work for replacement of beam-tube liner.

Facilities available:

For the work of this group the following are the principal facilities available:

- maintenance and electrical installation workshop. This deals with emergencies, maintenance and improvement of existing installations and some extensions and modifications (outside the Reactor),
- maintenance workshop for general technical installations (general fluids, heating, sanitary, ventilation, effluents (outside the Reactor), lifting and handling),

— general maintenance and handling workshop. Among other things this deals with the maintenance of the general and technical furnishings and the ILL cars, all internal moves, a considerable part of the internal transport and handling, and supervision of cleaning. It is also responsible for temporary reorganisation of installations con-

nected with the life at the ILL (committees, seminars, visits, elections, etc.),

— concrete prefabrication base. With the associated Civil Engineering equipment, this makes it possible to deal with particular requirements for experiments as regards shielding (ordinary or special concrete).

mechanical construction and maintenance section

The principal events in 1981 were:

- the reconstruction of several instruments,
- the replacement of 175 metres of neutron guides (including the in-pile part),
- work associated with the replacement of the beam tube liners,
- the start of production of new instruments.

Design Studies

The division into three working groups has proved particularly efficient:



ILL air-pad design.

Group One: aspects of integrated mobile shielding for monochromators (on rails), e.g. IN1B, IN20;

Group Two: development of focussing monochromators, in co-operation with the Monochromator Group;

Group Three: the secondary spectrometers (sample, analyser, detector) with general implementation of modular elements on air cushions, and the beam elements associated with the monochromators (diaphragms, beam shutters, collimators).

Assembly and Tests

There has been very intensive activity both in the assembly workshops and at the instrument positions because of the frequent need to carry out simultaneously operations such as the replacement of neutron guides, the assembly of rebuilt instruments, and maintenance work.

Construction Work

Instruments rebuilt, modified and operational again: IN8B, IN10B, D16B.

Instruments in course of assembly or reinstallation: PN8, IN2 (because of the replacement of beam-tube liner H13), D7, IN1B, D4B, IN1 Beryllium filter.

Under construction in the U.K.: monochromator shielding for IN20.

Design stage and preparation of invitation to tender: D19B, D2B, D20.

Instruments where minor work has been carried out: D11, S50, D10, IN13, H17 area.

Test equipment: the control equipment for mechanical orientation units (goniometers, tables, etc.) is now operational.

Technical Development

Tests of modules on inflatable air cushions are continuing: study of stabilisation and perpendicularity.

Adaptation of magnetic bearings on the choppers: commencement of construction phase.

Research on the performance of reluctance motors in collaboration with the pupils of the Grenoble Institut Polytechnique.

A prototype of analyser - detector shielding control with pneumatic logic is under test.



reactor
operation
department

Introduction

Le rythme habituel de fonctionnement adopté depuis 1975 a été modifié cette année pour tenir compte de deux opérations importantes sur le bloc-pile : remplacement du bloc mécanique du canal H1/H2 et du doigt de gant du canal H8. Ces opérations ont nécessité l'arrêt du Réacteur du 25 mars au 1^{er} juillet.

Le programme prévu pour 1981 ne comportait, en conséquence, que 207 jours de fonctionnement du Réacteur, répartis en 4 cycles de 44 jours et en 2 cycles partiels d'une durée de 24 jours et de 7 jours : comme d'habitude entre chaque cycle, un arrêt de 12 jours a été ménagé pour permettre de réaliser les opérations de contrôle et de maintenance courantes et de changement du combustible.

Einleitung

Das 1975 eingeführte Betriebsprogramm wurde dieses Jahr geändert, um zwei wichtige Eingriffe am Reaktorblock vorzunehmen: Ersatz des Neutronenleiterschubs H1/H2 und des Strahlkanals H8. Dazu war ein verlängerter Reaktorhalt vom 25. März bis zum 1. Juli notwendig.

Das für 1981 vorgesehene Reaktorprogramm belief sich daher lediglich auf 207 Betriebstage, aufgeteilt in 4 Zyklen von je 44 Tagen und 2 Teilzyklen von 24 bzw. 7 Tagen: die 12-tägigen "Pausen" zwischen den Zyklen dienten wie üblich dazu, das Brennelement auszuwechseln und die laufenden Wartungsarbeiten durchzuführen.

Introduction

The system of operation used since 1975 has been modified to allow two important operations on the reactor block: replacement of the beam tube H1/H2 support structure and of the beam-tube liner H8.

These operations necessitated a shut-down of the reactor from 25 March to 1 July.

The original schedule for 1981 therefore only included 207 days of reactor operation divided into 4 cycles of 44 days and two part-cycles of 24 and 7 days, respectively: each cycle being followed by a 12 day shut-down enabling the fuel element to be changed and regular inspection and maintenance operations to be carried out.

reactor operation 1981

Analysis of the Reactor Cycles.

Cycle 7/80

Commenced 6 January and ended 30 January 1981. The scheduled dates were maintained. There were two short shut-downs, followed by immediate restarts.

This cycle was a continuation of the cycle commenced on 3 December 1980 using the fuel element BS055.

Cycle 1/81

Commenced 9 February and ended 25 March 1981 using the fuel element BS056. The scheduled dates were maintained. There was a brief interruption during this cycle as a result of a voltage drop on the EDF supply; the reactor restarted immediately.

Reactor shut-down from 25 March to 1 July 1981

This shut-down, intended mainly to allow work on changes in the support structure H1/H2 and replacement of the H8 beam-tube liner, was also utilized for carrying out large-scale maintenance tests and checks, normally done during the annual shut-down in October. The October shut-down was omitted.

Cycle 2/81

This cycle, originally planned to run from 30 June until 13 August 1981, was delayed for various reasons; failure of an auxiliary pump on the D₂O circuit caused a 24-hour delay; water in the IH3 beam-tube liner stopped the cycle for 45 hours; a 57-hour shut-down followed a short-circuit in the electricity supply safety loop with subsequent Xenon poisoning.

The time lost as a result of the stoppages was partially made good at the end of the cycle, which was delayed until 16 August.

There were two further stoppages during this cycle. One, following a failure on the EDF supply, the other, caused by an electricity failure in a cold measuring circuit. The reactor restarted immediately in both cases.

Cycle 3/81

This cycle, originally planned to run from 25 August to 8 October 1981, actually commenced on 24 August and ended on the planned date. The cycle was advanced by one day to allow low-power reactor operation (6 MW) for a period of 24 hours, as requested for one experiment. The scheduled dates were maintained. There was a brief interruption during the cycles as a result of faults on the EDF supply, followed by an immediate restart.

Cycle 4/81

This was originally planned to commence on 20 October 1981 and to end on 3 December 1981. There was a shut-down during the cycle from 12-27 October to allow repairs to auxiliary pumps on the D₂O circuit. The time lost as a result of this shut-down was recovered by delaying the shut-down at the end of the cycle until 10 December.

Cycle 5/81

This first part of the cycle, scheduled from 15 to 22 December, went according to plan between the dates scheduled.

Data for 1981

| | |
|--|--------|
| N° of days originally scheduled | 207 |
| actual n° of days of operation | 205.6 |
| N° of equivalent days at full power | 202.4 |
| actual operating time | 56.3 % |
| actual operating time in relation to time scheduled | 99.3 % |
| N° of fuel elements used | 4.5 |
| N° of fuel elements actually despatched for processing | 5 |
| N° of unscheduled shut-downs | 9 |
| including: brief shut-downs | 6 |
| shut-downs with Xenon poisoning | 3 |

Analysis of Unscheduled Shut-downs

| | |
|---------------------------------|---|
| Intervention by operation staff | 1 |
| EDF power cuts | 3 |
| mechanical reasons | 2 |
| electrical reasons | 2 |
| experimental instruments | 1 |

The number of unscheduled shut-downs (7) is lower than in 1980 (10). The unchanged number of shut-downs with Xenon poisoning (3) is explained by one shut-down at the end of a cycle, excluding any possibility of an immediate restart, and two failures in equipment which necessitated relatively long repair periods. On the other hand, there was no unscheduled operation of the safety circuit, due to the improvement announced in 1980.

operation of the sub-assemblies

The Detritiation Plant

The detritiation plant operated during the 1st and 4th quarters of the year, the remainder of the year being occupied with modification work, in particular, with the adding of a supplementary 10 m³ tank.

| Heavy water processed in 1981 | Tritium extracted |
|-------------------------------|-------------------|
| HFR 75000 l | 125 000 Curies |
| EL3 3600 l | 15 000 Curies |

During the year 92000 Curies of tritium were despatched either to COGEMA or to HARWELL.

Reactor Block

Besides the operations already mentioned — the change in the H1/H2 beam-tube support structure and the change in the H8 beam-tube liner during the long shut-down — the replacement of the H13 beam-tube liner should also be mentioned.

These operations were carried out for the first time and proved very satisfactory.

The safety valves (VS) and the reactor boundary isolating valves (VTE) of the neutron guides were all checked and, if necessary, repaired during the same shut-down.

The plug in guide IH1 was replaced by a new model with modified cylinder and collimator. The safety rods n°s 2 and 4 were given a complete overhaul as was n° 5 whose absorbent and upper part were replaced.

For 10 years, the beam-tube thimbles of the high flux reactor have been exposed to intense radiation resulting in metallurgical changes in the original material. For this reason, a programme of preventative exchange of these thimbles has been established, the time scale of which will take into account the consequential effect on the scientific life of the ILL.

Beam tubes H9 and H10 will be exchanged in 1982. Dates for the exchange of the remaining thimbles will be determined later, with a probability that H5 and H11 will also be replaced by 1983.

Fuel Element Handling

This year, the ten-yearly tests on handling equipment valves and reactor valves commenced. New position and new weight sensors were installed in the containers.

The fuel element manufacturers (CERCA and NUKEM) are holding a renovation campaign for element control machines and electron arc welding machines.

Electricity

The reactor control has been the cause of numerous interruptions of the reactor operation. A general examination of the rectifier and static inverter units of the system by an agent of the manufacturer SIEMENS was considered necessary. The installation of the new central computer was accompanied by the installation of a new regulated supply system for the computers (ARO), of 150 KVA, consisting of a static rectifier/transformer unit and a battery for emergencies.

The relay systems of the "AIR ROD" compressor installations and of the source changer system of the instrument PN3/H6-H7 were completely recast and replaced by programmable automation.

The whole of the connector group reserve battery of the auxiliary D₂O N°2 pump has been replaced.

Electronics

The AEG computer which dealt with the automatic processing of analog measurements and binary signals from the reactor since its start-up in 1971 has been replaced by a newer model of the same make.

The upper level entrance to the reactor has been equipped with a complete Berthold control system, allowing the detection of possible contamination of persons leaving the reactor hall. The starting circuit period meters have been replaced by more recent models.

The SADI systems of binary code processing have continued to be developed for the processing of signals coming from the Detritiation Plant and experimental instruments.

The leak detection equipment in the beam-tube liners has been fitted with new sensors and the installations trebled to give a 2/3 increase in the efficiency of its safety system (modification is in process). The power-pump groups with rotors submerged in the heavy water circuit have been fitted with sensors and their associated electronics. This will allow operators to follow continuously the wear on the bearings.

Circuits

The operation of all the circuits was satisfactory, with the exception of the auxiliary pumps of the heavy water circuit whose graphite bearings wear out in some cases unusually fast. Studies are in progress to find new ways of adapting new bearings and to improve the balance of the fly-wheel.

During the long shut-down, various checks and overhauls were carried out. We note in particular:

(I) Control of main heat changer by the Foucault Currents Method.

(II) Checks on the motor bearings of the main heavy water circuit pumps.

(III) Complete overhaul of the two Diesel groups. These checks confirmed the good conditions of the equipment.

The most important work to be carried out in this sector in 1981 was:

(I) Repair of the water-tightness of the sheets B 50 and B 22.

(II) Overhaul and repairs to all the equipment for drawing water from the river Drac.

(III) Implantation and beginning of the connection of new tanks for liquid effluents (825 and 474).

(IV) Tests to improve the special bin for the conditioning of the used rests from the D₂O circuit.

7

computing and electronics department

Introduction

The new DEC 1091S Central Computer, replacing the DEC 1070, was delivered in stages between January and October. The initial configuration was started up in February and operated in temporary accommodation until the new building became available in July. The full configuration passed its provisional acceptance tests towards the end of October, enabling the 1070 to be closed down. As had been expected, there were no problems for the users in transferring their programmes, but the Central Computer Service had a very busy year familiarising themselves with the new system, operating old and new machines in parallel, and organising the move to the new building. It is to everyone's credit that the changeover was completed on schedule and with very little inconvenience to the users.

Consequential to the installation of the 1091, a network linking all principal on-site computers is under design.

In the area of instrument control, the systems for the new instruments IN6, IN13, D19A came into routine use during the year. The replacement of CARINE and other first generation ILL systems has continued. Emphasis is being placed on standardisation and the use of commercially available products. Effort is going into providing better graphics facilities. The closed loop motor controller design project has been completed.

The Detector Group is very active, since in addition to the new instruments, many existing instruments are being improved. Multidetectors have recently been installed on D4, D16, D19A, whilst that for D19B is under test, and for D20 under design. Several potentially interesting new detection techniques are under investigation, in collaboration with other laboratories.

The Data Treatment Group came into full operation during the year, with three software engineers covering all types of instrument and most fields of scientific interest.

Einleitung

Der Ersatz der DEC 1070, der neue Zentralrechner 1091S, wurde in mehreren Abschnitten zwischen Januar und Oktober geliefert. Die erste Konfiguration wurde im Februar eingeführt und auf vorläufiger Basis betrieben, bis die neuen Gebäude im Juli bezugsfertig wurden. Die vollständige Konfiguration wurde Ende Oktober erfolgreich den vorläufigen Abnahmeprüfungen unterzogen; damit konnte die DEC 1070 stillgelegt werden.

Wie erwartet verlief der Transfer der User-Programme problemlos, jedoch hatte die Zentralrechnergruppe in diesem Jahr viel zu tun, sich mit dem neuen System vertraut zu machen und nebenbei das alte System weiter zu betreiben, sowie den Umzug in das neue Gebäude zu organisieren. Eine tadellose Zusammenarbeit ermöglichte es, den Wechsel plangemäss und fast ohne Beeinträchtigung des Wissenschafts-Betriebs durchzuführen.

Im Anschluss an die Installation der DEC 1091 wird jetzt am Entwurf für das Verbindungsnetz gearbeitet, an das die hauptsächlich Instrumentenrechner angeschlossen werden sollen.

Auf dem Gebiet der Instrumentensteuerung wurden die Systeme für die neuen Instrumente IN 6, IN 13, D 19 A in den Normalbetrieb übernommen. Der CARINE-Ersatz und der Austausch sonstiger ILL-Systeme der ersten Generation wurde fortgesetzt. Dabei wird auf die Standardisierung und die Nutzung gängiger Komponenten besonders Wert gelegt. Auch werden Anstrengungen unternommen, um die graphischen Ausgabemöglichkeiten zu verbessern.

Der Projektentwurf für einen geschlossenen Regelkreis einer Motorsteuerung ist inzwischen abgeschlossen.

Die Multidetektorengruppe arbeitet sehr aktiv, nicht nur an der Installation neuer, sondern auch an der Verbesserung der bereits vorhandenen Detektoren. An D4, D16, D19A sind seit kurzem Multidetektoren in Betrieb, ein weiterer wird an D19B erprobt, während der für D20 bestimmte Detektor sich noch im Entwurfsstadium befindet. Mehrere vielversprechende neue Zählertechniken werden in Zusammenarbeit mit anderen Forschungslaboratorien untersucht.

Die Gruppe von Datenspezialisten, bestehend aus drei Software-Ingenieuren, die sich mit allen Arten von Instrumenten, und fast allen Gebieten von wissenschaftlichem Interesse beschäftigen, wurde dieses Jahr voll eingesetzt.

Introduction

Le nouvel ordinateur central DEC 1091S, remplaçant le DEC 1070, a été livré par étapes entre janvier et octobre. La configuration initiale a démarré en février et était opérationnelle dans un local provisoire jusqu'à ce que le nouveau bâtiment soit disponible en juillet. Les tests sur la configuration totale, pour l'acceptation provisoire, ont été passés fin octobre, et ont permis d'arrêter l'ordinateur 1070. Comme on le prévoyait, les utilisateurs n'ont pas eu de problèmes pour transférer leurs programmes, mais les membres du Service Calcul Scientifique ont eu une grande charge de travail pour se familiariser avec le nouveau système, mener en parallèle l'exploitation de l'ancienne et de la nouvelle machine, et organiser le déménagement dans le nouveau bâtiment. Les efforts conjugués de tous ont contribué à la réussite de ce transfert, aussi bien dans le respect du planning que pour le minimum de gêne apportée aux utilisateurs.

Suite à l'installation du 1091, un réseau reliant tous les principaux ordinateurs installés sur le site est en cours de conception.

Dans le domaine du contrôle des instruments, le système pour les nouveaux instruments IN6, IN13, D19A est entré en fonctionnement normal au cours de l'année. Le remplacement de CARINE et des autres systèmes de la première génération ILL s'est poursuivi. L'accent est porté sur la standardisation et l'utilisation de produits disponibles sur le marché. Un effort particulier est réservé au développement de meilleures facilités graphiques. Le projet du contrôleur de moteur en boucle fermée a été achevé.

Le groupe Détecteurs est très actif car en plus des nouveaux instruments, beaucoup de ceux existant déjà sont en cours d'amélioration. Des multidétecteurs ont été installés récemment sur D4, D16, D19A, alors que celui pour D19B est soumis aux tests, et celui pour D20 n'est encore qu'au stade des études. Plusieurs nouvelles techniques intéressantes de détection sont examinées, en collaboration avec d'autres laboratoires.

Le groupe Traitement des Données est entré en plein fonctionnement au cours de l'année avec les trois ingénieurs software s'occupant de tous les types d'instruments et de la plupart des domaines d'intérêt scientifique.

instrument control and data acquisition service

This Service is responsible for the construction, improvements and maintenance of instrument control systems, detectors and general electronic equipment.

The year has been marked by:

- Good progress in the programme to replace first generation systems.
- Emphasis on standardisation, and the use of commercially available products wherever possible.
- Improved graphics facilities at the instruments.
- An ever growing interest in position sensitive detectors.

Summary of Computer Control Systems at the end of 1981

In Routine Operation:

CARINE 2: IN2, IN3
PDP 11 network (11/55 concentrator; 11/34 on each instrument). D7, IN4, IN5, PN1.

Free Standing systems:

PDP 11s (various): IN6, IN10, IN11, IN13, D3, D4, D5, D8, D9, D10, D11, D15, D16, D17, D19A.

Plessey Micro 1 or 2: D1A, D2, D18, PN4, S3A.

Solar 16/40: IN12, D1B.

Under development and test:

Solar 16/40: IN1B, IN8B

Under design: IN20, D2B, D19B, D20, PN8.

Modernisation and Standardisation of Computer Systems

The replacement of CARINE moved towards completion with the successful installation of a PDP 11/34 on D5. The rebuilt instruments IN1B and IN8B will restart with Solar 16/40s. Thus at the end of 1981 only IN2 and IN3 remained on CARINE.

Long-serving computers reaching obsolescence have been replaced by PDP 11/34s on D15, D16 and IN10, and by a PDP 11/23 on IN11. D6 has also an 11/23, for data acquisition from the multidetector. Enhanced requirements have led to PDP 11/23s being installed on D4 and PN4.

All the larger PDP 11 systems have now standardised on RSX11M (Version 3.2.) as operating system.

Considerable improvements have been made at PN1, enabling data acquisition in list mode and providing software for energy and mass scans.

Network Studies

As part of the project to link all ILL computers via a modern network, a trial network using 8 PDP 11 computers has been set up to study the characteristics of DECNET Phase 3, the proposed protocol, using RSX11M.

Computers controlling PN2, PN3 (GAMS 1 and GAMS 2/3) and PN4 have been linked in order to share graphics facilities.

Graphics

As the price of graphics terminals continues to fall, and the facilities integrated into the terminals become more sophisticated, it is evident that some investment in this area is one of the most cost-effective ways of helping scientists to inspect their data.

Developments in this area have included:

- Equipping the VT100 terminals with graphics option, and associated programs.
- Introducing the Tektronix 4025 terminal at a number of instruments.
- A colour graphics terminal (DEC VS 11) has been acquired for D19.

In addition, some nuclear physics instruments which generate complex spectra, have been equipped with Benson pen-plotters.

Control Electronics

The replacement of ILL's own CAMAC controllers by commercially available units has continued.

This electronics on D7 has been modernised.

The project for the design of closed loop DC/step motor controllers has been completed, and the first implementations of the DC version are installed and performing satisfactorily.

Computer assisted testing of CAMAC modules is being introduced.

Detectors and Associated Electronics

The detector group is continuing to both improve its standard detectors currently in use, and to keep up with progress on other potentially interesting detection systems.

In respect of individual detectors, the banks of 337 elliptical and 37 cylindrical detectors for IN6 and IN13 respectively are now in routine use.

An area detector (64 × 16 cells) has been installed on D16, whilst those already in use on D2 and D4 have faster electronics.

The 512 × 16 cell detector for D19B is still undergoing modifications and evaluation. The drift principle has been adopted here, as elsewhere, for better spatial resolution.

A prototype (128 cells) for the D20 detector has been designed.

The D1B detector was opened up and cleaned, for the first time since its construction in 1975. The BF₃ gas has been replaced by a ³He/Xe mixture for greater efficiency.

Maintenance

Preventive maintenance and responding to breakdowns occupies much time, but is accepted as an integral part of the Department's obligations. Overall, the availability of systems during 1981 was good, the only serious problem being a fault on the data acquisition of D1B.

The Computer Maintenance Group was responsible for extensive re-cabling in connection with the installation of additional links and terminals for the new Central Computer.

The General Electronics Group, responsible for all portable electronic equipment, carried out comprehensive servicing during the very long reactor shut-down.

central computer service

The year's work was dominated by the installation of the new Central Computer. This is a DEC 1091S, including a KL10E processor, 1 million words (36-bit) of memory, 2300 MBytes of disk storage, 5 magnetic tape units and a communication front-end, including support for up to 64 terminals.

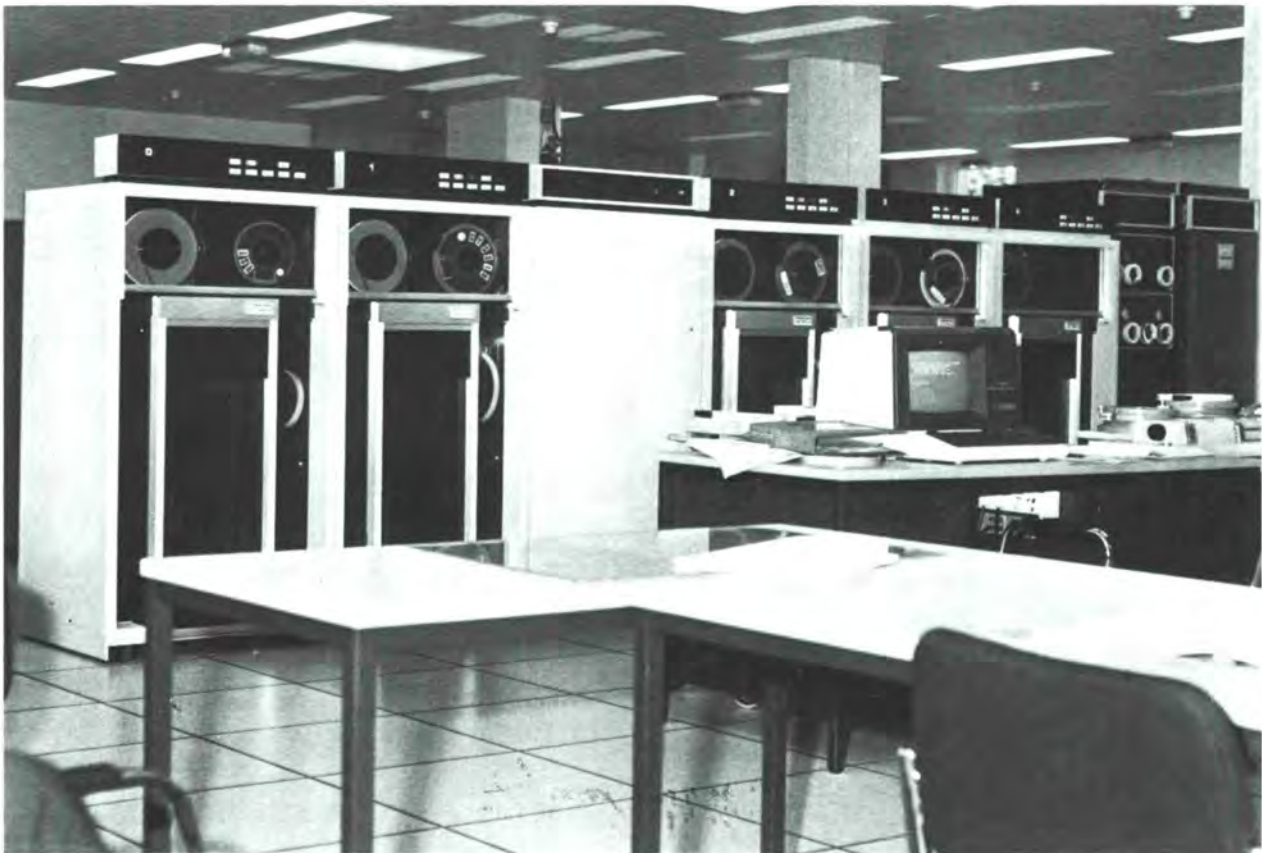
Installation of the 1091

As a result of good collaboration with DEC, the first part of the 1091 was delivered in January, in order to relieve the overload on the 1070. Although the temporary environment was far from ideal, the initial configuration was brought into operation in February with about 12 terminals connected.

In July the computer room in the new building became available. The 1091 was transferred and restarted with an interruption of only two weeks.

The remainder of the System was delivered in September and early October. Installation of these units, together with some being retained from the 1070, was quickly accomplished with little interruption of service. After successfully passing its tests and bench-mark, the 1091 was provisionally accepted on October 23, and the 1070 closed down on October 30.

The whole task of installation, which in addition to the activities described above involved much recabling and associated work, was achieved on schedule and with very little inconvenience to



The new DEC1091 computer installed in its new building.

data treatment group "gratin"

The aid the Department can offer towards treatment of data was greatly enhanced this year with the appointment of extra staff under the Modernisation Programme. It is now possible to assist the full range of scientific activities from Nuclear Physics to Biological Studies, though each engineer in the Data Treatment Group is engaged individually on projects of prime importance. An additional programmer has been engaged and detached from activities in the Central Computer Group to provide technical support.

The Group has been closely involved in the development of programs for analysing multidetector data from single crystal diffractometry. This year a novel algorithm has been realised and extensive comparisons have been made of techniques for rapid data reduction. An initial fully automatic on-line treatment has been provided for D19A equipped with a 64×16 cell area detector.

Automatic alignment routines have been implemented on several diffractometers, and the programs are being extended to both high and low resolution multidetector diffractometer projects.

One member of the Group is assisting the Nuclear Physicists modernise their programs. Primary treatment of GAMS and PN4 data has been improved and implemented on the control computers.

The identification of peaks in γ spectra using complementary data from two spectrometers has been automated and simplified for users. Programs have been rewritten to permit greater transportability enabling easier data treatment away from the Institut without additional program development.

A close involvement with the development of IN6 has led to the implementation of a simple software package in which this large multi-channel instrument has on-line surveillance of the consistency of quality of incoming data. An engineer detached from the Rutherford-Appleton Laboratory has participated in the development of the supporting software.

Other aid to the Inelastic Scattering Groups has been a general improvement and development of initial data reduction programs. The computing systems for the small angle scattering instruments, D11 and D17, were extensively modified; again the Data Treatment Group supported these changes, defining new standardised data formats, and creating new utility programs.

General facilities developed this year include a self-service catalogue for Users Programs, which allows physicists to interrogate and update a simple catalogue of existing programs classified principally by instrument technique; a simple plotting package has been developed which eases programming for the several different terminals and high grade plotters.

users. This was despite the fact that the staff involved had simultaneously to organise their own move to the new building.

DEC 1070 and 1091 Operations

During the period when the two machines ran in parallel, groups of users were switched over to the new machine on the basis of their need for computing power (e.g. crystallographers and nuclear physicists). However all instrument data continued to arrive at the 1070, which necessitated a link being set up between the two machines.

The only critical difference between the old and new hardware was a change in magnetic tape density from 800 b.p.i. to 1600/6250 b.p.i. As a result, the complete magnetic tape library is having to be transcribed, a task which will not be completed until early 1982.

Even before all users had been switched over, the KL10 processor was recording up to 80 % utilisation during peak hours. However, by relegating batch work to off-peak periods there should be no difficulty in providing a rapid response to the interactive terminals (of which about 35 will be available to scientists).

The running of the two machines in parallel placed considerable strain on the operations team, but they were much helped by the fact that there was almost complete software compatibility between the machines, and the vast majority of users encountered no difficulty in changing over.

System Programming

Whilst for the users the two machines seemed identical, a considerable amount of system programming has been necessary, to take account of the new devices, features in the operating system which are being invoked for the first time, and to handle various new graphics units.

The links bringing data from the instruments have provisionally been connected using the old protocol. The installation and verification of these links was achieved without too many problems.

Network Project

The Service has been actively involved in the design of the new computer network which will link all the instrument computers to the Central Computer. The 3 PDP 11/24s which will act as line concentrators were ordered in September.

Other Activities

The service of advice and assistance to users was maintained throughout the year, despite the other urgent tasks.

Support was provided to the Administration Department for their package handling travel expenses and training, which run on the 1091.

In the area of mathematical support a package to carry out algebraic manipulation (REDUCE) has been installed, and publicised by means of a seminar in June. The maintenance and expansion of mathematical subroutine libraries has continued.

Advantage was taken of the training credits available with the new computer, to send several of the programmers and operators on DEC training courses. In-house training was also provided.

8

administration

Einleitung

Die Verwaltungs- und Finanzabteilung liefert den verwaltungstechnischen Unterbau für den wissenschaftlichen Betrieb des Instituts. Sie stellt sicher, dass die von den Gesellschaftern zur Verfügung gestellten Mittel sachgemäss und den Regeln entsprechend genutzt werden, ohne dabei die notwendige Anpassungsfähigkeit zu verlieren, die der kreativen Forschung unerlässlich ist. Die Abteilung bereitet das jährliche Budget zur Genehmigung durch die Gesellschafter vor, sorgt dafür, dass sich die Ausgaben im Rahmen des genehmigten Wirtschaftsplans halten, stellt das Sekretariat des Lenkungsausschusses und dessen Unterausschüsse, ist für den Einkauf der für das Forschungsprogramm benötigten Materialien und Geräte zuständig, organisiert die Einstellung von Personal und verhandelt mit den Gewerkschaften.

Die Abteilung ist in drei Bereiche aufgeteilt: Personal, Finanzen (inklusive Einkauf) und Soziales ('relations sociales').

Zentral verwaltet wird der Sanitätsdienst und der Betriebsarzt, der Sprachendienst und das Sekretariat des Lenkungsausschusses.

Grössere, die Verwaltung betreffende Veränderungen waren im Jahr 1981 nicht zu verzeichnen. Gegen Ende des Jahres jedoch wurden die Verhandlungen zur Verlängerung des Firmentarifvertrages aufgenommen, wobei insbesondere die Arbeitsbedingungen des ILL — Personals und das Statut von Leihpersonal am ILL zur Debatte stehen.

Introduction

The Administration and Finance Department provides administrative support for the scientific life of the Institut. It is responsible for ensuring that the resources provided by the associates are used properly according to the regulations, but with the flexibility that creative research requires. The Department prepares the annual budget for the associates' approval, ensures that expenditure is kept within this budget, provides the Secretariat for the Steering Committee and its subcommittees, purchases the equipment and materials needed for the research programme, organises the recruitment of staff, and negotiates with the trade unions.

The Department is organized in three divisions: personnel, finance (including the purchasing group), and welfare ('relations sociales').

There is also a central group including the medical service, the translation office, and the secretariat of the Steering Committee.

There were no major administrative changes within ILL during the year 1981. At the end of the year, however, negotiations were beginning on the renewal of the collective agreement on conditions of service at ILL, and on the position of staff employed at ILL under contracts with outside firms.

Introduction

Le Département Administratif et Financier procure le support administratif à la vie scientifique de l'Institut. Il a pour responsabilité d'assurer que les ressources financières mises à disposition par les Associés sont utilisées à bon escient, conformément au règlement, mais avec toute la souplesse que la recherche créative nécessite. Le Département prépare le budget annuel et le soumet à l'approbation des Associés, assure que les dépenses sont maintenues à l'intérieur des limites de ce budget, fournit le Secrétariat pour le Comité de Direction et ses sous-comités, procède aux achats d'équipement et de matériel nécessaires pour le programme de recherche, organise le recrutement du personnel et négocie avec les syndicats.

Le Département se compose de trois secteurs: le Service du Personnel, le Service Financier et Achats et le Service Relations Sociales.

Il y a également un groupe central comportant un service médical, le bureau de traduction et le Secrétariat du Comité de Direction.

L'année 1981 n'a pas vu de changement majeur au niveau de l'Administration ILL. Cependant, à la fin de l'année, des négociations ont été commencées concernant le renouvellement de la Convention d'Entreprise au sujet des conditions de travail, et sur la situation des personnels employés à l'ILL par l'intermédiaire de contrats avec des entreprises extérieures.

personnel

The Personnel section is responsible for recruitment, salaries and staff management. It also deals with correspondence with the Social Security and the administrative work for the "Société Mutualiste" for ILL staff.

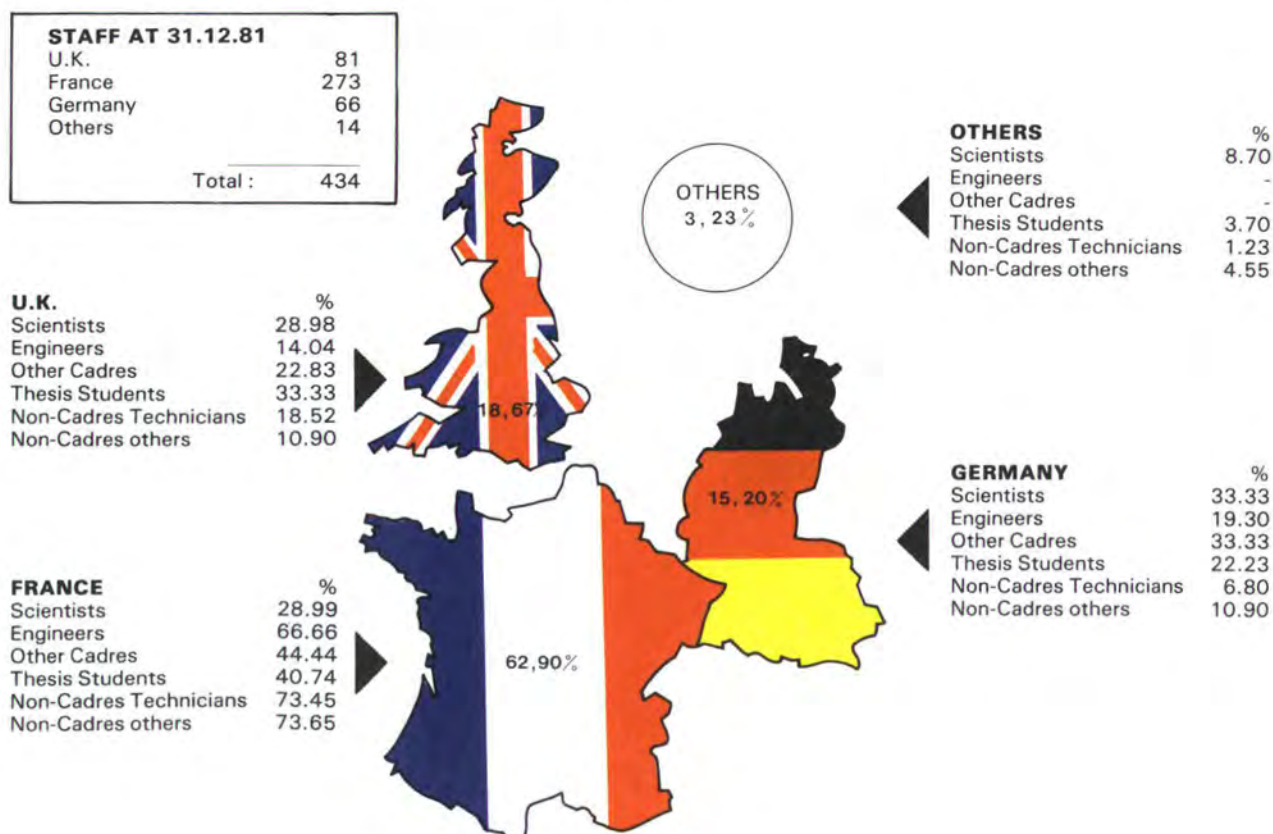
Staff

Table 11 below shows the fluctuation of staff in 1981. It may be noted that as always this fluctuation is considerable among the scientific staff.

Table 11: Staff changes in 1981. In addition 15 persons were detached to the ILL under the modernization programme.

| Categories | Position on 31.12.80 | Changes in 1981 | | Difference + or - | Position on 31.12.81 | Change % column 4 compared with column 2 |
|--------------------|----------------------|-----------------|------------|-------------------|----------------------|--|
| | | Recruitment | Departures | | | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| 1. Scientists | 74 | 16 | 18 | - 2 | 72 | 24.32 |
| 2. Engineers | 51 | 3 | - | + 3 | 54 | - |
| 3. Other "Cadres" | 9 | - | - | - | 9 | - |
| 4. Thesis students | 28 | 9 | 10 | - 1 | 27 | 35.71 |
| 5. Technicians | 155 | 15 | 8 | + 7 | 162 | 5.16 |
| 6. Others | 105 | 7 | 2 | + 5 | 110 | 1.90 |
| Total | 422 | 50 | 38 | + 12 | 434 | 9 % |

Table 12: Breakdown of staff by nationality and by category



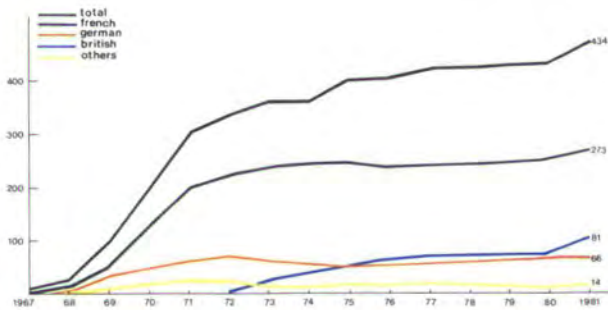


Fig. 23: the changes in staff by nationality from 1967 (foundation of the ILL) until 1981.

Salaries

The ILL continues to apply the measures implemented by the CEA. The changes resulting from general salary increases in 1981 resulted in a total of 13.3 %. In addition a cost of living pay-

ment of 108 F per month was paid to all staff in post in October 1981, for the period 1.1.81 to 30.9.81.

Average Age



Fig. 24: the average age of staff at 31.12.81. In 1980 this average was 36.6 for men and 35.2 for women.

Absenteeism

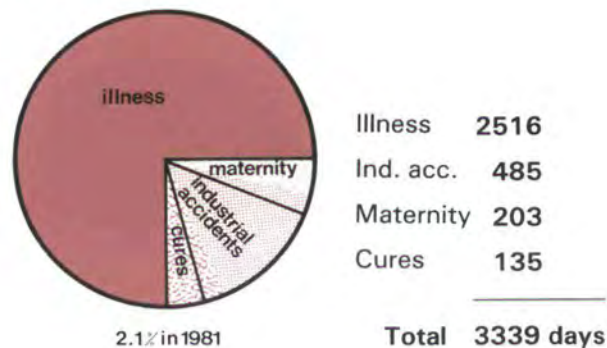


Fig. 25: absences representing 2.1% of the number of calendar days.

The Welfare Section ("Relations Sociales") deals with the reception of staff and guest scientists, administrative aspects of the medical-social group, training, travel and general services.

Reception

As regards reception of staff, the Welfare Group assists in particular in looking for accommodation for new arrivals and arranging for the children of non-French staff to attend the "Houille Blanche" international primary school.

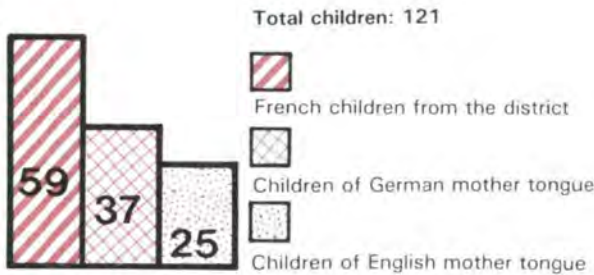


Fig. 26: the breakdown of the children attending the "Houille Blanche" international school on 28 September 1981 (beginning of the school year).

Training

As in previous years the Welfare/Training Group received a considerable number of applications for training for the year 1981/82 (191 by 1.12.81). Of these requests 73 % were accepted and 14 % are under discussion. (see fig. 27).

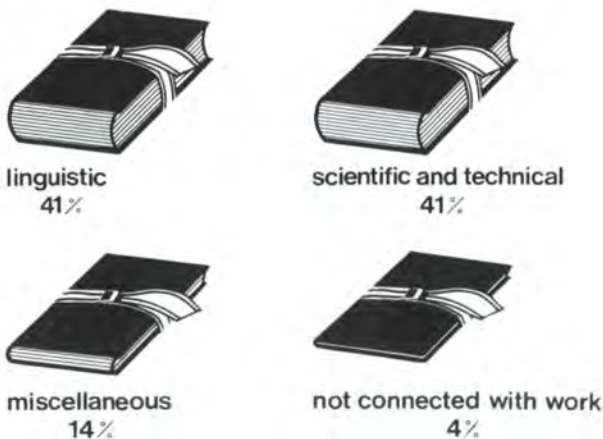


Fig. 27: breakdown of training applications.

Guest Scientists

During 1981 a total of 1 624 visits were made to the ILL. This number includes visits for:

- Reactor use,
- Scientific Council participation,
- Workshops,
- Seminars,
- Sabbaticals.

In comparison to 1980, when a total of 1 750 visits were made, this year's figure shows a small reduction of 7.2 %, which was mainly due to the long reactor shut-down of slightly more than 3 months in Spring. (see fig. 28).



All visitors to the Institut are initially received by Mesdames Gontier and Alexandre one of whom (Mme Vera Gontier) is shown above at the reception desk.

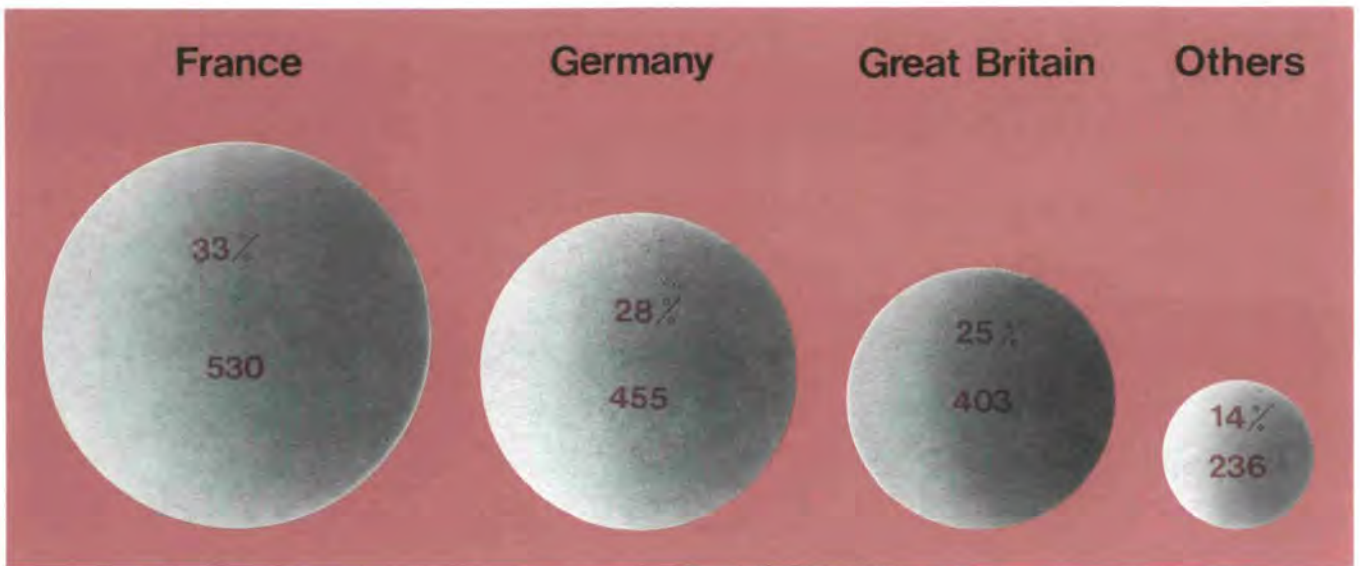


Fig. 28: breakdown of guest scientists by nationality.

Medical Group

The ILL has a half-time work's doctor and a full-time nurse. In addition to medical examinations of staff and long-term guest scientists, the doctor investigates conditions at places of work in collaboration with the department heads and takes an active part in the meetings of the Committee on Health and Safety (CHS).

Welfare Assistant

The Welfare assistant (assistante sociale) is at ILL three times a week. She attends various sub-committees of the works committee (Comité d'entreprise) on financial assistance, holidays, etc.) enrolls the children of staff at holiday centres, deals with all contacts with the Family Allowances Centre and with various welfare organisations in Grenoble and the Isère Department.

Budget and accounts

Introduction

The normal budget of the ILL was under heavy pressure, principally because of the rapid inflation in France (approximately 15 % during 1981). On the other hand, because of lack of manpower and some delays in delivery, certain parts of the modernisation programme were not progressing as fast as had been planned, and some expenditure therefore had to be postponed to the years 1983-85. The computerised accounts system operated successfully.

The new buildings were completed to schedule, the computer building was occupied in August and the new central computer started operation. Reception of the biology building took place on 30 October 1981 and was available for the scientists in December 1981.

The Modernisation Programme Budget

The 1981 phase of the modernisation programme amounted to 35.3 million Francs, including 3.4 million Francs covered by the ILL's own income. The Associates' contributions were 31.9 million Francs (excluding taxes). (see fig. 29).

The expenditure on the 1981 phase of the modernisation programme was as follows:

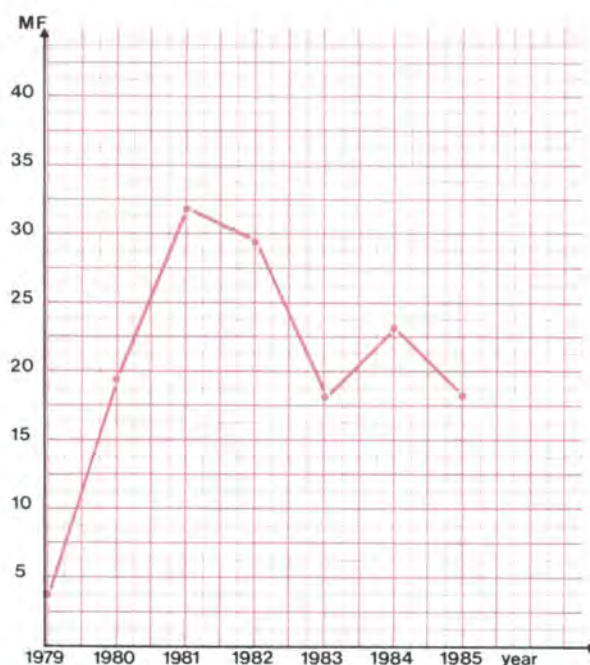


Fig 29: the Modernisation Programme

Table 13: 1981 budget for the modernization programme (excluding taxes)

| | 1981 (1 000 F) | % of total |
|--|-------------------|---------------|
| a) Operation | | |
| Consumable materials and small equipment | 417 | 1.3 |
| Staff costs | 1 989 | 6.2 |
| Long-term service and supply contracts | 667 | 2.2 |
| Other work, supplies and services from third parties | 4 023 | 12.6 |
| Transport, removal and travel expenses | 231 | 0.7 |
| Miscellaneous administrative costs | 346 | 1.1 |
| Total operation expenditure | 7 673 | 24.1 |
| ILL's own income | -3 398 | -10.7 |
| Total operation | 4 275 | 13.4 |
| b) Investments | | |
| Buildings | 7 151 | 22.4 |
| Experimental instruments | 15 326 | 48.1 |
| Other investments | 5 128 | 16.1 |
| Total investments | 27 605 | 86.6 |
| Total expenditure | 31 880 | 100.0 |

Normal Budget

For 1981 the normal budget provided for a total expenditure amounting to 158.6 MF, of which 5.4 million Francs were to be covered by the ILL's own income and 153.2 MF by the Associates.

In comparison with the preceding year, the operation expenditure increased from 122.5 to 142.0 MF (15.9 %, an increase partly financed by reducing the investment budget), to cover the expenditure due to an extended three-month shutdown of the reactor and the effects of inflation in France and of the considerable increase in the rate of exchange for the US Dollar.

As a result, certain items of the budget have been augmented, such as FUEL ELEMENTS, ENERGY AND FLUIDS, STAFF COSTS.

The investment budget, which had been maintained at a constant real level in 1980, was reduced in 1981 to augment the reactor operating budget for the reasons indicated above.

Additional ILL's own income resulting from the increase in bank interest rates enabled the ILL to cope with inflation.

According to the provisional annual accounts for 1981, the normal budget expenditure situation in comparison with 1980 was as follows (excluding taxes):

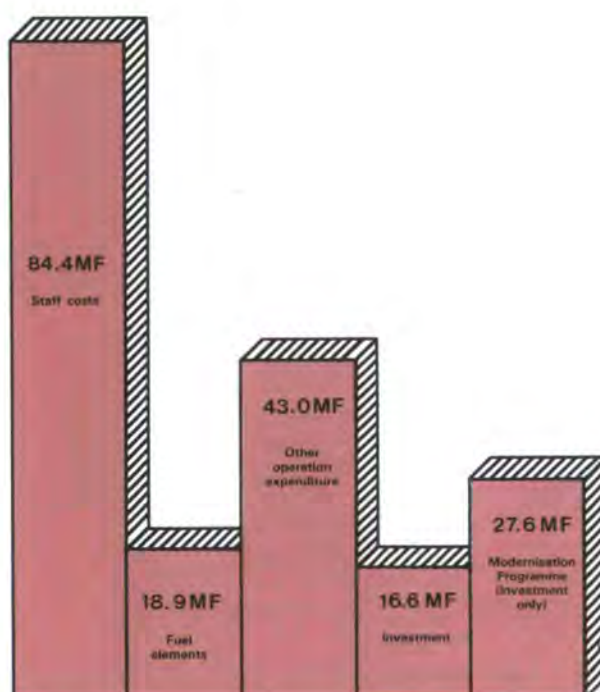


Fig 30: total budget 1981: 190.5 MF

Table 14: Normal Budget - Comparison of expenditures in 1981 and 1980

| | 1980 (× 1000 F) | % of total | 1981 (× 1 000 F) | % of total |
|--|--------------------|---------------|---------------------|---------------|
| a) Operation | | | | |
| Consumable materials | 9 015 | 6.5 | 11 554 | 7.3 |
| Fuel elements | 17 498 | 12.7 | 18 957 | 11.9 |
| Staff costs | 72 061 | 52.3 | 82 376 | 51.9 |
| Taxes | 294 | 0.2 | 450 | 0.3 |
| Long-term service and supply contracts | 11 561 | 8.4 | 13 108 | 8.3 |
| Other work, supplies and services from third parties | 7 145 | 5.2 | 10 373 | 6.5 |
| Transport, removal and travel expenses | 1 048 | 0.8 | 1 130 | 0.7 |
| Miscellaneous administrative costs | 3 928 | 2.8 | 4 102 | 2.6 |
| Total operation | 122 550 | 88.9 | 142 050 | 89.5 |
| b) Investments | | | | |
| Buildings | 336 | 0.2 | 421 | 0.3 |
| Equipment (except experimental instruments) | 2 203 | 1.6 | 3 167 | 2.0 |
| Experimental instruments | 9 971 | 7.2 | 10 066 | 6.3 |
| Other investments | 2 790 | 2.1 | 2 929 | 1.8 |
| Total investments | 15 300 | 11.1 | 16 583 | 10.4 |
| Total expenditure | 137 850 | 100.0 | 158 633 | 100.0 |
| c) Income | | | | |
| ILL's own income | 3 210 | 2.3 | 5 400 | 3.4 |
| Grants from Associates | 134 640 | 97.7 | 153 233 | 96.6 |
| Total income | 137 850 | 100.0 | 158 633 | 100.0 |

Implementation of the Budget (1967-1981) and Outlook for 1982-1985 (1982 Francs)

The graph of the implementation of the ILL budget from its foundation (1967) shows the various phases of the Institut's development (see fig. 31).

From 1967 to 1971 there was the construction phase for the buildings, the reactor and its associated installations, leading up to the reactor going critical in December 1971, which was followed by normal operation from 1972 to 1979. In 1979 the ILL's Associates decided to implement the aims of the modernisation programme under a financial plan for the period until 1985.

The changes in the total budget as shown in "constant Francs-1967 basis" shows the increasing difficulties faced by the ILL in keeping the effects of inflation within the limits of its budget.

In 1981 the financial situation of the ILL was particularly difficult, in the light of inflationary trends in France, considerable increases in the rate of exchange for the US Dollar and their immediate effects on the fuel element budget. The inflation rate is expected to be more than 14 % in 1981.

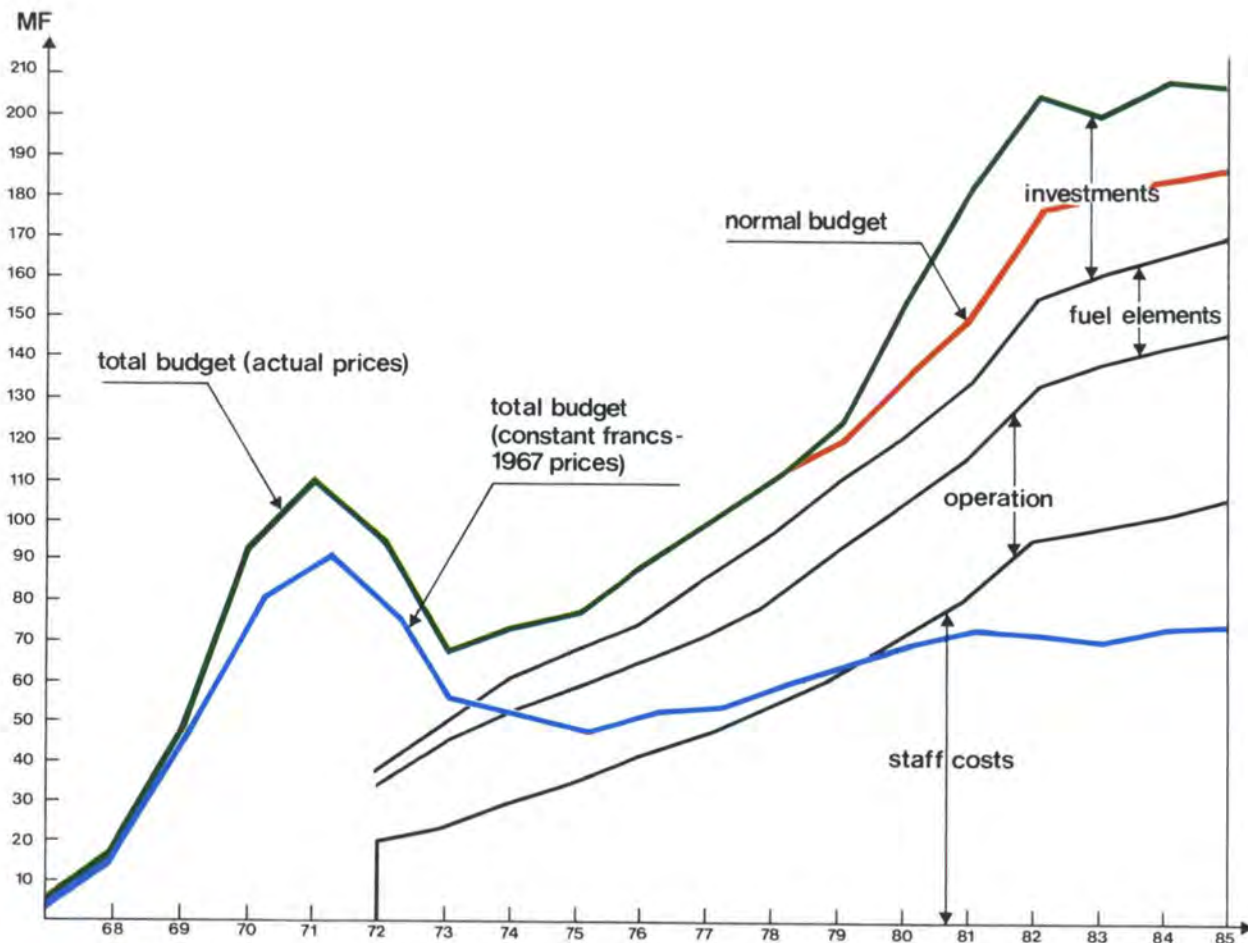


Fig. 31: Implementation of the budget (actual expenditure 1979-1981/forecast 1982-1985).

Purchasing

Efforts to consolidate last year's more even distribution of orders within the three member countries continued in 1981.

Total value of orders placed in U.K. in 1981 increased to 6.76 Million Francs, against 5.08 MF in 1980 (+ 33 %) and 2.03 MF in 1979; whilst purchases in Germany increased to 12.87 (including 8.6 MF fuel elements), against 6.77 MF in 1980 (+ 90 %) and 9.74 MF in 1979.

Furthermore, if one considers only purchases for which a real choice of supplier was possible, the statistics are the following.

In practice, however, only about 30 % of the orders are really open to international tendering.

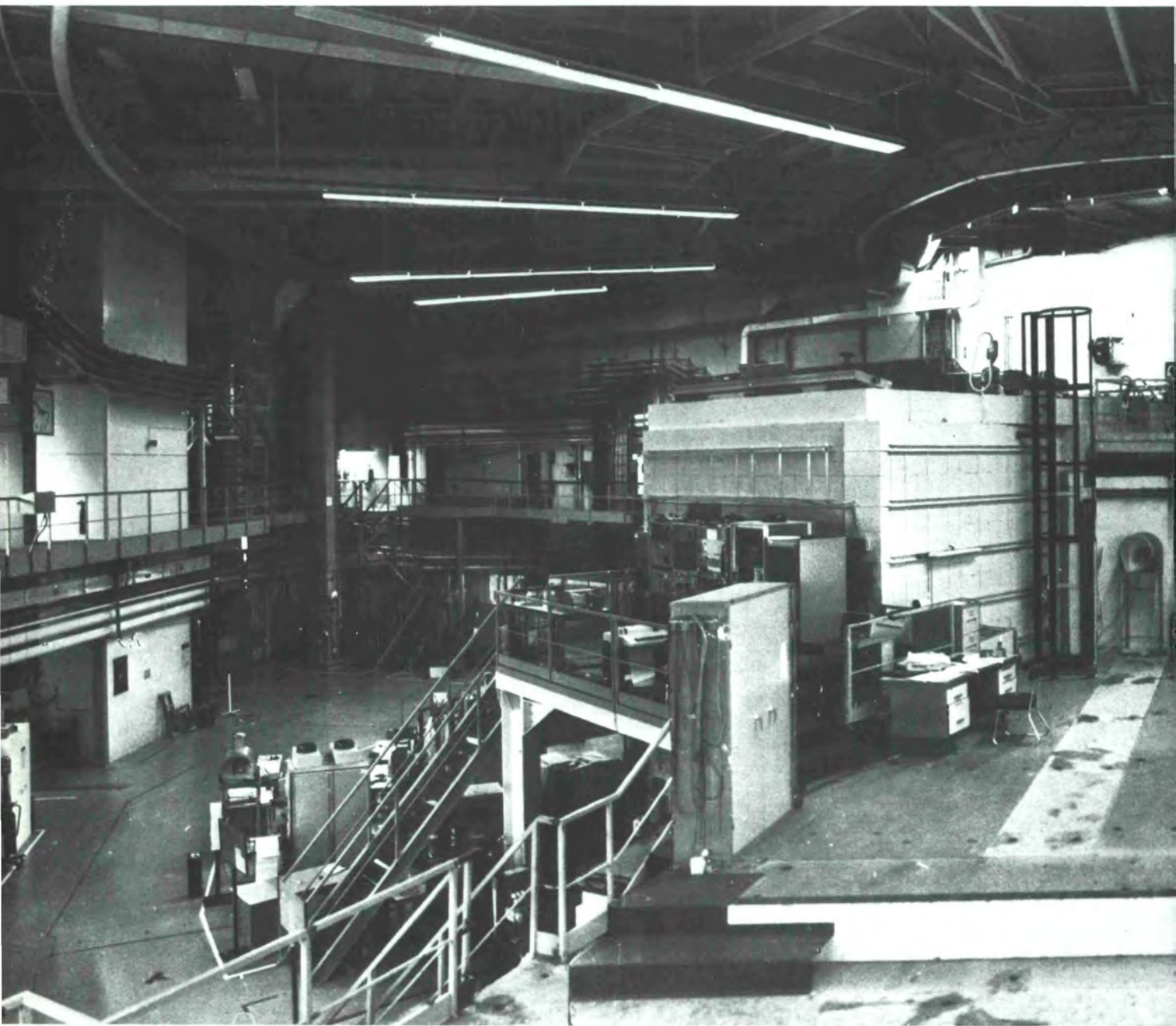
On large projects, the early involvement of the Purchasing Group allows the Institut to better identify potential sources through preliminary visits to suppliers, leading to a higher proportion of these large orders being won by British or German firms. Thus, excluding the fuel cycle, out of 6 orders valued above 350 000 F (and totalling 5.9 MF) 3 went to British suppliers (totalling 1.9 MF) and 1 to a German firm (0.9 MF).

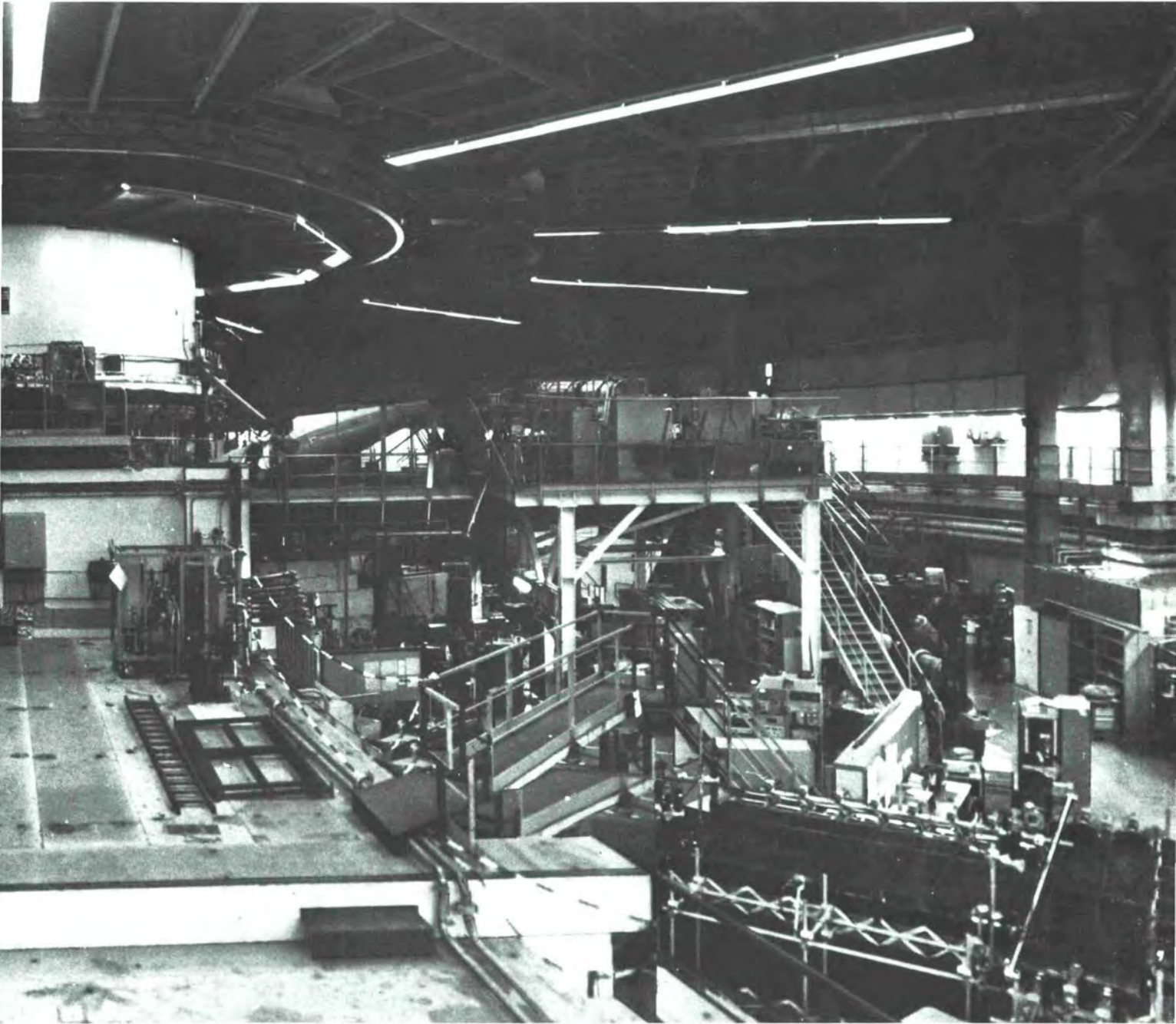
Table 15: Distribution of orders in 1981

| | Total | France | Germany | U.K. | Others |
|----------|--------|--------|---------|--------|--------|
| In Mio F | 25.453 | 12.420 | 3.687 | 5.713 | 3.683 |
| in % | 100 % | 48.8 % | 14.5 % | 22.4 % | 14.5 % |

Origin of proposals submitted to the ILL during 1981







A view of the HFR hall.



miscellaneous

experiments carried out at the i.l.l.

The following is the list of the experiments performed at the ILL in 1981 for which experimental reports were received before January 10, 1982. (It also includes some reports submitted in 1981 for experiments performed previously.)

Please refer to the Annex of the Annual Report 1981 for a detailed study of the results.

(* Reports marked with an asterisk are not available for publication.)

COLLEGE 3 (Fundamental and Nuclear Physics)

| | | | | | |
|-----------|---|------|------------|--|----------|
| 03 01 101 | Nuclear charge distribution of heavy mass fission products at various kinetic energies and ionic charge states. [Chains 142, 146, and 147 in ^{235}U (n_{th} , f)]. B. Sohnius, H. Braun, H.O. Denschlag, W. Pörsch, R. Sehr (Mainz) H.R. Faust (ILL) | PN1 | 03 01 121* | Energy calibration for surface barrier detectors in fission studies. E. Weissenberg, P. Geltenbort (Tübingen) F. Gönnerwein, A. Oed (ILL) | PN1 |
| 03 01 103 | Fragment kinetic energy distribution in symmetric mass region for thermal fission of ^{239}Pu . J.P. Bocquet, H. Nifenecker, C. Ristori (CEN-G) M. Mütterer, J.P. Theobald, C. Schmitt, H.G. Clerc (Darmstadt) D. Engelhardt (Karlsruhe) R. Brissot, H.R. Faust, F. Gönnerwein (ILL) | PN1 | 03 01 124 | Level scheme of ^{129}Sb . F. Schussler, E. Monnard, J.A. Pinston (CEN-G) H. Lawin (Jülich) B. Pfeiffer (ILL) U. Keyser (Braunschweig) | PN1 |
| 03 01 108 | Study of time-of-flight systems for fission fragments. P. Geltenbort (Tübingen) G. Barreau, F. Gönnerwein, A. Oed (ILL) P. Perrin, C. Ristori (CEN-G) | PN1 | 03 11 066 | Precise energy calibration of Lohengrin. H.R. Faust, F. Gönnerwein, A. Oed (ILL) P. Geltenbort (Tübingen) | PN1 |
| 03 01 110 | Energy calibration for surface barrier detectors in fission studies. E. Weissenberger, P. Geltenbort (Tübingen) F. Gönnerwein, A. Oed (ILL) | PN1 | 03 02 008 | Level structure of the transitional ^{153}Gd nucleus. | PN3, PN4 |
| 03 01 112 | Nuclear charge distribution for thermal neutron induced fission of $^{239}\text{Plutonium}$. J.P. Bocquet, A. Guessous, H. Nifenecker, C. Ristori (CEN-G), M. Mütterer, J.P. Theobald, C. Schmitt, H.G. Clerc (Darmstadt), D. Engelhardt (Karlsruhe) R. Brissot, H.R. Faust, F. Gönnerwein (ILL) | PN1 | 03 02 052 | G. Vandenput, P.H.M. Van Assche (Mol) H.G. Börner, D.D. Warner, W.F. Davidson (ILL) | |
| 03 01 115 | Nuclear charge distribution and isomeric yields at various kinetic energies of the fragments in ^{235}U (n_{th} , f). (Chains A = 130 and A = 131) W. Pörsch, H. Braun, H.O. Denschlag, W. Ditz, W. Faubel, B. Sohnius (Mainz) H.R. Faust (ILL) | PN1 | 03 02 120 | The reaction $^{35}\text{Cl}(n,\gamma)^{36}\text{Cl}$ as a calibration standard. | PN3 |
| 03 01 119 | $Q\beta^-$ -measurements of light fission products in the mass region A = 100 using the mass separator Lohengrin. F. Münnich, U. Keyser, H. Berg, M. Graefenstedt, B. Pahlmann (Braunschweig) H.R. Faust, B. Pfeiffer (ILL) H. Weikard (Braunschweig and ILL) | PN 1 | 03 02 139 | H. Daniel, T. von Egidy (München) G. Barreau, H.G. Börner (ILL) C. Hofmeyr (Pelindaba and ILL) B. Krusche, K.P. Lieb (Göttingen) | |
| | | | 03 02 151 | Study of EO transitions from K = 0 bands in ^{188}Os and ^{196}Pt . W.R. Kane, R.F. Casten, D.D. Warner (Brookhaven) K. Schreckenbach, H.R. Faust, S. Blakeway (ILL) | PN2 |
| | | | 03 02 158 | Detailed study of the ^{28}Al level structure by means of the $^{27}\text{Al}(n,\gamma)$ reaction. H. Daniel, T. von Egidy, P. Hungerford, H.H. Schmidt, K.P. Lieb (München) "GAMS Team" (ILL) | PN3 |
| | | | 03 02 161 | Search for dynamical supersymmetries in the level structure of ^{131}Ba and ^{133}Ba . R.F. Casten, D.D. Warner, W.R. Kane (Brookhaven) H.G. Börner, G. Barreau, R. Brissot, S. Kerr (ILL) | PN3, PN4 |
| | | | 03 02 183 | Nuclear levels in ^{242}Am . J. Kern, M. Gasser, J.-L. Salicio (Freiburg) H.G. Börner (ILL) | PN3 |
| | | | 03 02 184 | Photonuclear interaction below the neutron emission threshold studied with γ -rays from the $^{141}\text{Pr}(n,\gamma)$ reaction. M. Schumacher, P. Rullhusen, F. Smend, W. Mückenheim, U. Zurmühl (Göttingen) | PN3 |

| | | | | | |
|------------------------|--|----------|------------------------|--|------------|
| 03 02 185 | Relative measurement of the β spectral shape in neutron induced fission of ^{235}U and ^{239}Pu . H.R. Faust, A.A. Hahn, F. von Feilitzsch, K. Hawerkamp, K. Schreckenbach, J.L. Vuilleumier (ILL) | PN2 | 03 06 006 03 06 007 | $Q\beta$ -measurements with a magnetic-sector-field and a new Ge(HP)-detector. F. Blönnigen, H. Wollnik, G. Jung, E. Koglin, B. Pfeiffer (ILL) C. Geisse (Giessen) | PN6 |
| 03 02 193 | Determination of the partial neutron cross-section to the ^{116}Ir ground state. K. Schreckenbach (ILL) | PN2 | 03 06 008 | Level scheme of ^{97}Sr . E. Monnard, J.A. Pinston, F. Schussler (CEN-G) B. Pfeiffer, G. Jung (ILL) | PN6 |
| 03 02 195 | A study of the $^{23}\text{Na}(n,\gamma)^{24}\text{Na}$ and $^{19}\text{F}(n,\gamma)^{20}\text{F}$ reactions. P. Hungerford, H.H. Schmidt, T. von Egidy (München) G. Barreau, H.G. Börner, S. Kerr, E. Monnard (ILL) | PN3, PN4 | 03 06 011 03 06 012 | See 03 06 004 $Q\beta$ -measurements of neutron-rich Cs isotopes using the mass separator OSTIS. F. Münnich, M. Graefenstedt, U. Keyser, B. Pahlmann (Braunschweig) B. Pfeiffer (ILL) H. Weikard (Braunschweig and ILL) | PN6 |
| 03 02 200 | Investigation of Coulomb corrections to Delbrück scattering in the energy range 8-11 MeV. M. Schumacher, F. Smend, P. Rullhusen, U. Zurmühl (Göttingen), S. Kerr (ILL) | PN3, PN4 | 03 06 015 | Measurements of diffusion times for Rb, Cs, Sr and Ba in the high temperature ion source of OSTIS. J. Münzel, G. Jung, U. Stöhlker (Giessen) H. Wollnik, B. Pfeiffer, E. Koglin (ILL) | PN6 |
| 03 02 203 | Efficiency calibration of the PN4 pair spectrometer. S.A. Kerr, E. Monnard (ILL) | PN4 | 03 06 018* | Level structure of ^{154}Sm . W.D. Hamilton, S. Robinson, M. Snelling (Sussex) B. Pfeiffer (ILL) | PN6 |
| 03 03 008 | The electric dipole moment of the neutron. K. Smith (Sussex) N.F. Ramsey (Harvard) | PN5 | 03 07 001 | Parity non-conserving neutron spin-rotation: Pb and Be. B. Heckel, N.F. Ramsey (Harvard) O. Schärpf, R. Gähler (ILL) K. Green, G. Greene (Rutherford) M. Forte (Ispra) | PN7 |
| 03 03 156 | Response function measurements of a Ge (HP) detector. F. Blönnigen, H. Wollnik, G. Jung, B. Pfeiffer, K. Schreckenbach (ILL) C. Geisse (Giessen) | PN2 | 03 12 001 03 12 001 | Fragment energy correlation measurements (^{238}Pu). M. Asghar, G. Barreau (ILL) F. Caitucoli, B. Leroux (Bordeaux) P. Perrin, M. Maurel (CEN-G) Fragment energy correlation measurements (^{229}Th). M. Asghar, G. Barreau (ILL) F. Caitucoli, B. Leroux (Bordeaux) P. Perrin, M. Maurel (CEN-G) | IH1 IH1 |
| 03 03 187 | Beta-spectrum of ^{235}U -fission products. K. Hawerkamp (ILL) U. Keyser, F. Münnich (Braunschweig) | H22E | 03 12 004 03 05 027 | A search for neutron-antineutron transitions using free neutrons. M. Baldo-Ceolin, G. Fidecaro (Geneva) K. Green (Rutherford) | H18 |
| 03 05 003 | Parity non-conserving neutron spin rotation: bismuth. B. Heckel, N.F. Ramsey (Harvard) M. Forte (Ispra) K. Green, G. Green (Rutherford) | PN7 | 03 13 008* | Magnetic moments of excited states populated by neutron capture. W.D. Hamilton (Sussex) D.M. Snelling (ILL) | H22F |
| 03 05 027 | See 03 12 004 | | 03 13 013 | Multiparameter measurement of light charged particle accompanied fission. J.P. Theobald, M. Mütterer, H. Hoffmann, Weingärtner (Darmstadt) B. Leroux, G. Barreau, N. Carjan, T.P. Doan, A. Sicre (Bordeaux) F. Gönnerwein, J. Pannicke (ILL) | H22E |
| 03 06 002 | Gamma ray measurements on neutron-rich isotopes in the mass chains $A = 100$ and $A = 148$. B. Pfeiffer, E. Koglin, G. Jung (ILL) E. Monnard (CEN-G) J. Münzel (Giessen) | PN6 | 03 13 020 | On-line measurement of the neutron flux by means of a black cobalt absorber. K. Schreckenbach, J. Chauvin, P. Liaud (ILL) P. De Saintignon (ISN) | H22F |
| 03 06 003 | Conversion electron and life-time measurements on neutron-rich isotopes in the mass chain $A = 147$. F. Schussler, E. Monnard, J.A. Pinston (CEN-G) B. Pfeiffer (ILL) H. Lawin (Jülich) J. Münzel (Giessen) | PN6 | 03 13 021 | Instrumental neutron activation analysis of French alpine granites. R.A. Oliver, S.A. Kerr (ILL) | PN4, S34 |
| 03 06 004 03 06 011 | $Q\beta$ -measurements of the 99, 100 Rb and Sr isotopes using the mass separator OSTIS. F. Münnich, U. Keyser, B. Pahlmann, M. Graefenstedt (Braunschweig) B. Pfeiffer (ILL) H. Weikard (Braunschweig and ILL) | PN6 | 03 13 027 03 13 003 | Systematic study of (n, α) and (n, f) reactions. C. Wagemans, P. D'Hondt, Allaert, de Clercq (Mol) G. Barreau, R. Brissot (ILL) A. Emsallem (Lyon) | H22D |
| 03 06 005 | Neutron-gamma angular correlations in β^- -delayed neutron decay of neutron-rich Rb and Cs isotopes. K.L. Kratz, M. Kronenburg, Gabelmann (Mainz) G. Crawford (Glasgow) L.J. Alquist, G. Jung (ILL and Giessen) | PN6 | | | |

COLLEGE 4 (Inelastic Scattering in Simple solids)

| | | | | | |
|-----------|--|----------|-----------|--|------|
| 04 01 168 | Temperature dependence of the elastic constants of Nb ₃ Al. | IN4 | 04 02 144 | Phonon modes at the martensitic transformation of AuCuZn ₂ . | IN2 |
| 04 02 124 | H. Härdle, W. Reichardt (Karlsruhe) J.B. Suck (ILL) | | | R.A. Robinson, G.L. Squires (Cambridge) R. Pynn (ILL) | |
| 04 01 177 | Phonons in the perovskite type layer material K ₂ ZnF ₄ . | IN3 | 04 02 145 | Study of premartensitic phonon dispersion anomalies in Cu-Zn-Al alloy. | IN2 |
| 04 01 197 | R. Geick, H. Rauh (Würzburg) N. Lehner, J. Bouillot (ILL) | | | G. Guenin, D. Rios Jara, P.F. Gobin (Lyon) L. Delaey (Leuven) | |
| 04 01 198 | Investigation of optical phonons in the mixed crystal K ₅ Rb ₅ I. | IN3 | 04 02 150 | Li-diffusion and modulated structure in the 1-D superionic conductor β-eucryptite (LiAlSiO ₄). | IN12 |
| 04 01 198 | B. Renker (ILL) | | | H. Böhm (Münster) H. Grimm, W. Press (Jülich) N. Lehner, B. Renker (ILL) G. Heger (Karlsruhe) | |
| 04 01 202 | Phonons in graphite intercalated with bromine. | IN8 | 04 02 156 | Pressure and temperature dependence of the 2k _F -lattice distortion in KCP. | IN3 |
| | I. Rosenman, F. Batallan, C. Simon (Paris) H.J. Lauter (ILL) | | | R. Comes (Orsay) L. Bernard, B. Renker, C. Vettier (ILL) P. Schweiss (Karlsruhe) | |
| 04 01 202 | Phonon dispersion in anhydrite (CaSO ₄). | IN3 | 04 03 126 | Magnetic excitations in HoCo ₂ . | IN1 |
| | H. Fuess, P. Schweiss, W. Dyck (Frankfurt) | | | A. Castets, D. Gignoux (CNRS, Grenoble) B. Hennion (LLB, Saclay) | |
| 04 02 095 | Lattice dynamics studies of thiourea. | IN2, IN8 | 04 03 140 | Linear and nonlinear excitations in the 1-D-ferromagnet CsNiF ₃ . | IN12 |
| | A.H. Moudden, F. Denoyer, M. Lambert (Orsay) R. Currat (ILL) | | | M. Steiner, W. Knop (Berlin) R. Pynn (ILL) J.K. Kjems (Risø) | |
| 04 02 095 | High pressure study of incommensurate phase in thiourea. | IN2 | 04 03 141 | Lineshape and polarization analysis of the central peak for CsNiF ₃ at small q _c and small energies. | IN11 |
| | A.H. Moudden, F. Denoyer, M. Lambert, A. Bellamy (Orsay) R. Currat, C. Vettier (ILL) | | | M. Steiner, H. Dachs (Berlin) F. Mezei (ILL) | |
| 04 02 096 | See 04 02 114 | | 04 03 143 | Propagating energy modes in CsFeCl ₃ . | IN12 |
| 04 02 111 | Neutron and Raman scattering in SrTiO ₃ . | IN12 | | M. Steiner, W. Knop (Berlin) P. Day, G. Mc Leen (Oxford) R. Pynn (ILL) | |
| | R.A. Cowley, D.A. Bruce (Edinburgh) | | 04 03 145 | Breather excitations in the antiferromagnetic chains of TMMC. | IN12 |
| 04 02 114 | Lattice dynamics studies of the incommensurate phase of thiourea. | IN12 | 04 03 147 | J.P. Boucher, K. Maki, L.P. Regnault, J. Rossat-Mignod (CEN-G) J. Bouillot, W.G. Stirling (ILL) | |
| 04 02 096 | A.H. Moudden, F. Denoyer, M. Lambert (Orsay) R. Currat (ILL) | | 04 03 146 | Antiferromagnetic solitons in TMMC. | IN11 |
| 04 02 115 | The effect of pressure on the charge density waves of KCP. | IN2 | | J.P. Boucher, J. Rossat-Mignod, L.P. Regnault (CEN-G) F. Mezei, J. Bouillot (ILL) | |
| | L. Bernard, B. Renker (ILL) P. Schweiss (Frankfurt) P. Debray, R. Comes (Orsay) | | 04 03 147 | See 04 03 145 | |
| 04 02 123 | Phonon dispersion curves near the displacive transition temperature in an In Tl alloy. | IN8 | 04 03 151 | Magnetic excitation in the incommensurate and commensurate phases of NiBr ₂ . | IN2 |
| | D. Abbe (Châtillon) | | | P. Day, T.E. Wood (Oxford) K.R.A Ziebeck (ILL) | |
| 04 02 124 | See 04 01 168 | | 04 03 155 | Structural and magnetic scattering study of the "incommensurate" crystal BaMnF ₄ . | IN2 |
| 04 02 137 | Excitations in the incommensurate phase of ThBr ₄ . | IN3 | | M. Regis, R. Almairac (Montpellier) J. Nouet (Le Mans) | |
| | L. Bernard (ILL) P. Delamoye (Orsay) R. de Kouchkovsky (Saclay) | | 04 03 159 | Magnetic and phonon excitations in UX systems. | IN8 |
| 04 02 138 | Modulated structures and phase transformations in RbLiSO ₄ . | IN2 | | G.H. Lander (Argonne) W.G. Stirling (ILL) O. Vogt (Zürich) | |
| | F. Frey, H. Jagodzinski (München) K. Lukaszewicz, A. Pietraszko (Wroclaw) | | 04 03 165 | Spin fluctuation energy of stoichiometric TmSe under high pressure. | D7 |
| 04 02 139 | Comparative temperature and pressure dependence of the R ₂₅ mode in RbCaF ₃ , CsCaF ₃ and KZnF ₃ . | IN3 | | D. Debray, R. Kahn (Saclay) M. Loewenhaupt (Jülich) | |
| | M. Rousseau, C. Ridou (Le Mans) J. Bouillot, C. Vettier (ILL) | | | | |
| 04 02 141 | Study of the three peak structure in 1-cyanoadamantane plastic phase. | IN3 | | | |
| | J.L. Sauvajol, M. Bee, J.P. Amoureux (Lille) J. Lefebvre (ILL) | | | | |

| | | | | | |
|---|---|-----------|-----------|--|-----|
| 04 03 168 | Magnon dispersion in Pt_3Cr and Pt_6MnCr . D.E.G. Williams (Loughborough) | IN8 | 05 13 096 | Neutron diffraction study of $RbHSeO_4$ (paraelectric phase). J. Roziere, I. Brach (Montpellier) | D9 |
| 04 03 170 | Spin waves in pseudobinary alloy with a ferromagnetic-canted ferrimagnetic phase transition. D. McK. Paul (Edinburgh and ILL) M. Hagen (Edinburgh) | IN3 | 05 13 104 | Neutron-diffraction study of a symmetrical ruthenium-hydrogen-ruthenium bond in $(\mu-H)Ru_3(CO)_7(\mu-As(C_6H_5)CH_2As(C_6H_5)_2)(C_6H_5)_2AsCH_2(C_6H_5)_2$. J.J. Bonnet, G. Lavigne, N. Lugan, J.M. Savariault (Toulouse) | D8 |
| 04 03 171 | Spin waves in disordered $Pd_{81}Fe_{19}$. D. McK. Paul (Edinburgh and ILL) W.G. Stirling (ILL) | IN1 | 05 13 105 | Short H... H distance O. Ermer (Bochum) | D9 |
| 04 03 178 | Praseodymium at millikelvin temperatures. K.A. McEwen (Salford) J.L. Ragazzoni, W.G. Stirling, C. Vettier (ILL) | IN12 | 05 13 107 | Neutron diffraction study of a binuclear platinum hydride, $[Pt_2H_3(Ph_2PCH_2PPh_2)_2][BPh_4]$. K.W. Muir, A.S. Frew, Lj. Manojlovic-Muir (Glasgow) M.S. Lehmann, R.F.D. Stansfield (ILL) | D8 |
| 04 03 180 | Pressure dependence of crystal field excitations in PrBi and TmSb. C. Vettier (ILL) J. Voiron (CNRS, Grenoble) | IN8 | 05 13 108 | Proton positions in $HSbBr_6 \cdot 3H_2O$. H. Henke (Karlsruhe) | D8 |
| 04 03 181* | The pressure dependence of the magnetic exciton in TbP. K. Knorr, A. Loidl (Mainz) C. Vettier (ILL) | IN2 | 05 13 113 | Short H...H distance. O. Ermer (Bochum) | D8 |
| 04 03 193 | The low-energy magnetic excitations of the 1-D F $TiFeCl_3$. M. Steiner, W. Knop (Berlin) P. Day, D. Visser (Oxford) R. Pynn (ILL) | IN2, IN12 | 05 14 111 | Lone pair stereoactivity in crystallized MX_3 : electron density study of PCl_3 . J. Galy, J.P. Legros, J.M. Savariault (Toulouse) | D9 |
| 04 04 067 | Critical dynamics of Fe above the Curie Point. F. Mezei (ILL) | IN11 | 05 14 121 | 4.2 K structure of Cs_2CoBr_5 . B.N. Figgis, P.A. Reynolds (Perth) | D15 |
| 04 04 070 | Dynamical critical scattering from a two-dimensional easy plane ferromagnet, Rb_2CrCl_4 , in a magnetic field. P. Day, P. Fyne (Oxford) M.T. Hutchings (Harwell) | IN12 | 05 14 129 | Deformation density in salts of complex anions: $MgS_2O_3 \cdot 6H_2O$ Y. Elerman, H. Fuess, J.W. Bats (Frankfurt) J. Allibon (ILL) | D9 |
| 04 04 084 | A test of two-scale universality R.A. Cowley, M. Hagen (Edinburgh) D. McK. Paul (ILL) | IN2 | 05 14 130 | Deformation density in a pentavalent coordinated silicon compound. G. Klebe, J.W. Bats (Frankfurt) J.M. Savariault (Toulouse) J. Allibon (ILL) | D8 |
| 04 04 087 | Magnetic excitations of the nearly 1-D AF $CsMnI_3$ and 1-D F $TiFeCl_3$. W.J. Fitzgerald (Zürich) D. Visser (Oxford) D. McK. Paul, K.R.A. Ziebeck (ILL) | IN2 | 05 15 120 | Phase diagram of antiferromagnetic CrFe in the pressure-temperature plane. E. Fawcett (Toronto) | D10 |
| COLLEGE 5 (Crystallographic and Magnetic Structures) | | | 05 15 152 | Einkristall-Neutronenbeugungsuntersuchungen and der Jahn-Teller-deformierten Verbindung $Cs_2PbCu(NO_2)_6$. E. Hellner, H. Ahsbahs (Marburg) | D9 |
| 05 11 096 | Localization of lithium in $Na\beta$ ''-alumina (Mg-Li) stabilized. W.L. Roth (New York) M. Anne, D. Tran Qui (CNRS, Grenoble) M.S. Lehmann (ILL) | D9 | 05 15 159 | Determination of the average structure of low temperature $ThBr_4$. P. Delamoye, R. De Kouchkovsky (Saclay) J. Pannetier (ILL) | D9 |
| 05 11 097 | Anharmonic thermal vibrations in lead. F.K. Larsen (Aarhus) M.S. Lehmann (ILL) | D9 | 05 15 160 | The structure of LaF_3 approaching the melting point. C.R.A. Catlow, A.V. Chadwick (London) G. Lander, B.E.F. Fender (ILL) | D15 |
| 05 11 104 | 4.2K structure of $[Fe(III)(bipyridyl)_2Cl_2][FeCl_4]$. B.N. Figgis, P.A. Reynolds (Perth) | D15 | 05 15 162 | Anharmonic thermal vibrations and mean potentials in the fast-ionic conductor $RbAg_4I_5$. W.F. Kuhs (Freiburg) G. Heger (Karlsruhe) | D9 |
| 05 12 071* | The crystal and molecular structure of naphthalene at low temperature. B. Dorner, C. Zeyen (ILL) I. Natkaniec, E.F. Sheka (Dubna) G.S. Pawley (Edinburgh) J. Kalus (Bayreuth) | D10 | 05 15 166 | Accurate determination of the pressure dependence of the structure of tetragonal KH_2PO_4 and KD_2PO_4 near T_c . J.E. Tibbals, R.J. Nelmes (Edinburgh) | D15 |
| 5 12 077 | Neutron diffraction structure determination of (η^5 -methyl-cyclopentadienyl) dicarbonylhydrido-fluorodiphenylsilyl-manganese. U. Schubert, K. Ackermann (München) | D8 | 05 15 173 | Study of a possible Peierls phase transition in a 1-D conductor = $TMA^+(TCNQ)^{2/3}(I_3^-)_{1/3}$. J. Gaultier, B. Gallois (Bordeaux) A. Filhol (ILL) | D8 |

| | | | | | |
|------------|--|-----|-----------|--|-----|
| 05 15 183 | Study of anharmonicity in AuCu ₃ . G.H. Lander, P.J. Brown (ILL) | D9 | 05 22 155 | Low temperature crystallographic structure of YbCo ₂ . C. Meyer, F. Hartmann-Boutron (USMG, Grenoble) A. Percheron-Guegan (Meudon) F. Tasset (ILL) | D1A |
| 05 15 184 | Anharmonic thermal vibrations and mean potentials in the fast ionic conductor α -RbAg ₄ I ₅ at 220 K. W.F. Kuhs (ILL) G. Heger (Karlsruhe) | D9 | 05 22 166 | Etude de la déshydratation de VOSO ₄ · 5 D ₂ O en tubes scellés de silice par diffraction de neutrons. M. Tachez, F. Theobald (Besançon) | D1A |
| 05 15 187 | Examination of incommensurable charge-density wave in α -U. J.C. Marmeggi (CNRS, Grenoble) A. Delapalme (LLB, Saclay) C. Vettier (ILL) | D15 | 05 22 173 | High temperature study of the Th-C system. B.E.F. Fender, A. Fitch, A.F. Wright (ILL) | D2 |
| 05 15 192 | Refinement of the Li position and Debye factors in α -LiIO ₃ . E. Coquet (Dijon) J. Bouillot, J. Pannetier (ILL) | D9 | 05 22 177 | Structure of the plastic crystal phase of CF ₄ . A.J. Leadbetter, R.C. Ward (Exeter) | D1A |
| 05 16 125 | Precise profile measurements of superlattice reflection and the evolution with time in palladium deuteride. D.K. Ross, R.A. Bond, B.S. Bowerman (Birmingham) I.S. Anderson, N. Lehner (ILL) C.J. Carlile (Rutherford) | D10 | 05 22 179 | The structure of Ca [(NH ₂) _{0.5} (NH) _{0.5}]. B.E.F. Fender (ILL) J.A.K. Cockcroft (Oxford) | D1A |
| 05 16 130 | See 05 32 118 | | 05 22 180 | Structures of three phases of t-butyl bromide by powder diffraction. R.M. Richardson (Rutherford) A.J. Leadbetter, R.C. Ward (Exeter) | D1A |
| 05 17 137 | Magnetic structure of RbFeCl ₃ . P. Radhakrishna (LLB, Saclay) N. Lehner (ILL) | D15 | 05 23 187 | Magnetic structures on HoIG and ErIG. M. Guillot (CNRS, Grenoble) A. Marchand (USMG, Grenoble) F. Tcheou (CEN-G) | D1B |
| 05 17 143* | Magnetic structure on DyIG with magnetic field at low temperature. G. Aubert, B. Michelutti, M. Guillot (CNRS, Grenoble) | D15 | 05 23 191 | Neutron diffraction study of TmTe under high hydrostatic pressure. D. Debray, E. Kaldis, R. Millet (LLB, Saclay) | D1A |
| 05 17 149 | Determination of the magnetic structure of Pd ₂ MnIn _{0.65} Sn _{0.35} . P.J. Webster, S.L. Town (Salford) | D12 | 05 23 194 | Diffraction study of magnetic phases in the Kondo compound CeB ₆ . S. Horn, F. Steglich (Darmstadt) M. Loewenhaupt (Jülich) | D1B |
| 05 17 152 | Magnetisation and magnetic structure of the dilute metamagnets Fe _p Mg _{1-p} Cl ₂ . P. Day, T.E. Wood (Oxford) | D15 | 05 23 201 | Helimagnetic structure of the Fe _x Co _{1-x} Si alloys. J. Beille, J. Voiron, F. Towfiq (CNRS, Grenoble) Z.Y. Zhang (ILL) | D17 |
| 05 21 114 | Influence of substitutions in LaNi ₅ compound on the stoichiometry of related hydrides. J.C. Achard, A. Percheron-Guegan (Meudon) C. Lartigue, F. Tasset (ILL) | D1B | 05 23 206 | Magnetic ordering in ATiF ₄ fluorides (A = Cs, Rb, K, Na). J.L. Soubeyrou (ILL) R. Sabatier, A.M. Vasson, A. Vasson, D. Avignant, J.C. Cousseins (Clermont-Ferrand) | D1B |
| 05 21 118 | Nitrogen incorporation in new series of intergrowth phases in the system Cr ₂ O ₃ -(Ti-Zr)O ₂ . I. Grey, D. Tran Qui, M. Marezio (CNRS, Grenoble) | D1A | 05 23 207 | Magnetic structure of greenalite. J.M.D. Coey, A. Moukarika (Dublin). | D1B |
| 05 21 124 | Neutron diffraction studies on natural and synthetic silicates. J.M. Thomas, Lodge (Cambridge) A.K. Cheetham (Oxford) | D1A | 05 23 208 | Magnetic structure on YIG-TbIG. M. Guillot (CNRS, Grenoble) F. Tcheou (CEN-G) | D1B |
| 05 21 133 | Determination of hydrogen positions in platonic acid H ₈ PtO ₆ . M. Trömel, H. Fuess, G. Burckhardt (Frankfurt) A.W. Hewat (ILL) | D1A | 05 23 220 | ²³⁹ Pu powder neutron diffraction. J.M. Fournier (CEN-G) L. Manes, J. Rebizant (Karlsruhe) F. Rustichelli (ILL) | D2 |
| 05 21 136 | Metal exchanged zeolites. J.M. Adams, D.A. Haselden (Aberystwyth) | D1A | 05 23 224 | Covalency in iron-oxygen bonds. P.D. Battle, R. Price (Oxford) | D1A |
| 05 21 146 | Study of the atomic modifications preceding calcium deuterioxide dehydration. D. Ciosmak, J.C. Niepce, O. Pluchery (Dijon) J. Bouillot (ILL) F. Freund (Köln) | D1A | 05 23 229 | Magnetic structure of CoMn alloys. J. Crangle (Sheffield) | D2 |
| 05 22 130 | Transformation of three-connected silicon nets in ThSi ₂ . J. Evers, G. Oehlinger (München) | D1A | 05 23 234 | Magnetic investigation of the clustered compounds RuF ₅ and OsF ₅ . J.L. Soubeyrou (ILL) J. Darriet, A. Tressaud (Bordeaux) | D1B |
| (05 22 136 | The structural transition of s-triazine. A.W. Hewat (ILL) | D1A | | | |

| | | | | | |
|------------|--|-----|-----------|--|---------|
| 05 23 236 | Magnetic structures of CeMg_3 and CeInAg_2 . R.M. Galera, J. Pierre (CNRS, Grenoble) | D1B | 05 31 059 | Form factor of Ce^{3+} ion in CeTe . J.X. Boucherle, J. Rossat-Mignod (CEN-G) J. Schweizer (CEN-G and ILL) D. Ravot (Meudon) | D3 |
| 05 23 242 | Magnetic phase diagram of Cr-Ge | D2 | 05 31 062 | Magnetic form factor of praseodymium. | D3, D5 |
| 05 23 243 | and Cr-Ga alloys. J.G. Booth (Salford) M.M.R. Costa (Coimbra) K.R.A. Ziebeck (ILL) | | 05 31 052 | B.D. Rainford (Southampton) | |
| 05 23 251 | Magneto-elastic coupling and spin-ordering in BiFeO_3 . I. Sosnowska (Garching and Warsaw) E. Steichele (Garching) A.W. Hewat, C. Vettier (ILL) | D1A | 05 31 070 | K.A. McEwen (Salford) B. Lebeck (Risø) | |
| 05 23 252 | Reorientation of the magnetic moment of iron in NdFeO_3 . A.W. Hewat (ILL) I. Sosnowska (Garching and Warsaw) E. Steichele (Garching) | D1A | 05 31 069 | Magnetic form factors of Np in NpAs_2 . A. Blaise, J.M. Fournier (CEN-G) A. Delapalme (LLB, Saclay) | D3 |
| 05 23 258 | The magnetic structures of $\text{Ba}_2\text{LaRuO}_6$ and $\text{Ca}_2\text{LaRuO}_6$. P.D. Battle (Oxford) | D1A | 05 31 070 | See 05 31 062 | |
| 05 24 148 | Differential diffraction pattern of deuterium chemisorbed on spinel Co_3O_4 . Y. Barbaux (Lille) J.P. Beaufilets (ILL) | D1B | 05 32 067 | Spin density distribution in CrCl_3 . A. Simon (Stuttgart) P.J. Brown, K.R.A. Ziebeck (ILL) | D3 |
| 05 24 151 | Structures of ^3He bi- and multilayers on highly uniform graphite. H.J. Lauter (ILL) H. Godfrin (CNRS, Grenoble) C. Tiby, H. Wiechert (Mainz) | D1B | 05 32 088 | Magnetisation density distribution in CrBr_3 . P. Radhakrishna (LLB, Saclay) P.J. Brown (ILL) | D3, D15 |
| 05 25 120 | Small angle scattering from montmorillonite/pyridine system. J.M. Adams, C. Breen (Aberystwyth) | D17 | 05 32 102 | A neutron diffraction study of weak ferromagnetism in nickel fluoride. P.J. Brown (ILL) J.B. Forsyth (Rutherford) | D3, D5 |
| 05 25 135 | Preferred orientation of deformed anorthosite. H.J. Bunge (Clausthal) R. Baro (Metz) H.R. Wenk (Berkeley) | D1B | 05 32 115 | Thermal variations of a conduction electron polarisation in HoAl_2 . J.X. Boucherle (CEN-G) J. Schweizer (CEN-G and ILL) | D5 |
| 05 25 138 | Reaction kinetics of hydrothermal deuteration of α - AlOOH , $\text{In}(\text{OH})_3$, and $\text{Y}(\text{OH})_3$. A.N. Christensen (Aarhus) M.S. Lehmann (ILL) | D1B | 05 32 117 | Magnetic form factor of UNi_2 . J.M. Fournier (CEN-G) A. Delapalme (LLB, Saclay) A. Bœuf (ILL) | D3 |
| 05 25 139 | A kinetic study on the intercalation of potassium into a graphite single crystal. C. Riekel (Stuttgart) L. Bonnetain, P. Touzain, A. Hamwi (ENSEEG, Grenoble) | D1B | 05 32 118 | Density map in CeNi_5 . | D3, D9 |
| 05 25 142 | Residual stress measurements in bulk steel samples using neutron diffraction. A.J. Allen, C.G. Windsor, C. Andreani, M.T. Hutchings (Harwell) | D1A | 05 16 130 | Structure defects and extinction in CeNi_5 . D. Gignoux, F. Givord, R. Lemaire (CNRS, Grenoble) F. Tasset (ILL) | |
| 05 25 143 | Analysis of line shape in structure refinement and studies of crystal imperfections. J.I. Langford (Birmingham) D. Louër (Rennes) | D1A | 05 32 122 | Magnetization density in $\text{Mn}_{1/4}\text{TaS}_2$. S.S.P. Parkin, E.A. Marseglia (Cambridge) P.J. Brown (ILL) | D15 |
| 05 25 144* | Kinetic effects during high temperature electrochemical solid state reactions. C. Riekel, W. Weppner (Stuttgart) (not to be published) | D1B | 05 32 123 | Magnetization density in iron silicate. H. Fuess, R. Müller (Frankfurt) P.J. Brown (ILL) | D3 |
| 05 25 145 | A neutron diffraction study on the doping of organic polymers. C. Riekel (Stuttgart) H. Hässlin (ILL) | D1B | 05 32 126 | Paramagnetic form factor of nickel fluoride. J.B. Forsyth (Rutherford) P.J. Brown (ILL) | D3 |
| 05 31 052 | See 05 31 062 | | 05 32 127 | Spin-density and bonding in the $[\text{CoBr}_4]^{2-}$ ion. R. Mason (Sussex) B.N. Figgis, P.A. Reynolds (Perth) | D3 |
| | | | 05 32 128 | Spin density and bonding in $\text{Ni}(\text{ND}_3)_4(\text{NO}_2)_2$. R. Mason (Sussex) B.N. Figgis, P.A. Reynolds (Perth) | D3 |
| | | | 05 32 129 | Magnetic moment distribution in the ionic ferromagnet Rb_2CrCl_4 by polarised neutron diffraction. E. Hellner, G. Münnighoff (Marburg) P. Day, P.J. Fyne (Oxford) M.T. Hutchings (Harwell) F. Tasset (ILL) | D3 |
| | | | 05 33 061 | The origin of diffuse scattering in paramagnetic Pr metal. S.K. Burke, W.G. Stirling (ILL) K.A. McEwen (Salford) | D5 |

| | | | | | |
|--|--|------|------------|---|------|
| 05 34 054 | The diamagnetism of graphite. J.B. Forsyth (Rutherford) P.J. Brown (ILL) | D3 | 06 05 043 | Neutron scattering by SF ₆ vapour. J.G. Powles, J.C. Dore, E.K. Osae (Kent) | D2 |
| 05 34 057 | Paramagnetic scattering of α Mn. P.J. Brown, K.R.A. Ziebeck (ILL) | D5 | 06 05 047 | Structural studies of methyl alcohol by H/D substitution. J.C. Dore (Kent) D.G. Montague (Willamette) | D2 |
| 05 34 070 | Determination of paramagnetic response in palladium based Heusler alloys. K.R.A. Ziebeck (ILL) P.J. Webster, S.L. Town (Salford) | D5 | 06 06 011 | Inelastic scattering from acoustic and optic modes in molten CsCl. R. McGreevy, E.W.J. Mitchell (Oxford) S. Messoloras (Reading) J.B. Suck (ILL) | IN4 |
| 05 34 072 | Paramagnetic scattering in iron (short range magnetic order in paramagnetic iron and nickel). H. Capellmann, P.J. Brown, K.R.A. Ziebeck (ILL) J. Desportes, D. Givord (CNRS, Grenoble) | D5 | 06 06 012 | Density fluctuations in molten Rb- RbBr. J. Dupuy, G. Chabrier, J.F. Jal (Villeurbanne) | D1B |
| 05 34 078 | Polarization-analysis study of Y ₄ Co ₃ . B.R. Coles, B.V.B. Sarkissian, A.K. Grover (London) S.K. Burke (ILL) | D5 | 06 06 012 | Fluctuation concentration in molten K-KF system. J. Dupuy, J.F. Jal (Villeurbanne) P. Chieux (ILL) | D17 |
| COLLEGE 6 (Fluids and amorphous substances) | | | | | |
| 06 01 052 | Phonon dispersion curve of superfluid ⁴ He at small wavevectors. W.G. Stirling (ILL) R.A. Cowley (Edinburgh) | IN12 | 06 07 020* | Pressure dependence study of aqueous solutions. G.W. Neilson (Bristol) | D2 |
| 06 01 059 | See 06 01 068 | | 06 07 027 | | |
| 06 01 063 | Neutron scattering from liquid ³ He (test of transmission cell). R.A. Cowley, K.S. Pedersen (Edinburgh) W.G. Stirling (ILL) | IN12 | 06 07 041 | Dynamic of aqueous solutions. J.E. Enderby, N.A. Hewish (Bristol) W.S. Howells (Rutherford) | IN10 |
| 06 01 068 | Lifetime of phonon excitations in superfluid ⁴ He. F. Mezei (ILL) | IN11 | 06 07 042 | Homogeneous nucleation of ice in amorphous LiCl, D ₂ O. J. Dupuy, J.F. Jal, A. Elarby (Villeurbanne) R. Parreins (Montpellier) | D2 |
| 06 01 059 | | | 06 07 047 | Dynamics of aqueous solutions. J.E. Enderby, P. Salmon (Bristol) | IN10 |
| 06 02 047 | Structure factor of fluid selenium in the semiconducting regime. W. Freyland, M. Edeling (Marburg) | D4 | 06 08 040 | Chemical short-range order in titanium-nickel/cobalt glasses. H. Ruppersberg, C.H.J. Wagner, H.J. Güntherodt, H. Rudin (Saarbrücken) | D4 |
| 06 02 048 | Partial structure factors of amorphous Ni ₈₁ B ₁₉ . W. Sperl, P. Lamparter, S. Steeb (Stuttgart) | D2 | 06 08 041 | Chemical short range order in CuTi: metallic glasses. N. Cowlam, H.A. Davies, M. Sakata (Sheffield) | D4 |
| 06 02 049 | Diffusion retardation and long time behaviour in simple liquids. W. Gläser, C. Morkel (München) | IN4 | 06 08 042 | Neutron diffraction study of ¹¹ B enriched Co-B amorphous alloys. J.M. Dubois, G. Le Caer (Nancy) P. Chieux (ILL) | D5 |
| 06 03 098 | Short-range order in liquid lithium/lead. H. Ruppersberg (Saarbrücken) | D4 | 06 08 046 | Nucleation and growth studies in a lattice glass. D.K. Ross, D.G. Wittchell (Birmingham) I.S. Anderson (ILL) C.J. Carlile (Rutherford) | D17 |
| 06 03 107 | Clustering analysis in AuSi liquid alloys. P. Tavernière, P. Desre, P. Hicter, C. Senillou (LTPCM, Grenoble) P. Chieux (ILL) | D11A | 06 08 048* | Structure of SiD films. A.J. Leadbetter, A.A.M. Rashid (Exeter) | D4 |
| 06 03 113 | Long life fluctuation analysis in Ag-Ge liquid alloys by isotopic substitution. M.C. Bellissent-Funel (LLB, Saclay) P. Desre, P. Hicter, M. Maret (LTPCM, Grenoble) | D17 | 06 08 050 | Collective modes in metallic glasses. H. Beck (Neuchâtel) H.J. Güntherodt, H. Rudin (Basel) J.B. Suck (Karlsruhe) | IN4 |
| 06 04 021 | Polarized neutron studies of Fe _{4.7} Co _{70.3} Si ₁₅ B ₁₀ . D.E.G Williams (Loughborough) | D5 | 06 08 059 | Neutron SAS with amorphous Ni ₈₁ B ₁₉ , Fe ₈₀ B ₂₀ and Ni ₈₁ P ₁₉ . W. Sperl, P. Lamparter, S. Steeb, P. Linden (Stuttgart). | D11 |
| 06 05 040 | Partial structure factors of formamide. M.D. Zeidler, F.J. Wiesmann (Aachen) H. Bertagnolli (Würzburg) | D4 | | | |

COLLEGE 7 (Imperfections)

| | | | | | |
|-------------|---|---------|-----------|---|-----|
| 07 01 055 A | Spin dynamics of intermediate valence systems. E. Holland-Moritz (Köln) | IN4 | 07 02 086 | Linewidths of magnetic excitations in cerium intermetallics. R.M. Galera, J. Pierre (CNRS, Grenoble) A.P. Murani (ILL) | IN5 |
| 07 01 131 | Spin dynamics in quasi 1-D spin glass FeMgBO ₄ . A. Wiedenmann, P. Burlet (CEN-G) H. Scheuer (ILL) | D7 | 07 02 087 | Concentration fluctuations in glasses Rb ₂ O - SiO ₂ . D. Ravaine (Grenoble) A.F. Wright (ILL) | D11 |
| 07 01 156 | See 07 01 190 | | 07 02 093 | Crystal field in rare earth intermetallics (RMg ₃ ; RInAg ₂). R.M. Galera, J. Pierre (CNRS, Grenoble) | IN4 |
| 07 01 167 | Magnetic short-range ordering in new fluoride glasses. C. Jacobini, A. Le Bail, G. Courbion, R. de Pape (Le Mans) | D1B | 07 03 130 | Diffuse scattering of interstitial FeC alloys. M.C. Cadeville (Strasbourg) R. Caudron (Châtillon) | D7 |
| 07 01 169 | Short range order in FeV alloys. G. Parette, I. Mirebeau (LLB, Saclay) | D7 | 07 03 148 | Determination of short range order parameters in Ni _{0.765} Fe _{0.235} at 600° C. S. Lefebvre, F. Bley (Vitry) | D10 |
| 07 01 189 | Paramagnetic scattering in anomalous Co ₂ TiZ alloys. P.J. Webster, R.M. Mankikar (Salford) J. Desportes (CNRS, Grenoble) | D5 | 07 03 154 | Structural disorder in ZrO ₂ - Y ₂ O ₃ system. C.H. Perry, A. Feinberg (Boston) | IN4 |
| 07 01 190 | Small angle scattering from the magnetic superconductor HoMo ₆ S ₈ . J.W. Lynn (Maryland) | D11 | 07 03 154 | Phonon dispersion in cubic zirconia. C.H. Perry, A. Feinberg (Boston) | IN3 |
| 07 01 191 | Polarisation by reflection from magnetised Fe/Co/Gd thin films. W.G. Williams, J. Penfold (Rutherford) J.B. Hayter (ILL) | D17 | 07 03 179 | Small angle neutron scattering from irradiated GaAs. E.W.J. Mitchell (Oxford) M.R. Baig, S. Messoloras, R.J. Stewart (Reading) | D11 |
| 07 01 194 | Search for long-range magnetic order in reentrant superconductors. R. Pynn, G.H. Lander, J. Joffrin (ILL) M. Ishikawa (Geneva) | D11 | 07 03 181 | Short range order measurement in a ternary alloy FeNiCr. F. Bley, S. Lefebvre (Vitry) P. Cenedese (ILL) | D10 |
| 07 01 202 | Magnetic small angle scattering in Y ₄ Co ₃ . B.R. Coles, A.K. Grover, B.V.B. Sarkissian (London) S.K. Burke (ILL) | D11 | 07 03 187 | Voids and crack nucleation in fatigued copper single crystals. P.O. Kettunen, T. Lepistö (Tampere) G. Goeltz (ILL) G. Kostorz, P. Studerus, R. Schmelzger (Zürich) | D11 |
| 07 02 060 | Crystal field in rare earth intermetallics with CsCl structure. P. Morin, D. Schmitt (CNRS, Grenoble) | IN4 | 07 03 190 | The effects of temperature and stress on the precipitates in nickel based superalloys. R.J. Stewart, M. Dusic, S. Messoloras (Reading) | D11 |
| 07 02 064 | Determination of crystal field splitting of RE impurities in intermediate valence compounds. E. Holland-Moritz (Köln) U. Walter (Jülich) | IN5, D7 | 07 03 191 | Etude de la précipitation γ' dans l'alliage 800. A. Mathiot, G. Robert (CEN-G) S. Refioertin (Turin) | D11 |
| 07 02 068 | Crystal field parameters of rare earths dissolved in YAl ₂ . B. Barbara, M.F. Rossignol (CNRS, Grenoble) A.P. Murani (ILL) | IN4 | 07 03 194 | Study of Al-Zn and Al-Ag-Zn decomposition by neutron small angle scattering. P. Guyot, J.P. Simon, F. Livet (Grenoble) S. Vignesoult, A. de Salva (CNRS, Grenoble) | D17 |
| 07 02 071 | Measurement of magnetic response function in uranium arsenide. G.H. Lander (Argonne and ILL) M. Loewenhaupt (Jülich) A. Murasik (Swierk) | IN4 | 07 03 197 | Precipitation of γ' in Ni-Al alloys. P. Haasen, R.E. Beddoe, G. Frommeyer, H. Wendt (Göttingen) G. Kostorz, R. Schmelzger (Zürich) | D11 |
| 07 02 074 | Spin dynamics of dilute intermediate valence systems. E. Holland-Moritz (Köln) U. Walter (Jülich) | D7 | 07 03 205 | The structure of Li _x V ₆ O ₁₃ . C.R.A. Catlow, A.S. Brah, B.C.H. Steele (London) | D1A |
| 07 02 075 | Electric field effect in the lithium iodate α LiIO ₃ . M. Remoisenet (Dijon) | S20 | 07 03 206 | Powder diffraction study of U ⁴⁺ doped BaF ₂ . C.R.A. Catlow (London) K. Wapenaar (Utrecht) | D1A |
| 07 02 077 | Crystal field in cerium intermetallics. R.M. Galera, J. Pierre (CNRS, Grenoble) A.P. Murani (ILL) | IN4 | | | |

| | | | | | |
|------------|--|------|----------------------------|---|------|
| 07 03 207 | Small angle scattering from phase solitons in K_2SeO_4 . J. Joffrin, R. Pynn (ILL) W. Rehwald (Zürich) | D11 | 07 06 126 | Mobility of hydrogen in $LaNi_5H_6$. R. Hempelmann, D. Richter (Jülich) L.A. Vinhas (Sao Paulo) | IN10 |
| 07 03 208 | SANS from Al-Cu-Ag-Mg and Ni-Al-bronze alloys. J.G. Booth, J.G. Prince (Salford) R.J. Barton (Aldermaston) | D11A | 07 06 129 | Hydrogen tunneling in lutetium. H. Wipf, K. Neumaier, K.A. Gschneidner (Garching) A. Magerl, A. Heidemann (ILL) | IN13 |
| 07 03 217 | Small angle neutron scattering from oriented latent nuclear tracks. D. Albrecht, P. Armbruster, R. Spohr (Darmstadt) | D17 | 07 06 132 | Diffusion of alkali atoms intercalated in graphite. A. Magerl, A.J. Dianoux (ILL) H. Zabel (Urbana) | IN6 |
| 07 03 220 | Small angle scattering of neutron studies of some amorphous Fe-Ni-Mo-B alloys. M. Roth, Zhang Zhi-You (ILL) Wang Zhen-Xi (Pekin) | D17 | 07 07 032 | Anion diffusion in $SrCl_2$. W. Hayes, P. Schnabel (Oxford) M.T. Hutchings (Harwell) R.E. Lechner (Berlin) | IN12 |
| 07 03 228 | Cavitation in prefatigued and crept copper. J.R. Weertman, M. Yang (Evanston) M. Roth, Zhang Zhi-You (ILL) | D11 | 07 07 033 | Powder diffraction studies of Li-electrolytes. A.S. Brah, C.R.A. Catlow, B.C.H. Steele (London) | D1A |
| 07 03 231 | Nucleation and growth processes in pure and doped zirconia gels on decomposition at 250-350° C. N.H. Brett (Sheffield) A.F. Wright (ILL) | D17 | 07 07 035 | Anisotropy of Ag^+ -ion diffusion in α - Ag_2Se single crystals. K. Funke, A. Höch (Hannover) R.E. Lechner (Berlin) | IN5 |
| 07 04 002A | In-beam NMR of 8Li in the superionic conductor Li_3N . H. Ackermann, B. Bader, W. Buttler, P. Freiländer, P. Heitjans, G. Kiese, H.J. Stöckmann (Marburg and ILL) | S6 | 07 07 041 | Solid electrolyte α - AgI : separation of different scattering terms by using silver isotopes. R.E. Lechner (Berlin) K. Funke, A. Hoeh (Hannover) | IN5 |
| 07 04 002A | Measurement of the pressure induced electric field gradient in CaF_2 by β -decay detection of ^{20}F -NMR. D. Dubbers, H. Grupp, H. Vogt, A. Winnacker (Heidelberg) S6-group (Marburg) | S6 | 07 07 042 | Fast ion conductors. J.B. Goodenough, P.J. Wiseman, H.J. Orman (Oxford) | D1A |
| 07 04 005 | Examination of concentration profiles of light atoms in solids by (n, p) and (n, α) spectrometry. R. Henkelmann, F. Jahnel (München) J.P. Biersack, D. Fink, K. Tjan (Berlin) | S30 | 07 07 050 | Local modes and phonon softening in UO_2 at elevated temperatures. M.T. Hutchings (Harwell) W. Hayes, K. Clausen, J.E. MacDonald (Oxford) | IN2 |
| 07 04 006 | Determination of lattice location of light atoms by (n, α) reactions. J.P. Biersack, D. Fink, J. Lauch (Berlin) R. Henkelmann, F. Jahnel, H.D. Carstanjen (München) | S44 | 07 07 051 | Anion diffusion in $SrCl_2$. W. Hayes, P. Schnabel (Oxford) M.T. Hutchings (Harwell) R.E. Lechner (Berlin) | IN12 |
| 07 06 106 | Inelastic neutron scattering from intermetallic hydrides. D.K. Ross, C.J. Carlile, I.S. Anderson, R. Khoda-Bakhsh (Birmingham) | IN1B | COLLEGE 8 (Biology) | | |
| 07 06 113 | Proton diffusion in Mn and Al substituted $LaNi_5$ hydrogen sponges. J.C. Achard, A. Percheron-Guegan (Meudon) F. Tasset, C. Lartigue (ILL) | IN5 | 08 01 023 | Crystallite orientation in the human spine. G.E. Bacon, P.J. Bacon, R.K. Griffiths (Sheffield) | D1B |
| 07 06 121* | Correlated hydrogen diffusion jumps in concentrated metal-hydrogen systems. R. Hempelmann, K. Kehr, R. Kutner, D. Richter (Jülich) | IN12 | 08 01 024 | Orientation in the radius bone of sheep. G.E. Bacon, P.J. Bacon, R.K. Griffiths (Sheffield) | D1B |
| 07 06 123 | Localization of hydrogen in the layer oxide $HTiNbO_5$. H. Rebbah, B. Raveau (Caen) | D1A | 08 01 025 | Aspartyl-tRNA synthetase tRNA ^{Asp} system from yeast: structure determination of the crystalline complex at low resolution. R. Giege, D. Moras, J.C. Thierry (Strasbourg) M. Roth (ILL) | D17 |
| | | | 08 01 026 | Single crystal diffraction study of the nucleosome core particle. J.T. Finch (Cambridge) A. Lewit-Bentley, G.A. Bentley, P. Timmins, M. Roth (ILL) | D17 |
| | | | 08 01 027 | Contrast variation studies on single crystals of satellite tobacco necrosis virus. L. Liljas, U. Skoglund, T. Unge (Uppsala) G.A. Bentley, A. Lewit-Bentley (ILL) | D17 |

| | | | | | |
|------------|--|-----|------------------------|--|----------|
| 08 01 032 | Contrast variation studies on single crystals of satellite tobacco necrosis virus. L. Liljas, U. Skoglund, B. Strandberg, T. Unge (Uppsala) A. Lewit-Bentley, G. Bentley (ILL) | D17 | 08 04 042 08 04 030 | A study of low frequency collective motions in biological structures: hemoglobin, bromegrass mosaic virus, red cells. Y. Alpert (Paris) | IN11 |
| 08 02 086 | See 08 02 100 | | 08 04 046 | The use of inelastic neutron scattering to study conformational changes in hexokinase. S. Cusack, B. Jacrot (EMBL, Grenoble) D.M. Engelman (Yale) | IN6 |
| 08 02 091 | The measurement of protein-protein distances in the small ribosomal subunit of <i>E. coli</i> . D. Engelman, P. Moore, S. Yabuki, V. Ramakrishnan (Yale) | D11 | 08 05 060 | The major protein from the outer membrane of <i>E. coli</i> solubilized with nonionic detergents. M. Zulauf (EMBL, Grenoble) J.P. Rosenbusch (Basel) | D11 |
| 08 02 093 | Structure and function of the 50S subunit from <i>E. coli</i> ribosomes. K.H. Nierhaus, P. Wurmbach, R. Lietzke (Berlin) R.P. May (ILL) H.B. Stuhmann (Hamburg) A. Miller (Oxford) | D11 | 08 05 062 | Structural basis for membrane permeability. Interaction of bee melittin with phospholipids. R. Strom, C. Crifo', F. Podo (Roma) G. Zaccai (ILL) | D16 |
| 08 02 097 | Structure of ribosomal protein. I. Serdyuk, A. Spirin, Baranov (Moscow) | D11 | 08 05 063 08 07 037 | Contrast variation studies of reductase, bc ₁ fragment of reductase, and b fragment of reductase. S.J. Perkins (EMBL, Grenoble) J. Weiss (Heidelberg) | D17, D11 |
| 08 02 098 | See 08 02 103 | | 08 05 063 | Contrast variation studies of cytochrome c oxidase. S.J. Perkins (EMBL, Grenoble) H. Weiss (Heidelberg) | D17 |
| 08 02 100 | Neutron small angle scattering of T-RNA. Z.Q. Li, G. Zaccai (ILL) R. Giege, J.C. Thierry (Strasbourg) B. Jacrot (EMBL, Grenoble) | D11 | 08 05 064 08 05 065 | Structure of membranes in dispersion. D.M. Sadler, A. Easton (Bristol) F. Reiss-Husson, E. Rivas (CNRS, Gif-sur-Yvette) | D11, D17 |
| 08 02 102 | Interaction between EF-Tu and tRNA and EF-Ts and L7/L12. S.J. Perkins (EMBL, Grenoble) A. Miller (Oxford) G.A. Bentley (ILL) R. Leberman, A. Wittinghofer (Heidelberg) | D11 | 08 05 074 | Investigation of the cause of choline asymmetry in myelin membranes. D.L. Worcester (ILL) | D17 |
| 08 02 103 | Structure and function of the 50s subunit from <i>E. coli</i> ribosomes. K.H. Nierhaus, R. Lietzke, P. Wurmbach, H. Schulze, A. Bartetzko (Berlin) R.P. May (ILL) H.B. Stuhmann (Hamburg) | D11 | 08 05 079 | The determination of bacteriorhodopsin structure using neutron diffraction measurements of specifically deuterated purple membranes. D.M. Engelman, S. Khan, E. Gogol, J. Trehwella (Yale) G. Zaccai (ILL) | D16 |
| 08 02 098 | See 08 02 103 | | 08 06 021 | See 08 06 026 | |
| 08 02 104 | Shape determination of the ribosomal protein S4 as isolated entity and in situ. J. Littlechild, K.H. Nierhaus, R. Lietzke (Berlin) R.P. May (ILL) | D11 | 08 06 022 | Structure of mature adenovirus type 2. P. Boulanger (Lille) C. Devaux (Lille and ILL) P. Timmins (ILL) B. Jacrot (EMBL, Grenoble) | D11 |
| 08 03 054 | See 08 03 065 | | 08 06 026 08 06 021 | Structural studies of influenza virus. S. Cusack (EMBL, Grenoble) J.E. Mellema (Leiden) A. Miller (Oxford) | D11 |
| 08 03 058 | See 08 03 066 | | 08 06 027 | Packing of RNA in spherical plant viruses. J. Witz, J. Kruse (Strasbourg) P. Timmins (ILL) | D17 |
| 08 03 062 | See 08 03 065 | | 08 06 031 | Packing of RNA in a spherical plant virus. J. Witz, J. Kruse (Strasbourg) P. Timmins (ILL) | D11 |
| 08 03 063* | Studies of native and unfolded chromatin. D.Z. Staynov, M. Spencer (London) D.L. Worcester (ILL) | D11 | 08 06 032 | The conformation of viral RNA in solution. B. Jacrot, S. Cusack, B. Schoot (EMBL, Grenoble) J.E. Mellema, G. Oostergetel (Leiden) | D11 |
| 08 03 064 | Higher order structure of chromatin in metaphase chromosomes. K. Ibel (ILL) | D11 | | | |
| 08 03 065 | Neutron scattering studies of chromatin. | D11 | | | |
| 08 03 062 | See 08 03 065 | | | | |
| 08 03 054 | J.P. Baldwin, B.G. Carpenter, G.A. Poland, J.S. Nixon, G. Sibbet (Portsmouth) | | | | |
| 08 03 066 | Lac repressor-DNA interactions. | D11 | | | |
| 08 03 058 | M. Charlier, J.C. Maurizot (Orléans) | | | | |
| 08 04 030 | See 08 04 042 | | | | |

| | | | | | |
|------------------------------|---|-----------|------------|--|-----------|
| 08 07 025 | A neutron scattering study of the folding of muscular parvalbumins. Role of Ca(II) and Mg(II) ions. J. Parello, A. Cave, A. Saint-Yves (Montpellier) | D11 | 09 03 262 | Reorientational motions in solid ethylene. L.A. de Graaf, A.A. van Well (Delft) A. Heidemann (ILL) | IN10 |
| 08 07 027 | Contrast studies of the surface water of proteins. B. Jacrot (EMBL, Grenoble) M.S. Lehmann, G. Zaccai (ILL) | D11A | 09 03 269 | Pressure dependence of methyl tunnelling. S. Clough, M.N.J. Paley, R.A. Jarjis (Nottingham) C. Vettier, A. Heidemann (ILL) | IN10 |
| 08 07 033* | Unfolding of penicillinase. J.T. Randall (Edinburgh) J. Torbet (ILL) | D11 | 09 03 272 | Methyl tunnelling in pentamethyl benzene. S. Clough (Nottingham) B. Gabrys (Leuven) A. Heidemann (ILL) | IN10 |
| 08 07 037 | See 08 05 063 | | 09 03 274 | Rotational tunneling in CH ₄ under pressure. A. Heidemann, C. Vettier (ILL) M. Prager, W. Press (Jülich) | IN5, IN10 |
| 08 07 038 | 3-D organisation of phenylalanyl-tRNA synthetase subunits. S. Blanquet, P. Dessen, A. Ducruix (Palaiseau) | D11 | 09 03 285 | Q dependence of transition matrix elements of tunneling molecules. M. Prager, W. Press (Jülich) A. Heidemann, I.S. Anderson (ILL) | IN13 |
| 08 07 048 | Structure of the glycoproteins of component C1 of complement by SANS. S.J. Perkins (EMBL, Grenoble) R.A. Dwek, J. Boyd (Oxford) D.R. Burton (Sheffield) | D11 | 09 03 287 | Test of methyl hopping rate theory. S. Clough, A.J. Horsewill (Nottingham) | IN5 |
| 08 07 049 | Structure of the glycoproteins of component C1 of complement by SANS. S.J. Perkins (EMBL, Grenoble) R.A. Dwek, J. Boyd (Oxford) D.R. Burton (Sheffield) | D11 | 09 03 289 | Rotational motions and dimerization in trimethylacetic acid. J.P. Amoureux, M. Bee, W. Longueville (Lille) | IN6 |
| 08 07 050 | Fragments of cytochrome reductase by SANS. S.J. Perkins (EMBL, Grenoble) H. Weiss (EMBL, Heidelberg) | D11 | 09 03 293 | NH ₄ ions dispersed in alkali halide lattices; tunnelling transitions. J. Howard (Durham) J. Tomkinson (Rutherford) | IN6 |
| 08 08 006 | Crude protein determination in single maize seeds by neutron capture gamma activation of the nitrogen-content. A. Feher, L. Andras, A. Csöke (Budapest) | H22C | 09 04 251 | Inelastic neutron scattering of the strong H bonds in KH(DCO ₂) ₂ and NaH(CD ₃ CO ₂) ₂ . J. Roziere (Montpellier) J. Tomkinson (Rutherford) | IN1 |
| 08 Test | Pressure tests for solution scattering. G. Zaccai (ILL) | D11 | 09 04 260 | Aqueous solution glasses. A.J. Leadbetter, C.J. Breen, J. Piper (Exeter) | IN1B |
| COLLEGE 9 (Chemistry) | | | 09 04 262 | Comparison of calculated and experimental NIS spectra of ethylene, cyclohexane and cyclohexene. H. Jobic (ILL) A. Renouprez (Lyon) | IN1 |
| 09 01 270 | See 09 04 267 | | 09 04 263 | Organometallic complexes containing C _n H _n . T.C. Waddington, K. Robson, J. Howard, I. Braid (Durham) J. Tomkinson (Rutherford) | IN4 |
| 09 01 302 | Radius of gyration of a chain segment incorporation in a longer chain R. Duplessix, C. Picot, G. Weill (Strasbourg) M. Rawiso (ILL) | D17 | 09 04 267 | Protonic involvement in intermolecular vibrational coupling. S.F.A. Kettle, G.J. Kearley (Norwich) | IN1 |
| 09 11 007 | See 09 12 004 | | 09 01 270 | Centrosymmetric/Non-centrosymmetric transitions in H bonds. J. Howard, T.C. Waddington (Durham) J. Tomkinson (Rutherford) | IN1 |
| 09 01 306 | See 09 12 005 | | 09 04 268* | Hydrogen bonding: the H ₅ O ₂ ⁺ ion. J. Howard (Durham) J. Tomkinson (Rutherford) | IN1 |
| 09 01 308 | See 00 15 005 | | 09 04 269 | Inelastic neutron scattering study on P ₄ S ₃ with a time of flight neutron spectrometer. T.K. Chattopadhyay, H.G.v Schnering (Stuttgart) D.Mc.K. Paul (ILL) | IN4 |
| 09 01 314 | Polymer networks. J.S. Higgins, K. Ma (London) | IN10 | 09 04 278 | | |
| 09 02 215 | Study of reorientational motions in C ₁₈ H ₁₄ near the antiferro-reorientational phase transition. R.E. Lechner (Berlin) B. Toudic, J. Meinel, H. Cailleau (Rennes) | D10 | | | |
| 09 03 244 | Study of the antiferro-reorientational phase transition of hydrogenated p-terphenyl by incoherent neutron scattering. R.E. Lechner (Berlin) B. Toudic, H. Cailleau, J. Meinel (Rennes) | D10 | | | |
| 09 03 259 | Study of the antiferro-reorientational phase transition of hydrogenated p-terphenyl by incoherent neutron scattering. R.E. Lechner (Berlin) B. Toudic, H. Cailleau, J. Meinel (Rennes) | D1B, IN10 | | | |
| 09 03 260 | Reorientational motions in some molecular crystals. C. Sourisseau (Thiais) G. Lucazeau (Villetaneuse) A.J. Dianoux (ILL) | IN5 | | | |
| 09 03 261 | Reorientational motions in some molecular crystals. C. Sourisseau (Thiais) G. Lucazeau, K. Chhor (Villetaneuse) A.J. Dianoux (ILL) | IN5 | | | |
| 09 03 261 | Reorientational motions in some molecular crystals. C. Sourisseau (Thiais) G. Lucazeau, K. Chhor (Villetaneuse) A.J. Dianoux (ILL) | IN6 | | | |

| | | | | | |
|------------------------|---|----------|------------------------|---|-----------|
| 09 04 281 | Torsional and librational modes of intercalated species in $MnPS_3$. Y. Mathey (Orsay) C. Sourisseau (Thiais) | IN4 | 09 05 306 | Microscopic mechanism of H mobility in hectorite. J. Conard, H. Estrade (Orléans) | IN5 |
| 09 05 237 | Kinetics of absorption and swelling by d-styrene of spherical polystyrene latex particles. J.W. Goodwin, R.H. Ottewill (Bristol) N.M. Harris, J. Tabony (ILL) | D11 | 09 05 306 09 06 338 | Microscopic mechanism of H mobility in hectorite. J. Conard, H. Estrade (Orléans) C. Poinsignon (ILL) | IN10 |
| 09 05 263 | Kinetics of formation of ethylene hydrate. J.P. Beaufils (ILL) R. Pernolet, N. Gerard (Dijon) | D1B | 09 05 307 | Micellar interactions of a nonionic detergent. M. Zulauf (EMBL, Grenoble) J.B. Hayter (ILL) | IN11 |
| 09 05 264 | Measurement of anisotropic conformation of polymeric flexible chain in nematic solvent. A. Dubault, M. Veyssié, C. Casagrande, R. Ober (Paris) | D17 | 09 05 308 | Micellar structures with fluorinated nonionic surfactant and fluorocarbon solubilization. G. Mathis, J.C. Ravey (Nancy) | D11, D17 |
| 09 05 269 | Properties of sterically stabilised non-aqueous latices. D.J. Cebula (ILL) J.W. Goodwin, R.H. Ottewill (Bristol) | D11 | 09 05 313 09 05 279 | Magnetic colloids. D.J. Cebula (ILL) S.W. Charles, J. Popplewell (Bangor) | D17 |
| 09 05 279 | See 09 05 313 | | 09 05 317 | Structure of milk proteins P.H. Stothart (Reading) D.J. Cebula (ILL) | D17 |
| 09 05 281 | Location of alcohol in solutions of mixed (alcohol + surfactant) micelles) R. Zana, C. Picot (Strasbourg) | D17 | 09 05 320 | Location of organic solubilisates in ionic micelles. J.B. Hayter (ILL) J. Penfold (Rutherford) | IN11, D17 |
| 09 05 282 | Structure of polymer + soap aggregates in water. B. Cabane (Orsay) R. Duplessix (Strasbourg) | D11, D1B | 09 05 321 | Hydrodynamic interactions in microemulsions. J.B. Hayter, D.J. Cebula (ILL) R.H. Ottewill (Bristol) P.N. Pusey (Malvern) | IN 11 |
| 09 05 285 | Critical reflection from fatty acid multilayers. R.K. Thomas, R.R. Highfield (Oxford) J.B. Hayter (ILL) P. Cummins (Port Sunlight) | D17 | 09 05 323 | See 09 07 029 | |
| 09 05 287 | Critical reflection from fatty acid multilayers. R.K. Thomas, R.R. Highfield (Oxford) P. Cummins, J. Mingins (Port Sunlight) J.B. Hayter (ILL) | D17, S43 | 09 05 327 | Structure factor for sheared colloids. B.J. Ackerson (Oklahoma) N.A. Clark (Boulder) J.B. Hayter (ILL) | D11 |
| 09 05 291 | The structure of inorganic dispersions in non-aqueous media. D.J. Cebula (ILL) I. Markovic, R.H. Ottewill (Bristol) | D17 | 09 06 264 | Silicates intercalates. J.M. Adams, C. Breen (Aberystwyth) | IN10 |
| 09 05 294 | Configuration of polymers adsorbed on colloidal particles. T. Cosgrove, B. Vincent (Bristol) T.L. Crowley (Oxford) | D11 | 09 06 298 | $C(CH_3)_4/Pt$. A. Renouprez (Lyon) H. Jobic (ILL) | IN4 |
| 09 05 296 | Neutron diffraction experiments on micellar solutions. H. Hoffmann, J. Kalus, K. Reizlein, W. Ulbricht (Bayreuth). | D11 | 09 06 299 | Ethylene adsorbed on platinum black. J. Howard, I. Braid (Durham) J. Tomkinson (Rutherford) | IN4 |
| 09 05 297 | Micellar structures with fluorinated nonionic surfactants and fluorocarbon solubilization. G. Mathis, J.C. Ravey (Nancy) | D11, D17 | 09 06 300 | Influence of the Debye-Waller factor in neutron inelastic scattering. Tejero-Andrade (Lyon) H. Jobic (ILL) | IN1 |
| 09 05 298 | Microemulsions with nonionic surfactants. J.C. Ravey, M. Buzier (Nancy) | D11, D17 | 09 06 301 | I. Hydrogen/Nickel + deuterated hydrocarbon II. Cyclohexane and cyclohexadiene/Nickel H. Jobic (ILL) A. Renouprez (Lyon) | IN1 |
| 09 05 300 09 15 039 | Structure of some surfactant + polymer aggregates in water. B. Cabane (Orsay) R. Duplessix (Strasbourg) | D1B, D17 | 09 06 304 | Hydrocarbons on nickel. A. Renouprez (Lyon) H. Jobic (ILL) | IN2 |
| 09 05 303 | Particle size during the amorphous to crystalline transition of iron (III) hydroxide. A.N. Christensen (Aarhus) M.S. Lehmann, A.F. Wright (ILL) | D11 | 09 06 311 | Dynamics of molecules adsorbed in synthetic zeolite NaA. E. Cohen de Lara (Paris) R. Kahn (LLB, Saclay) | IN10 |
| | | | 09 06 314 | Water in oxide gels. J.D.F. Ramsay (Harwell) H.J. Lauter (ILL) | IN1 |
| | | | 09 06 318 | The forces between clay platelets. R.K. Thomas, C. Skinner (Oxford) D.J. Cebula (Rutherford and ILL) W.G. Stirling (ILL) | IN3 |

| | | | | | |
|-----------|---|------|------------|--|----------|
| 09 06 320 | Hydrogen vibrations in alkali-metal-graphite intercalates. J.W. White, J.P. Beaufils (ILL) T. Crowley, J. McCaffrey (Oxford) | IN1B | 09 07 010 | Structure of adsorbed layers of CD_4 on the cleavage face of $NiCl_2$. Y. Larher, C. Tessier (Saclay) P. Thorel (CEN-G) | D1B |
| 09 06 323 | CD_4 on graphon. R.K. Thomas, J.W. White (Oxford) | IN10 | 09 07 012 | Adsorption site determination in NaA zeolites. E. Cohen de Lara (Paris) R. Kahn (LLB, Saclay) P. Thorel (CEN-G) | D1B |
| 09 06 326 | Mobility of ethane adsorbed on graphite. M. Bienfait, J.P. Coulomb (Marseille) P. Thorel (CEN-G) | IN5 | 09 07 013 | Structure of water adsorbed on hectorite-Na. G. Bomchil, C. Poinignon (ILL) | D2 |
| 09 06 332 | QNS-experiment on $K_{1/3}(H_2O)_{2/3}NbS_2$. C. Riekel (Stuttgart) R. Schöllhorn (Münster) | IN10 | 09 07 017 | Electrochemical formation of a copper monolayer on platinum. G. Riekel (Stuttgart) G. Bomchil (ILL) | D2 |
| 09 06 334 | Investigation of intermolecular forces at surfaces using tunnelling spectroscopy. R.K. Thomas, R.P. Humes (Oxford) | IN5 | 09 07 022 | Diffraction from neopentane adsorbed on rutile. R.K. Thomas, G. Bryson (Oxford) | D2 |
| 09 06 335 | Rotational tunnelling of H_2 in $C_{24}Rb(H_2)_{1.5}$. J.W. White, J.P. Beaufils (ILL) G. Naylor, P. Mehan (Oxford) | IN5 | 09 07 026 | Phase transitions of Ne adsorbed on graphite. H.J. Lauter (ILL) C. Tiby, H. Wiechert (Mainz) | D2 |
| 09 06 338 | See 09 05 306 | | 09 07 029 | Structural investigations of V_2O_5 -gels. P. Aldebert, N. Baffier, J. Livage (Paris) H.W. Hässlin (ILL) | D17, D1B |
| 09 06 339 | Hydrogen on zeolites. T.C. Waddington, J. Howard, I. Braid (Durham) | IN1B | 09 07 030 | Deuterium ordering in $C_{24}Rb$ intercalates. S. Baskett, G. Naylor, J.W. White (Oxford) | D2 |
| 09 06 352 | Chemisorption of benzene on Raney platinum. H. Jobic (ILL) A. Renouprez (Lyon) | IN1 | 09 07 037* | Thiophene adsorbed on molybdenum disulphide. T. Rayment, S. Vasudevan (Cambridge) | D1B |
| 09 06 354 | High pressure adsorption of hydrogen by MoS_2 . C.J. Wright (Harwell) J.M. Thomas (Cambridge) | IN1B | 09 07 040 | Nucleation of $3He$, $4He$ and $36Ar$ on MgO . H.J. Lauter (ILL) C. Tiby, H. Wiechert, G. Knopp (Mainz) | D2 |
| 09 06 355 | Thiophene adsorption on molybdenum sulphide. C.J. Wright (Harwell) R.B. Moyes (Hull) | IN1B | 09 08 004 | Two-dimensional order in the smectic F phase of T.B.P.A. F. Moussa (LLB, Saclay) J. Benattar (Orsay) | D10 |
| 09 06 361 | Neutron scattering studies of adsorbed water and hydrogen. T.C. Waddington, I. Braid, J. Howard (Durham) | IN4 | 09 08 005 | Study of lyotropic nematic phases of amphiphilic molecules. J. Charvolin, Y. Hendrikx (Orsay) M. Rawiso (ILL) | D2, D17 |
| 09 06 363 | Intrazeolitic complexes. J. Howard, I. Braid (Durham) J. Tomkinson (Rutherford) | IN4 | 09 08 006 | Study of nematic lyotropic phases of amphiphilic molecules. J. Charvolin, Y. Hendrikx (Orsay) M. Rawiso (ILL) | D17 |
| 09 06 365 | Investigation of intermolecular forces at surfaces using tunnelling spectroscopy. R.K. Thomas, S.K. Mehta (Oxford) | IN5 | 09 08 007 | Cooperative molecular motions in the smectic B phase of 50.7 and the smectic B- smectic G transition. A.J. Leadbetter (Exeter) R.M. Richardson (Rutherford) W.G. Stirling (ILL) | IN12 |
| 09 06 375 | Dynamics of methane and deuteromethane adsorbed in $C_{24}Cs(CH_4)_x$. J.W. White, F. Trouw (Oxford) | IN6 | 09 08 011 | Cooperative dynamics in the disordered phase of t-butyl cyanide. A.J. Leadbetter, R.C. Ward (Exeter) R.M. Richardson (Rutherford) | IN12 |
| 09 06 378 | H mobility in $KC_8H_{2/3}$. J. Conard, H. Estrade (Orléans) D. Guerard, P. Lagrange (Nancy) | IN6 | 09 08 012 | Cooperative molecular motions in the smectic liquid crystal phases of 50.7 A.J. Leadbetter, R.C. Ward (Exeter) R.M. Richardson (Rutherford) | IN6, IN5 |
| 09 07 001 | Orientational ordering and melting in CD_4 and N_2 layers. A. Glachant, J.P. Coulomb, M. Bienfait (Marseille) | D2 | 09 11 007 | See 09 01 302 | |
| 09 07 005 | Study of commensurate-incommensurate transition in a monolayer of methane adsorbed on graphite. R. Beaume, J. Suzanne, J.P. Coulomb, A. Glachant (Marseille) | D1B | 09 11 018 | Study of the rotational motion of the ester methyl group in PMMA. J.S. Higgins, K. Ma (London) | IN5 |
| 09 07 006 | The phase diagrams of two dimensional inert gas-methane mixtures. R.K. Thomas, S.J. Roser, M. Graham (Oxford) G. Bomchil (ILL) | D2 | | | |

| | | | | | |
|------------|--|----------|-----------|--|-----------|
| 09 11 022 | Cyclic polymers. J.S. Higgins, K. Ma (London) | IN10 | 09 14 011 | Conformation of chain-molecules in solution in a constant shear gradient. P. Kirste (Mainz) P. Lindner, R.C. Oberthür (ILL) | D11 |
| 09 11 025 | Scattering length density increment of polymers in solution from neutron interferometry. R. Oberthür, U. Kischko (ILL) M. Schlenker (CNRS, Grenoble) | D18 | 09 14 012 | Polymer chain conformation in rubbery network. | D11A, D17 |
| 09 11 029 | Dynamics of single polymer chains in different molecular environments. D. Richter (Jülich) B. Ewen, B. Stühn (Mainz) | IN11 | 09 14 016 | H. Benoît, C. Picot, M. Beltzung (Strasbourg) | |
| 09 11 030* | Dynamical scaling in polymer solutions. D. Richter (Jülich) B. Ewen, B. Stühn (Mainz) | IN11 | 09 14 014 | Experimental evidence for reptation concepts in polystyrene bulk stretched then relaxed. M. Nierlich, F. Boué (LLB, Saclay) | D11, D17 |
| 09 11 038 | Molecular dimensions and shape of branched epoxide resins in solution. W. Burchard, S. Bantle, H.U. ter Meer (Freiburg) | D17 | 09 14 015 | Experimental evidence for reptation concepts in polystyrene bulk. F. Boué, M. Nierlich (LLB, Saclay) | D11, D17 |
| 09 11 040 | See 09 15 028 | | 09 14 016 | See 09 14 012 | |
| 09 12 004 | Dimension and conformation of a | D11, D17 | 09 15 003 | Investigation of single phase polymer mixtures. R.S. Stein (Massachusetts) J.S. Higgins, D.J. Walsh, A. Carter, A. Maconnachie (London) | D11 |
| 09 01 306 | polyelectrolyte chain in semi-dilute solutions. M. Nierlich, B. Farnoux (LLB, Saclay) | | 09 15 005 | Conformation and thermodynamics of chain molecules in polymer blends. R. Kirste, J. Jelenic, S. Schmitt- Strecker (Mainz) | D11, D17 |
| 09 12 005 | Conformation of a chain with equally spaced discrete electric charges. J.C. Galin, C. Picot, G. Weill (Strasbourg) | D17 | 09 01 314 | | |
| 09 01 308 | | | 09 15 006 | Study of copolymer-homopolymer blends in the solid state. Y. Gallot, C. Picot, J. Selb, A. Rameau (Strasbourg) | D11A, D17 |
| 09 12 008 | Nature of electrostatic interactions in polyelectrolytes: aqueous chondroitin sulphate. M. Drifford, P. Tivant, J. Tabony (Saclay) | D17 | 09 15 011 | Conformation in two-phase polymeric systems. J.S. Higgins, A.J. Carter (London) | D17 |
| 09 13 001 | Fibres of polyethylene. D.M. Sadler, P.J. Barham, A. Keller (Bristol) P. Smith, P. Lemstra (Geleen) | D11 | 09 15 018 | Domain interface dimensions in block copolymers. R.W. Richards, J.L. Thomason (Glasgow) | D17 |
| 09 13 006 | Molecular conformation in semicrystalline polymers. E.W. Fischer, K. Hahn, B. Jiang (Mainz) | D11 | 09 15 023 | Investigation of scaling theories of polymers adsorbed in pores. R.W. Richards, J.A. Bishop (Glasgow) | D11 |
| 09 13 006 | Molecular conformation in semicrystalline polymers. E.W. Fischer, K. Hahn (Mainz) | D1B | 09 15 028 | Polymers. | IN11 |
| 09 13 007 | Conformation of chain molecules. E.W. Fischer, K. Hahn (Mainz) | D1B | 09 11 040 | J.S. Higgins, K. Ma (London) | |
| 09 13 015* | Molecular conformation in semicrystalline polymers. E.W. Fischer, K. Hahn (Mainz) | D1B | 09 15 038 | The configuration of terminally anchored polymer on polystyrene latex. T. Cosgrove (Bristol) T.L. Crowley (Oxford) | D11 |
| 09 13 015 | Molecular conformation in semicrystalline polymers E.W. Fischer, K. Hahn, U. Struth, P. Kaschanián (Mainz) | D11 | 09 15 039 | See 09 05 300 | |
| 09 13 016 | Morphology of native cellulose. E.W. Fischer, K. Hahn, G.P. Hellmann, R. St. J. Manley (Mainz) | D11 | 9 Test | Stoichiometric equilibrium in C ₂₄ Cs(CD ₄), at 100 K. F. Trouw, J.W. White (Oxford) J.P. Beaufils (ILL) | D2 |

workshops and conferences organised by the i.l.l.

Workshop organized by the I.L.L. in 1981

Workshop on "Semiclassical Approximation in Nuclear Physics" (81 QU 50 S)
(organised by P. Quentin and P. Schuck, I.L.L.)

I.L.L.
18-20 March 1981

Fourth International Symposium on Neutron-Capture Gamma-Ray Spectroscopy and related
Topics, T. von Egidy, F. Gönnerwein, B. Maier, Eds. (organised by I.S.N. and I.L.L.).
Proceedings to be published in "Institute of Physics Conference Series n° 62".

I.S.N.
7-11 September 1981

Workshop on "Water at Interfaces: Water Dynamics at clays, hydroxides, charged polymers
and proteins Surfaces". (81 TO 55 S)
(organised by C. Touret-Poinsignon and P. Timmins, I.L.L.)

I.L.L.
12-13 October 1981

theses

The experimental work of which was carried out at I.L.L.

- B. DORNER Habilitationsarbeit zur Erlangung der Lehrbefähigung im Fach Physik an der Naturwissenschaftlichen Fakultät
II-Physik der Universität Regensburg (1980)
Coherent Inelastic Neutron Scattering in Lattice Dynamics.
- A.R. GREGORY Doktorarbeit, Johann Wolfgang Goethe-Universität, Frankfurt am Main (1981).
Vergleich der Magnetisierungen von Holmium und Eisen in den Kubischen Laves Phasen LuFe_2 und HoFe_2 ,
bestimmt durch Magnetometer-messungen und Beugung spinpolarisierter Neutronen.
- B.R. HECKEL Thesis, Harvard University, Cambridge, Massachusetts, May 1981, The Department of Physics in partial fulfill-
ment of the requirements for the degree of Doctor of Philosophy in the subject of Physics. Parity Non-
Conserving Neutron Spin Rotation: The Tin Isotopes.
- H. JOBIC Thèse de Doctorat d'Etat, Université Claude-Bernard Lyon 1 (octobre 1980).
Etude par Diffusion Inélastique des Neutrons de l'Adsorption du Benzène sur le Nickel et le Platine de Raney.
- M. LESLIE Thesis, St. John's College (June 1981).
Polarised Neutron Diffraction from Oriented Nuclei.
- Z.Q. LI Thèse de Doctorat 3^e Cycle - Grenoble (juin 1981).
Etude aux neutrons de l'A.R.N. de transfert en solution en fonction de l'environnement ionique.
- A. MHEEMED Thèse de Doctorat 3^e Cycle - Grenoble (octobre 1981).
Les structures de Niveaux de ^{114}Cd .
- S.M. SCOTT Thesis, University of Sussex (Oct. 1979).
Directional Correlation Studies of Neutron Rich Barium Isotopes.
- J.L. SOUBEYROUX Thèse de Doctorat d'Etat. Université de Bordeaux I (Sciences) (mai 1981).
Détermination de Structures Cristallines et Magnétiques par Diffraction Neutronique. Application aux Conduc-
teurs Anioniques et aux Composés à Dimensionnalité Restreinte.

Internal Reports 1981

T = Technical Report
S = Scientific Report

- 81 CH 01 T
R. CHEVALIER. Expérience IN 13
- 81 GR 02 T
M. GREVAZ. Gestion Informatique des Rapports d'Expérience
- 81 GR 03 T
M. GREVAZ. Gestion Informatique des Publications
- 81 FR 04 S
A. FREUND. Intensity of Gold Sources for the Gamma-Ray Diffractometer.
- 81 HA 05 S
J. HAYTER, R. PYNN. On the Production of Homogeneous Field Integrals for Neutron Spin-Echo.
- 81 IN 06 S
INSTITUT LAUE-LANGEVIN. Neutron Beam Facilities Available for Users. (January 1981).
- 81 IB 07 S
K. IBEL. Proposal for a New Small Angle Camera at the Second Cold Source (revised version March 1981).
- 81 TH 08 T
M. THOMAS, A. FILHOL. Traitement des données de D 19 A équipé d'un multidétecteur bidimensionnel "Œil de mouche".
- 81 LE 9 T
Y. LEFEBVRE. Expérience PN3 - GAMS 2 et 3.
- 81 MU 10 T
J. MUNNIER. Flipping Unit. Compteur à Présélections Multiples.
- 81 RO 11 T
M. ROURE. Contrôle de D1B par Solar 16/40. Guide d'utilisation.
- 81 HU 12 T
P. HUNGERFORD. S.A. KERR A description of the nuclear physics college multiparameter system.
- 81 GR 13 T
M. GREVAZ. Gestion Informatique du Secrétariat Scientifique.
- 81 LE 14 T
Y. LEFEBVRE. Description de l'Expérience IN 10. Nouvelle version - mars 1981.
- 81 CU 15 T
R. CURRAT. Projet IN 8 B: "Fonctionnement du Beam-stop escamotable et des blocs mobiles de la protection analyseur".
- 81 MA 16 S
Roland P. MAY. The influence of interparticle effects on the shape determination of ribosomal proteins in situ.
- 81 MU 17 T
J. MUNNIER. Module de commande de relais par CAMAC. Réf. RLY-02.
- 81 AL 18 T
J.R. ALLIBON, M.S. LEHMANN, H. DACHS. A list of Computer Programs for Neutron Diffraction.
- 81 BR 19 T
A. BRESSON. Préamplificateurs pour Mesures Cryogéniques.
- 81 CE 20 S
D.J. CEBULA. IN 20: An Optimised 3-axis Spectrometer with Purpose built Polarisation Facilities including a Neutron Spin Echo Option.
- 81 CE 21 S
D.J. CEBULA. Calculation of Optimum Beam Tube and Monochromator Dimensions for the IN 20 Three-Axis Spectrometer.
- 81.BA 22 T
A. BARTHELEMY. GEFIPRO. Gestion de Fiches de Programmes.
- 81 BA 23 T
A. BARTHELEMY. Système Espion.
- 81 GH 24 T
R. GHOSH, G. GREENWOOD. Standardised Plotting Routines SPLT and HPLT.
- 81 OS 25 T
I. OSBORN, R. GHOSH. "Catalogue of User Programs".
- 81 GH 26 T
R.E. GHOSH. TOFLIB. Utility Subroutines. Second edition. July 1981.
- 81 IN 27 S
INSTITUT LAUE-LANGEVIN. Annual Report 1980.
- 81 IN 28 S
INSTITUT LAUE-LANGEVIN. Annex to the Annual Report, 1980.
- 81 GH 29 T
R.E. GHOSH. A Computing Guide for Small Angle Scattering Experiment.
- 81 HE 30 T
R. KLESSE. IN 6 Electronics.
- 81 HE 31 S
S. HEATHMAN. Users Guide and Manual for the Powder Diffractometer D 1 A.
- 81 SC 32 S
J. SCHWEIZER. D 5 and the Polarization Analysis Technique.
- 81 RI 33 T
D.E. RIMMER. Computing and Electronics Department. Annual Report.
- 81 MU 34 T
J. MUNNIER, R. KLESSE, F. EPAUD. Electronique D 16.
- 81 EP 35 T
F. EPAUD. Module Video Ram 2562.
- 81 KO 36 T
A. KOLLMAR, J. JACOBÉ, D. FELTIN. Identification of Higher Order Reflections on an Analyzer Crystal by Measuring the Absorption Profile in the Neutron Detector.
- 81 GO 37 T
R. GOLUB. Upscattering of a Neutron at Rest by Thermally Excited. Rotons in Superfluid He⁴.
- 81 CR 38 S
Mary CROPLEY. An Inelastic Neutron Scattering Study of Cyclopropane Adsorbed onto Partially Mn and Co Exchanged 4A Type Zeolites. (Rapport de stage.)
- 81 BU 39 S
S.K. BURKE, D.J. CEBULA. Use of IN 20 for D 5 B Elastic/Quasielastic Scattering Experiments.
- 81 JO 40 S
J. JOFFRIN, G. BRIGGS, P. CHIEUX, B. RENKER, W. STIRLING. Neutron Beam Facilities in Western Europe. July 1981. Published by the European Science Foundation, Strasbourg.
- 81 KA 41 T
W. KAISER, A. ROBERT. Users Guide for Neutron Shielding. Calculations with the ANISN. Program.

- 81 NA 42 T
Doris NAGEL. Description of the Program LINDA. List Index Alphabetically for Solar 16-40.
- 81 MU 43 T
J. MUNNIER. Système d'acquisition de données modulaire en standard CAMAC.
- 81 BR 44 T
R. BRISSOT, H. FAUST, F. GÖNNENWEIN, J. MOUGEY, LOHENGRIN, review of the past, prospects for the future.
- 81 FA 45 S
H.R. FAUST, P. GELTENBORT, F. GÖNNENWEIN, A. OED. Calibration and adjustment procedures for LOHENGRIN.
- 81 LE 46 T
Y. LEFEBVRE. Expérience D 3. Extensions. **Y. LEFEBVRE.**
- 81 IN 47 T
L'INSTITUT LAUE-LANGEVIN. General BROCHURE.
- 81 BR 48 T
BROWN P.J., MATTHEWMAN J.C. The Cambridge Crystallography Subroutine Library. Extended Mark II User's Manual (RL-81-063)
- 81 SP 49 S
T. SPRINGER (Ed.). The Installation of a Second Cold Source in the High Flux Reactor at the Institut Laue-Langevin.
- 81 QU 50 S
P. QUENTIN, P. SCHUCK (Editors). Workshop on semiclassical methods in nuclear physics, I.L.L. Grenoble, March 18-20, 1981.
- 81 HE 51 T
A.W. HEWAT. D 2 B. A New High Resolution Neutron Powder Diffractometer. Definition and Planning.
- 81 BO 52 S
H.G. BORNER, S.A. KERR. A background analysis with a view to axion measurements at the HFR of the ILL, Grenoble.
- 81 TI 53 S
P.A. TIMMINS, R.P. MAY. D 11: Operating manual.
- 81 CH 54 S
F. CHILDS, J.B. HAYTER, J. PENFOLD, W.G. WILLIAMS. Antireflecting sublayers for neutron thin film polarising mirrors. (RL-81-082)
- 81 TO 55 S
C. TOURET-POINSIGNON, P. TIMMINS (Editors). Workshop on Water at Interfaces: Water dynamics at clays, hydroxides, charged polymers and proteins surfaces. I.L.L., Grenoble, October 12-13, 1981.

**Publications in books,
periodicals,
conference proceedings. 1981**

- 81 AL 101
A. ALASTUEY, B. JANCOVICI. On the Classical Two-Dimensional One-Component Coulomb Plasma. *J. Physique* **42**, 1-12 (1981).
- 81 HA 102
F.D.M. HALDANE. Demonstration of the "Luttinger Liquid" Character of Bethe-Ansatz-Soluble Models of 1-D Quantum Fluids. *Phys. Lett.* **81 A**, 153-155 (1981).
- 81 MC 103
K.A. McEWEN, **W.G. STIRLING.** Magnetic Ordering in Praseodymium at Millikelvin Temperatures. *J. Phys. C* **14**, 157-165 (1981).
- 81 OE 104
A. OED, G. BARREAU, F. GÖNNENWEIN, P. PERRIN, C. RISTORI, P. GELTENBORT. A Fast Beam Coaxial Time Pickoff System. *Nucl. Instrum. & Methods* **179**, 265-270 (1981).
- 81 LY 105
J.W. LYNN, **A. RAGGAZONI, R. PYNN, J. JOFFRIN.** Observation of Long Range Magnetic Order in the Reentrant Superconductor HoMo_6S_8 . *J. Physique, Lettres* **42**, L-45, L-49 (1981).
- 81 NO 106
J. NOUET, **J. PANNETIER, J.L. FOURQUET.** The Room-Temperature Structure of Potassium Tetrafluoroaluminate. *Acta Cryst. B* **37**, 32-34 (1981).
- 81 JU 107
G. JUNG, B. PFEIFFER, P. HUNGERFORD, S.M. SCOTT, F. SCHUSSLER, E. MONNAND, J.A. PINSTON, L.J. ALQUIST, H. WOLLNIK, W.D. HAMILTON. The Level Structure of ^{96}Y from the Decay of ^{96}Sr . *Nucl. Phys. A* **352**, 1-12 (1981).
- 81 LO 108
R.D. LOWDE, R.T. HARLEY, G.A. SAUNDERS, M. SATO, **R. SCHERM, C. UNDERHILL.** On the Martensitic Transformation in f.c.c. Manganese Alloys I. Measurements. *Proc. R. Soc. Lond. A* **374**, 87-114 (1981).
- 81 ME 109
J. MEYER, **G. ZACCAI.** Neutron small angle scattering of the Mo-Fe protein (nitrogenase) from *clostridium pasteurianum*. *Biochemical and Biophysical Research Communications* **98**, 43-50 (1981).
- 81 DO 110
B. DÖRNER, A.A. CHERNYSHOV, V.V. PUSHKAREV, A.Yu. RUMYANTSEV, R. PYNN. Phonons in cadmium at 80 K. *J. Phys. F* **11**, 365-376 (1981).
- 81 LE 111
M. LESLIE, G.T. JENKIN, J.B. HAYTER, J.W. WHITE, S. COX, G. WARNER. Precise Location of Hydrogen Atoms in Complicated Structures by Diffraction of Polarized Neutrons from Dynamically Polarized Nuclei. *Phil. Trans. R. Soc. Lond. B* **290**, 497-503 (1980). (Discussion Meeting on Neutron Scattering in Biology, Chemistry and Physics, London, Sept. 26-27, 1979.)
- 81 BE 112
G.A. BENTLEY, S.A. MASON. Neutron Diffraction Studies of Proteins. *Phil. Trans. R. Soc. Lond. B* **290**, 505-510 (1980). (Discussion Meeting on Neutron Scattering in Biology, Chemistry and Physics, London, Sept. 26-27, 1979.)
- 81 JA 113
B. JACROT. The Use of Neutrons to study protein-RNA interactions. *Phil. Trans. R. Soc. Lond. B* **290**, 627-633 (1980). (Discussion Meeting on Neutron Scattering in Biology, Chemistry and Physics, London, Sept. 26-27, 1979.)
- 81 CA 114
H. CAILLEAU, J.L. BAUDOUR, J. MEINNEL, A. DWORKIN, F. MOUSSA, **C.M.E. ZEYEN.** Double-well Potentials and Structural Phase Transitions in Polyphenyls. *Faraday Discussions of the Chemical Society*, n° 69, 1980: "Phase Transitions in Molecular Solids" pp. 7-18.
- 81 FR 115
J.C. FROST, A.J. LEADBETTER, **R.M. RICHARDSON.** The Phase Transition in t-Butyl Cyanide $[(\text{CH}_3)_3\text{CCN}]$. *Faraday Discussions of the Chemical Society*, n° 69, 1980: "Phase Transitions in Molecular Solids", pp. 32-48.
- 81 HI 116
J.S. HIGGINS, L.K. NICHOLSON, **J.B. HAYTER.** Observation of Single Chain Motion in a Polymer Melt. *Polymer*, **22**, 163-167 (1981).
- 81 SC 117
K. SCHRECKENBACH, H.R. FAUST, F. von FEILITZSCH, A.A. HAHN, K. HAWERKAMP, J.L. VUILLEUMIER. Absolute Measurement of the Beta Spectrum from ^{235}U Fission as a basis for Reactor Antineutrino Experiments. *Phys. Lett.* **99 B**, 251-256 (1981).
- 81 SC 118
A.N. CHRISTENSEN, **P. CONVERT, M.S. LEHMANN.** Hydrothermal Crystal Growth Rate of Goethite and Haematite from Amorphous Iron (III) Hydroxide Investigated by X-Ray Diffraction and Neutron Diffraction. *Acta Chemica Scandinavica A* **34**, 771-776 (1980).
- 81 BO 119
R.A. BOND, D.K. ROSS, **I.S. ANDERSON, C.J. CARLILE.** Neutron Diffraction Studies of the Time Dependence of the 50K Transition in α' Pd/D. in "Physics of Transition Metals 1980", *Inst. Phys. Conf. Ser. Nr. 55* (Institute of Physics 1981), pp. 379-382.
- 81 WI 120
G.A. WILLIAMS, B.N. FIGGIS, R. MASON, **S.A. MASON, P.E. FIELDING.** Structure of Phthalocyaninatocobalt (III) at 4.3 K: A Neutron-Diffraction Study. *J. Chem. Soc. (Dalton Transactions)* 1688-1692 (1980).
- 81 HA 121
J.B. HAYTER, J. PENFOLD. An Analytic Structure Factor for Macroion Solutions. *Mol. Phys.* **42**, 109-118 (1981).
- 81 HO 122
D. HOHLWEIN, **S.A. MASON.** Neutron Photographic Measurements of Protein Single-Crystal Reflections. *J. Appl. Cryst.* **14**, 24-27 (1981).
- 81 SI 123
P. SIMMS. An Adjustable Diaphragm/collimator for Neutron Diffraction Experiments. *J. Appl. Phys.* **14**, 58-59 (1981).
- 81 BU 124
S.K. BURKE. Magnetic Small-angle Neutron Scattering from Ferromagnetic Fine Particles: Modification of the Guinier law. *J. Phys. F*, **11**, L 53-L-58 (1981).
- 81 PI 125
J. PIERRE, **A.P. MURANI, R.M. GALERA.** Magnetic Susceptibility, Electrical Resistivity and Neutron Spectroscopy of some Cubic Cerium Intermetallics. *J. Phys. F*, **11**, 679-98 (1981).
- 81 MU 126
A.P. MURANI. Spectral Distribution of Relaxation Times in Spin Glasses. *J. Magn. & Magn. Mat.* **22**, 271-281 (1981).
- 81 TA 127
H. TAKEUCHI, S. SUZUKI, **A.J. DIANOUX, G. ALLEN.** Low frequency vibrations in crystalline biphenyl: Model calculations and Raman and neutron spectra. *Chemical Physics* **55**, 153-162 (1981).
- 81 TA 128
J.M. TARASCON, **J.L. SOUBEYROUX, J. ETOURNEAU, R. GEORGES, J.M.D. COEY, O. MASSENET.** Magnetic structures determined by neutron diffraction in the $\text{EuB}_{6-x}\text{C}_x$ system. *Solid State Communications* **37**, 133-137 (1981).
- 81 RO 129
P.K. ROGAN, G. ZACCAI. Hydration in purple membrane as a function of relative humidity. *Journal of Molecular Biology* **145**, 281-284 (1981) (Letters to the Editor).
- 81 BE 130
G.A. BENTLEY, J.T. FINCH, A. LEWIT-BENTLEY. Neutron diffraction studies on crystals of nucleosome cores using contrast variation. *Journal of Molecular Biology* **145**, 771-784 (1981).

- 81 DE 131
F. DENOYER, A.H. MOUDDEN, A. BELLAMY, R. CURRAT, C. VETTER, M. LAMBERT. Phases à structures modulées de la thiourée : accrochages sur des valeurs entières de la période de modulation. Comptes rendus des Séances de l'Académie des Sciences de Paris, **292**, Série II, 13-16 (1981).
- 81 BU 132
T.W. BURKHARDT. Localisation-delocalisation transition in a solid-on-solid model with a pinning potential. Journal of Physics A **14**, L 63-L 68 (1981).
- 81 HA 133
J.P. HANSEN. On the Equivalence of two Models of Charged Hard Spheres in a Uniform Background. J. Phys. C. **14**, L 151-L 154 (1981).
- 81 CL 134
S. CLOUGH, A. HEIDEMANN, M. PALEY. The Temperature Dependence of Methyl Tunnelling Motion in Three Acetates. J. Phys. C. **14**, 1001-1008 (1981).
- 81 SC 135
U. SCHMELZER, E.L. BOKHENKOV, B. DORNER, J. KALUS, G.A. MACKENZIE, I. NATKANIEC, G.S. PAWLEY, E.F. SHEKA. Pressure Dependence of Phonon Energies in d_8 -naphthalene. J. Phys. C. **14**, 1025-1041 (1981).
- 81 BA 136
P. BASTIE, M. VALLADE, C. VETTER, C.M.E. ZEYEN, H. MEISTER. Neutron Diffractometry Investigation of the Tricritical point of KH_2PO_4 . J. Physique **42**, 445-458 (1981).
- 81 BR 137
P.J. BROWN, K.R.A. ZIEBECK, J.A.C. BLAND, P.J. WEBSTER. An Investigation of Pd-Mn-Sb Alloys using polarised neutrons. J. Phys. D **14**, 511-522 (1981).
- 81 TR 138
A. TRESSAUD, J.L. SOUBEYROUX, J.M. DANCE, R. SABATIER, P. HAGENMULLER, B.M. WANKLYN. Etude de la structure magnétique et de la transition de type "Spin-flop" de Rb_2FeF_5 . Solid State Communications **37**, 479-484 (1981).
- 81 JA 139
U.A. JAYASOORIYA, G.J. KEARLEY, S.F.A. KETTLE, H.J. LAUTER. A Comparison of Inelastic Neutron Scattering and Vibrational Spectral Data for Phase V of Ammonium Nitrate. Physica Status Solidi (a) **63**, 169-177 (1981).
- 81 DA 140
P. DAY, C. VETTER. Pressure dependence of the incommensurate magnetic phase of NiBr_2 and $\text{Ni}_{0.92}\text{Zn}_{0.08}\text{Br}_2$. J. Phys. C **14**, L 195-L 197 (1981).
- 81 AL 141
A. ALASTUEY, B. JANCOVICI. Absence of Strict Crystalline Order in a Two-Dimensional Electron System. J. Stat. Phys. **24**, 443-449 (1981).
- 81 BE 142
J.R. GAVARRI, J.P. VIGOUROUX, G. CALVARIN, A.W. HEWAT. Structure de SnPb_2O_4 à Quatre Températures: Relation entre Dilatation et Agitation Thermiques. J. Solid State Chem. **36**, 81-90 (1981).
- 81 NU 143
N. NÜCKER, J. DAUBERT, H. JEX, M. MÜLLNER, J.B. SUCK. The Phonon Frequency Distribution of the three Modifications of NaCN. J. Phys. C. **14**, 1217-1223 (1981).
- 81 HO 144
D. HOHLWEIN, A.F. WRIGHT. A Low-Temperature Weissenberg Camera for Neutrons. J. Appl. Cryst. **14**, 82-84 (1981).
- 81 DA 145
W.F. DAVIDSON, D.D. WARNER, R.F. CASTEN, K. SCHRECKENBACH, H.G. BÖRNER, J. SIMIC, M. STOJANOVIC, M. BOGDANOVIC, S. KOICKI, W. GELLETLY, G.B. ORR, M.L. STELTS. Identification of all Intrinsic Excitations below 2 MeV in ^{168}Er . J. Phys. G. **7**, 455-528 (1981). Addendum/ corrigendum J. Phys. G **7**, 843-844 (1981).
- 81 CE 146
D.J. CEBULA, R.H. OTTEWILL. Neutron Diffraction Studies on Lithium Montmorillonite-Water Dispersions. Clays and Clay Minerals **29**, 73-75 (1981).
- 81 TI 147
C. TIBY, H. WIECHERT, H.J. LAUTER, J. SCHAAB. Absence of Continuous Growth for bcc and hcp Solid ^3He on Grafoil. J. Physique Lettres **42**, L-155-L-158 (1981).
- 81 ME 148
C. MEYER, F. HARTMANN-BOUSTRON, Y. GROS, Y. BERTHIER, J.L. BUEVOZ. Detailed Study of NdFe_2 and Additional Results Relative to PrFe_2 and YbFe_2 . Comparison with other R.E. Fe_2 Compounds. J. Physique **42**, 605-620 (1981)
- 81 BE 149
H. BERTAGNOLLI, P. CHIEUX. A Neutron Diffraction Study of a Hydrogen containing Organic Liquid CHCl_3 as an Example. Ber. Bunsenges. Phys. Chem. **84**, 1225-1231 (1980).
- 81 CU 150
M. CUILLEL, B. JACROT, M. ZULAUF. AT = 1 Capsid formed by Protein of Brome Mosaic Virus in the Presence of Trypsin. Virology **110**, 63-72 (1981).
- 81 GA 151
R. GÄHLER, A.G. KLEIN, A. ZEILINGER. Neutron Optical Tests of Nonlinear Wave Mechanics. Phys. Rev. A **23**, 1611-1617 (1981).
- 81 SU 152
J.B. SUCK, H. RUDIN, H.J. GÜNTHERODT, H. BECK, J. DAUBERT, W. GLÄSER. Dynamical Structure Factor and Frequency Distribution of Amorphous $\text{Cu}_{46}\text{Zr}_{54}$. In "Liquid and Amorphous Metals". E. Lüscher and H. Coufal Eds., (Sijthoff & Noordhoff 1980), pp. 649-652. Proc. of the Nato Advanced Study Institute Series E n° 36, Zwiesel, Germany, Sept. 11-22 (1979).
- 81 HO 153
S. HORN, E. HOLLAND-MORITZ, M. LOEWENHAUPT, F. STEGLISH, H. SCHEUER, A. BENOIT, J. FLOUQUET. Magnetic Neutron Scattering and Crystal-Field States in CeCu_2Si_2 . Phys. Rev. B **23**, 3171-3176 (1981).
- 81 KL 154
A.G. KLEIN, P.D. KEARNEY, G.I. OPAT, A. CIMMINO, R. GÄHLER. Neutron Interference by Division of Wavefront. Phys. Rev. Letters **46**, 959-962 (1981).
- 81 LI 155
D.C. LICCIARDELLO, D.L. STEIN, F.D.M. HALDANE. Excitations and Metastability in Amorphous Semiconductors. Phil. Mag. B **43**, 189-201 (1981).
- 81 WR 156
A.F. WRIGHT, M. BERNERON, S.P. HEATHMANN. Radial Collimator System for Reducing Background Noise during Neutron Diffraction with Area Detectors. Nucl. Instrum. & Methods **180**, 655-658 (1981).
- 81 LO 157
D. LORIN, J.M. DANCE, J.L. SOUBEYROUX, A. TRESSAUD, P. HAGENMULLER. Ferromagnetic Ordering in the MMnF_3 Series (M = Ni, Cu, Zn, Pd). J. Magn. & Magn. Mat. **23**, 92-96 (1981).
- 81 LE 158
S. LEFEBVRE, F. BLEY, M. FAYARD, M. ROTH. Neutron Diffractometry Investigation of Different States of Local Order in $^{62}\text{Ni}_{0.765}\text{Fe}_{0.235}$. Acta Metallurgica **29**, 749-761 (1981).
- 81 CE 159
D.J. CEBULA, S.W. CHARLES, J. POPPLEWELL. The Structure of Magnetic Particles Studied by Small Angle Neutron Scattering. Colloid & Polymer Sci. (Letter to the Editors). **259**, 395-397 (1981).
- 81 AL 160
A. ALASTUEY, B. JANCOVICI. Equilibrium Statistical Mechanics of a Nearly Classical One-Component Plasma in a Magnetic Field, in Three or Two Dimensions. Physica **106 A**, 290-291 (1981).
- 81 WR 161
A.F. WRIGHT, M.S. LEHMANN. The Structure of Quartz at 25 and 590° C Determined by Neutron Diffraction. J. of Solid State Chem. **36**, 371-380 (1981).
- 81 WI 162
C.G. WINDSOR, J.C. DAMIEN, J. LEFEBVRE, R.M. RICHARDSON. The Neutron Scattering Function $S(Q, \omega)$ from Adamantane. J. Phys. C. **14**, 1555-1567 (1981).

- 81 WI 163
C. WILKINSON, F. SINCLAIR, P. GARDNER, J.B. FORSYTH, B.M.R. WANKLYN. The Antiferromagnetic Structure of DyMn_2O_5 at 4.2. K. J. Phys. C. **14**, 1671-1683 (1981).
- 81 ME 164
S. MEGTERT, R. COMES, C. VETTER, R. PYNN, A.F. GARITO. Structural Evidence of $2k_F$ Commensurability Effects in TTF-TCNQ under High Pressure. Solid State Commun. **37**, 875-877 (1981).
- 81 AD 165
J.M. ADAMS, V. RAMDAS, A.W. HEWAT. Neutron Profile Refinement of $4\text{Na}_2\text{SO}_4 \cdot 2\text{D}_2\text{O}_2 \cdot \text{NaCl}$. Acta Cryst. **B 37**, 915-917 (1981).
- 81 GE 166
W. GELLETLY, S.J. BLAKEWAY, R.F. CASTEN, K. SCHRECKENBACH. L- and M-Subshell Conversion Line Intensity Ratios for Pure E2 Transition in ^{168}Er . Phys. Lett. **101 B**, 21-26 (1981).
- 81 WI 167
D.E.G. WILLIAMS, K.R.A. ZIEBECK, D.A. HUKIN, A. KOLLMAR. Magnetic Excitations in Pt_3Cr and Pt_5MnCr . J. Phys. F. **11**, 1119-1122 (1981).
- 81 BR 168
M. BRACK, P. QUENTIN. The Strutinsky Method and its Foundation from the Hartree-Fock-Bogoliubov Approximation at Finite Temperature. Nucl. Phys. **A 361**, 35-82 (1981).
- 81 MA 169
G. MARIOLOPOULOS, Ch. HAMELIN, J. BLACHOT, J.P. BOCQUET, R. BRISSOT, J. CRANÇON, H. NIFENECKER, Ch. RISTORI. Charge Distributions in Low-Energy Nuclear Fission and their Relevance to Fission Dynamics. Nucl. Phys. **A 361**, 213-241 (1981).
- 81 KL 170
A.G. KLEIN, P.D. KEARNEY, G.I. OPAT, R. GÄHLER. Focusing of Slow Neutrons with Cylindrical Zone Plates. Phys. Lett. **83 A**, 71-73 (1981).
- 81 CH 171
M.R. CHOWDHURY, J.C. DORE, P. CHIEUX. Neutron Diffraction Studies of Vapour-deposited Ammonia- ND_3 . J. of Non-Crystalline Solids **43**, 267-278 (1981).
- 81 WI 172
A. WIEDENMANN, P. BURLET, H. SCHEUER, P. CONVERT. Spin Correlation in the Quasi-1 D Spin Glass FeMgBO_4 . Solid State Commun. **38**, 129-133 (1981).
- 81 BE 173
J.P. BEAUFILS, Y. BARBAUX. Determination, par Diffraction Différentielle de Neutrons des faces Cristallines exposées par des Supports de Catalyseurs en Poudre. J. Chim. Phys. **78**, 347-352 (1981).
- 81 BE 174
P.J. BECKER, G.A. GEHRING, R. GHOSH, M. STEINER. Neutron Scattering Study of Cooperative Jahn-Teller Effects in TmAsO_4 . J. Phys. C **14**, 1945-1954 (1981).
- 81 RO 175
J.M. ROWE, J.J. RUSH, R. PYNN, A. HEIDEMANN, K.H. MICHEL. Observation of Critical Dynamics in ND_4Br by High-Resolution Neutron Spectroscopy. J. Chem. Phys. **74**, 5323-5324 (1981).
- 81 KN 176
K. KNORR, A. LOIDL, B. STUHN, J.L. BUEVOZ. Modulated Magnetic Structures of ErPb_3 , HoPb_3 , ErTi_3 , and HoTi_3 . Z. Physik B **41**, 315-320 (1981).
- 81 KE 177
P.O. KETTUNEN, T. LEPISTO, G. KOSTORZ, G. GÖLTZ. Voids Produced by Fatigue in Copper Single Crystals of $\langle 111 \rangle$ -Orientation. Acta Metallurgica **29**, 969-972 (1981).
- 81 WA 178
G. WAGEMANS, E. ALLAERT, A. DE CLERQ, P. D'HONDT, A. DERUYTTER, G. BARREAU, A. EMSALLEM. The (n_{th}, α) Reaction on ^{233}U , ^{235}U and ^{238}U and Determination of the $^{238}\text{U}(n_{\text{th}}, \alpha)^{235}\text{Th}$ Reaction Characteristics. Nucl. Phys. **A 362**, 1-7 (1981).
- 81 NO 179
A. NORLUND-CHRISTENSEN, R.G. HAZELL, M.S. LEHMANN. An X-Ray and Neutron Diffraction Investigation of the Crystal Structure of γ -NbN. Acta Chemica Scandinavica **A 35**, 111-115 (1981).
- 81 ZI 180
K.R.A. ZIEBECK, P.J. BROWN, J.G. BOOTH, J.A.C. BLAND. Observation of Spatial Magnetic Correlations in the Paramagnetic Phase of Weak Ferromagnets; short-range magnetic order in MnSi at $20 T_N$. J. Phys. F. **11**, L 127-30 (1981).
- 81 LA 181
P. LABARBE, A.K. BANDYOPADHYAY, J. ZARZYCKI, A.F. WRIGHT. Stabilisation of Crystal Densities during Nucleation of Glass Ceramics: a Hidden Ripening Process. J. of Non Cryst. Solids **43**, 433-438 (1981).
- 81 CH 182
S.L. CHAPLOT, G.S. PAWLEY, E.L. BOKHENKOV, E.F. SHEKA, B. DORNER, J. KALUS, V.K. JINDAL, I. NATKANIEC. Eigenvectors of Low Frequency Internal Phonons in Crystalline Anthracene- d_{10} . Chem. Phys. **57**, 407-414 (1981).
- 81 BU 183
T.W. BURKHARDT, V.R. VIEIRA. Molecular-Field Theory of Interface Pinning in an External Potential. J. Phys. A **14**, L 223-L 227 (1981).
- 81 CA 184
H. CAPELLMANN, R.E. PRANGE. Green's Function in a Disordered Spin-Exchange Field. Phys. Rev B **23**, 4709-4713 (1981).
- 81 MA 185
H. MALETTA, W. ZINN, H. SCHEUER, S.M. SHAPIRO. Search for Spin Waves in (Eu, Sr)S Spin Glasses. J. Appl. Phys. **52**, 1735-1737 (1981). Proc. of the 26th Annual Conf. on Magnetism and Magnetic Materials, Dallas, Texas, 11-14 Nov. 1980 (Ed. J.C. Bonner, R.C. O'Handley and J.F. Janak).
- 81 CO 186
M.M.R. COSTA, J.G. BOOTH, K.R.A. ZIEBECK, P.J. BROWN. Diffuse Magnetic Elastic Scattering of Neutrons from Cr-Fe and Cr-Co Alloys. J. Appl. Phys. **52**, 1681-1683 (1981). Proc. of the 26th Annual Conf. on Magnetism and Magnetic Materials, Dallas, Texas, 11-14 Nov. 1980 (Ed. J.C. Bonner, R.C. O'Handley and J.F. Janak).
- 81 BO 187
J.P. BOUCHER, L.P. REGNAULT, J. ROSSAT-MIGNOD, J.P. RENARD, J. BOUILLOT, W.G. STIRLING. Experimental Evidence for Magnetic Solitons in the Antiferromagnetic Chains of $(\text{CD}_3)_4\text{NMnCl}_3$. J. Appl. Phys. **52**, 1956-1960 (1981). Proc. of the 26th Annual Conf. on Magnetism and Magnetic Materials, Dallas, Texas, 11-14 Nov. 1980 (Ed. J.C. Bonner, R.C. O'Handley and J.F. Janak).
- 81 LO 188
J.M. LOVELUCK, T. SCHNEIDER, E. STOLL, H.R. JAUSLIN. A Comparison of Static and Dynamic Properties of One-dimensional Magnets and Corresponding sG system. J. Appl. Phys. **52**, 1965-1967 (1981). Proc. of the 26th Annual Conf. on Magnetism and Magnetic Materials Dallas, Texas, 11-14 Nov. 1980 (Ed. J.C. Bonner, R.C. O'Handley and J.F. Janak).
- 81 DE 189
J. DEPORTES, D. GIVORD, K.R.A. ZIEBECK. Evidence of Short Range Magnetic Order at Four Times T_c in a Metallic Compound containing Fe: Susceptibility and Paramagnetic Scattering in CeFe_2 . J. Appl. Phys. **52**, 2074-2076 (1981). Proc. of the 26th Annual Conf. on Magnetism and Magnetic Materials. Dallas, Texas, 11-14 Nov. 1980 (Ed. J.C. Bonner, R.C. O'Handley and J.F. Janak).
- 81 GI 190
D. GIGNOUX, R. LEMAIRE, P. MOLHO, F. TASSET. New Properties Associated with the Occurrence of d-band Magnetism in the Y-Ni Compounds. J. Appl. Phys. **52**, 2087-2089 (1981). Proc. of the 26th Annual Conf. on Magnetism and Magnetic Materials, Dallas, Texas, 11-14 Nov. 1980 (Ed. J.C. Bonner, R.C. O'Handley and J.F. Jansk).

- 81 BO 191
J.G. BOOTH, K.R.A. ZIEBECK. Temperature Variation of the Magnetic Inelastic Neutron Scattering from Pure Chromium. *J. Appl. Phys.* **52**, 2107-2109 (1981). Proc. of the 26th Annual Conf. on Magnetism and Magnetic Materials, Dallas, Texas, 11-14 Nov. 1980 (Ed. J.C. Bonner, R.C. O'Handley and J.F. Jansk).
- 81 BO 192
H.G. BOHN, W. ZINN, B. DORNER, A. KOLLMAR. Neutron Scattering Study of Spin Waves and Exchange Interactions in Ferromagnetic and Paramagnetic EuS. *J. Appl. Phys.* **52**, 2228-2230 (1981). Proc. of the 26th Annual Conf. on Magnetism and Magnetic Materials, Dallas, Texas, 11-14 Nov. 1980 (Ed. J.C. Bonner, R.C. O'Handley and J.F. Jansk).
- 81 HA 193
J.B. HAYTER, R.R. HIGHFIELD, B.J. PULLMAN, R.K. THOMAS, A.I. McMULLEN, J. PENFOLD. Critical Reflection of Neutrons. *J. Chem. Soc. Faraday Trans. 1*, **77**, 1437-1448 (1981).
- 81 KL 194
A.G. KLEIN, G.I. OPAT, A. CIMMINO, A. ZEILINGER, W. TREIMMER, R. GÄHLER. Neutron Propagation in Moving Matter: The Fizeau Experiment with Massive Particles. *Phys. Rev. Lett.* **46**, 1551-1554 (1981).
- 81 VO 195
F. VOLINO, A.F. MARTIN, A.J. DIANOUX. Temperature Dependence of DMR Splittings in Nematic PAA: A Quantitative Interpretation in Terms of Changes in the Molecular Conformation - Comparison with Other Models. *Mol. Cryst. Liq. Cryst.* **66**, 37-56 (1981).
- 81 SU 196
J.B. SUCK, H. RUDIN, H.J. GÜNTHERODT, H. BECK. Dynamical Structure Factor and Vibrational Density of States of the Metallic Glass $Mg_{70}Zn_{30}$ measured at Room Temperature. *J. Phys. C*, **14**, 2305-2317 (1981).
- 81 FI 197
K.H. FISCHER. Kondo Effect in Spin Glasses: Electrical Resistivity. *Z. Phys. B* **42**, 27-38 (1981).
- 81 SC 198
M. SCHUMACHER, F. SMEND, W. MÜCKENHEIM, P. RULLHUSEN, H.G. BÖRNER. Nuclear Photoexcitation and Delbrück Scattering Studied in the Energy Range 2-8 MeV. *Z. Phys. A*, **300**, 193-203 (1981).
- 81 BO 199
J.X. BOUCHERLE, J.L. BUEVOZ, S. HORN, M. LOEWENHAUPT, H. SCHEUER, J. SCHWEIZER, F. STEGLICH. Evolution of the Modulated Antiferromagnetic Structure of $CeAl_2$ in the Presence of Nonmagnetic Impurities. *Solid State Commun.* **38**, 669-671 (1981).
- 81 OK 200
A.I. OKOROKOV, A.G. GUSAKOV, V.V. RUNOV, M. ROTH. Polarization Effects in the Scattering of Cold Neutrons from Iron above T_c . *Solid State Commun.* **38**, 583-587 (1981).
- 81 QU 201
P. QUENTIN. Vers une description microscopique de la fission nucléaire? Comptes rendus de la 6^e session d'études biennales de Physique nucléaire, Aussois, Février 1981. LYCEN report 81-02, pp. C.17.1-13 (1981).
- 81 KE 202
U. KEYSER, F. MÜNNICH, B. PAHLMANN, B. PFEIFFER. Experimental Beta-Decay Energies of Very Neutron-Rich Cs Isotopes. *Z. Phys. A* **300**, 249-250 (1981).
- 81 SP 203
T. SPRINGER, B. MAIER. Neutronen erforschen den Bauplan der Materie. Der Höchststufensreaktor in Grenoble. *Bild der Wissenschaft* **18** (n° 7) 52-59 (1981).
- 81 BO 204
J.C. BOULOUX, J.L. SOUBEYROUX, G. LE FLEM, P. HAGENMULLER. Bidimensional Magnetic Properties of β - Sr_2MnO_4 . *J. Solid State Chem.* **38**, 34-39 (1981).
- 81 EG 205
T. VON EGIDY, G. BARREAU, H.G. BÖRNER, W.F. DAVIDSON, J. LARYSZ, D.D. WARNER, P.H.M. VAN ASSCHE, K. NYBØ, T.F. THORSTEINSEN, G. LØVHØIDEN, E.R. FLYNN, J.A. CIZEWSKI, R.K. SHELIN, D. DECMAN, D.G. BURKE, G. SLETTEN, N. KAFFRELL, W. KURCEWICZ, T. BJÖRNSTAD, G. NYMAN. The Rotational Structure of ^{227}Ra . *Nucl. Phys. A* **365**, 26-60 (1981).
- 81 HO 206
S. HORN, F. STEGLICH, M. LOEWENHAUPT, H. SCHEUER, W. FELSCH, K. WINZER. The magnetic behavior of CeB_6 : comparison between elastic and inelastic neutron scattering, initial susceptibility and high-field magnetization. *Zeitschrift für Physik B* **42**, 125-134 (1981).
- 81 SU 207
J.B. SUCK, H. RUDIN, H.-J. GÜNTHERODT, H. BECK. Dynamical structure factor of the metallic glass $Ca_{70}Mg_{30}$ at room temperature. *J. Phys. F* **11**, 1375-1383 (1981).
- 81 MO 208
P. MORIN, D. SCHMITT, C. VETTER. Magnetic excitations in the quadrupolar phase of $Tm_{0.9}Lu_{0.1}Zn$. *J. Phys. F* **11**, 1487-1493 (1981).
- 81 FI 209
A. FILHOL, G. BRAVIC, J. GAULTIER, D. CHASSEAU, C. VETTER. Room- and high-pressure neutron structure determination of tetrathial-fulvalene-7,7, 8,8-tetracyano-p-quinodimethane (TTF-TCNQ). Thermal expansion and isothermal compressibility. *Acta Crystallographica B* **37**, 1225-1335 (1981). *Acta Crystallographica - Corrigendum B* **37**, 2120 (1981).
- 81 CL 210
S. CLOUGH, A. HEIDEMANN, A.J. HORSEWILL, J.D. LEWIS, M.N.J. PALEY. The correlation of methyl tunnelling and thermally activated reorientation. *Journal of Physics C* **14**, L 525-L 529 (1981).
- 81 HA 211
F.D.M. HALDANE. "Luttinger liquid theory" of one-dimensional quantum fluids: I. Properties of the Luttinger model and their extension to the general 1D interacting spinless Fermi gas. *Journal of Physics C* **14**, 2585-2609 (1981).
- 81 MA 212
G. MAISANO, P. MIGLIARDO, F. WANDERLINGH, M.P. FONTANA, M.C. BELLISSENT-FUNEL, M. ROTH. Small angle neutron scattering and structural properties in electrolytic solutions. *Solid State Communications* **38**, 827-830 (1981).
- 81 RA 213
T. RAYMENT, R.K. THOMAS, G. BOMCHIL, J.W. WHITE. The Structure and Properties of Methane Adsorbed on Graphitized Carbon Black determined by Neutron Diffraction. *Mol. Phys.* **43**, 601-620 (1981).
- 81 RI 214
D. RICHTER, A. BAUMGÄRTNER, K. BINDER, B. EWEN, J.B. HAYTER. Dynamics of Collective Fluctuations and Brownian Motion in Polymer Melts. *Phys. Rev. Lett.* **47**, 109-113 (1981).
- 81 ST 215
M. STEINER, K. KAKURAI, W. KNOP, B. DORNER, R. PYNN, U. HAPPEK, P. DAY, G. McLEEN. Collective Excitations in the 1-D-Ferromagnet $CsFeCl_3$ with Singlet Ground State. *Solid State Commun.* **38**, 1179-1184 (1981).
- 81 RA 216
H. RAUH, R. GEICK, H. KÖHLER, N. NÜCKER, N. LEHNER. Generalised Phonon Density of States of the Layer Compounds Bi_2Se_3 , Bi_2Te_3 , Sb_2Te_3 and $Bi_2(Te_{0.5}Se_{0.5})_3$, $(Bi_{0.5}Sb_{0.5})_2Te_3$. *J. Phys. C*, **14**, 2705-2712 (1981).
- 81 FU 217
H. FUOSS, N. BURGER, J.W. BATS. Deformationsdichteverteilung in Salzen Komplexer Anionen I: X-N-Dichte in α -Calciumformiat bei 100 K und 296 K. *Zeitschrift für Kristallographie* **156**, 219-232 (1981).

81 NI 218

L.K. NICHOLSON, J.S. HIGGINS, J.B. HAYTER. Dynamics of Dilute Polymer Solutions. *Macromolecules* **14**, 836-843 (1981).

81 FI 219

K.H. FISCHER. Thermopower of Spin Glasses. *Z. Phys. B.* **42**, 245-252 (1981).

81 TR 220

A. TRESSAUD, J.L. SOUBEYROUX, H. TOUHARA, G. DEMAZEAU, F. LANGLAIS. On a New Structural Type of Fluorine Compounds: Crystal and Magnetic Structures of a High Pressure Form of PdF_2 . *Mat. Res. Bull.* **16**, 207-214 (1981).

81 GA 221

R.M. GALERA, A.P. MURANI, J. PIERRE. Magnetic Interactions and Crystal Field in RMg_3 Compounds ($R = \text{Ce, Pr, Nd}$). *J. Magn. & Magn. Mat.* **23**, 317-322 (1981).

81 AD 222

W. ADLHART, F. FREY, C. ZEYEN. Dynamic Origin of Order Phenomena in Feldspars (Anorthite). *Naturwissenschaften* **68**, 372-373 (1981).

81 BO 223

A. BOEUF, R. COPPOLA, F. ZAMBONARDI, J.P. MORVELAT, F. RUSTICHELLI, D. WENGER. Time dependence at 600 and 650° C of M_{23}C_6 precipitate composition in AISI 304 stainless steel. *Journal of Materials Science* **16**, 1975-1979 (1981).

81 KR 224

K.L. KRATZ, A. SCHROEDER, H. OHM, G. JUNG, B. PFEIFFER, F. SCHUSSLER. Observation of beta-delayed neutron decay to excited 0^+ states in the residual nucleus: the case $^{97}\text{Rb}(\beta\text{ny})^{96}\text{Sr}$. *Physics Letters* **103 B**, 305-308 (1981).

81 SE 225

R. SEIFERT, W. TREIMER, O. SCHAEPPF, H. STROTHMANN, G. GOELTZ. Determination of the Bloch wall thickness in Fe-4 at %Si single crystals by neutron small angle scattering. *Colloid and Polymer Science* **259**, 666-669 (1981).

81 DE 226

R. DECKER, K.D. WUENSCH, H. WOLLNIK, G. JUNG, J. MUENZEL, G. SIEGERT, E. KOGLIN. Präzise Q_β -Wert-Messungen mit einem Intrinsic-Germanium-Detektor an schweren, neutronenreichen Spaltprodukten. *Zeitschrift für Physik A* **301**; 165-175 (1981).

81 PR 227

M. PRAGER, W. PRESS, A. HEIDEMANN. Rotational tunneling in phase III of CD_4 . *Journal of Chemical Physics* **75**, 1442-1450 (1981).

81 FA 228

J. FABER, G.H. LANDER, P.J. BROWN, A. DELAPALME. Neutron diffraction study of thermal parameters in UX_3 compounds. *Acta Crystallographica A* **37**, 558-565 (1981).

81 HA 229

J.P. HANSEN, D. LEVESQUE. The two-dimensional one-component plasma in the hypernetted chain approximation. *Journal of Physics C* **14**, L 603-L 608 (1981).

81 ME 230

G. MELCHART, G. CHARPAK, F. SAULI, G. PETERSEN, J. JACOBÉ. The multistep avalanche chamber as a detector for thermal neutrons. *Nuclear Instruments and Methods* **186**, 613-620 (1981).

81 MA 231

G. MARION, R. ALMAIRAC, J. LEFEBVRE, M. RIBET. Neutron Study of the Incommensurate Phase in $(\text{N}(\text{CD}_3)_4)_2\text{ZnCl}_4$ Crystal. *J. Phys. C* **14**, 3177-3185 (1981).

81 HA 232

J.B. HAYTER, J. PENFOLD. Self-Consistent Structural and Dynamic Study of Concentrated Micelle Solutions. *J. Chem. Soc. Faraday Transactions I*, **77**, 1851-1863 (1981).

81 RO 233

W.L. ROTH, M. ANNE, D. TRANQUI, A. HEIDEMANN. Structure and Ion Transport in Beta' Alumina. In "Fast Ion Transport in Solids", P. Vashishta, J.N. Mundy and G.K. Shenoy Eds. (North-Holland, 1980), pp. 267-271. Proc. of the Int. Conf. on Fast Ion Transport in Solids, Electrodes and Electrolytes, Lake Geneva, Wisconsin, U.S.A., May 21-25, 1979.

81 SU 234

J.B. SUCK, J.H. PEREPEZKO, I.E. ANDERSON, C.A. ANGELL. Temperature Dependence of the Dynamic Structure Factor for Supercooled $\text{Sn}_{1-x}\text{Pb}_x$ alloys: A Test of Instability Theories for the Liquid-Solid Phase Transition. *Phys. Rev. Lett.* **47**, 424-427 (1981).

81 BE 235

L. BERNARD, A.N. FITCH, A.T. HOWE, A.F. WRIGHT, B.E.F. FENDER. Hydrogen Ordering Effects in $\text{DUO}_2\text{AsO}_4 \cdot 4\text{D}_2\text{O}$. *J. Chem. Soc.: Chemical Communications* n° 15, 784-786 (1981).

81 JA 236

D. JANSSEN, P. SCHUCK. Symmetry Conserving Generalisation of Hartree-Fock Bogoliubov Theory. I. Particle number. *Z. Phys. A* **301**, 255-261 (1981).

81 AL 237

R. ALMAIRAC, M. REGIS, J. NOUET, C. FILIPPINI. Observation of Forbidden Bragg Reflections in BaMnF_4 . *J. Physique - Lettres* **42**, L-385, L-388 (1981).

81 NO 238

P. NOZIERES, D. SAINT-JAMES. Transient Growth of Fluctuations when Sweeping a System through Bifurcation. Supplement of the Progress of Theoretical Physics, n° 69, 122-136 (1980).

81 DA 239

P. DAY, M.W. MOORE, C. WILKINSON, K.R.A. ZIEBECK. Neutron Diffraction Study of the Incommensurate Magnetic Phase of $\text{Ni}_{0.92}\text{Zn}_{0.08}\text{Br}_2$. *J. Phys. C* **14**, 3423-3432 (1981).

81 WI 240

A. WIEDENMANN, P. BURLET, H. SCHEUER, W. GUNSSER. Spin Dynamics in the Quasi-1 Dimensional Spin-Glass FeMgBO_4 . *Solid State Communications* **39**, 801-805 (1981).

81 MO 241

V. MOISY-MAURICE, C.H. DE NOVION, A.N. CHRISTENSEN, W. JUST. Elastic Diffuse Neutron Scattering Study of the Defect Structure of $\text{TiC}_{0.76}$ and $\text{NbC}_{0.73}$. *Solid State Communications* **39**, 661-665 (1981).

81 BU 242

T.W. BURKHARDT, E. EISENRIEGLER. Critical Phenomena near Free Surfaces and Defect Planes. *Phys. Rev. B* **24**, 1236-1243 (1981).

81 GR 243

W. DULTZ, H.H. OTTO, H. KRAUSE, J.L. BUEVOZ. Elastic Neutron Scattering Investigations of New High-Pressure Phase of KCN. *Phys. Rev. B* **24**, 1287-1291 (1981).

81 GR 244

A. GRIFFIN. Raman Scattering of Light from Thermally Excited Rotons. *Phys. Rev. B* **24**, 1565-1567 (1981).

81 PO 245

J.G. POWLES, E.K. OSAE, J.C. DORE, P. CHIEUX. The Structure of Liquid Deuterium Chloride by Slow-Neutron Scattering. *Mol. Phys.* **43**, 1051-1067 (1981).

81 BO 246

J.C. BOULOUX, J.L. SOUBEYROUX, A. DAOUDI, G. LE FLEM. Propriétés Magnétiques de la Phase $\text{Sr}_{1.50}\text{La}_{0.50}\text{MnO}_4$. *Mat. Res. Bull.* **16**, 855-860 (1981).

81 BO 247

J. BARUCHEL, S.B. PALMER, M. SCHLENKER. Observation of Chirality Domains of Terbium by Polarized Neutron Diffraction Topography. *J. Physique* **42**, 1279-1283 (1981).

81 HA 248

F.D.M. HALDANE. Scaling Approach to Impurity Configurational Fluctuations in Metals. In "Valence Fluctuations in Solids" L.M. Falicov, W. Hanke, M.B. Maple Eds., (North-Holland 1981) pp. 153-157. Proc. Conf. Santa Barbara, California, Jan. 27-30, 1981.

81 BE 249

A. BENOIT, J.X. BOUCHERLE, J. FLOUQUET, F. HOLTZBERG, J. SCHWEIZER, C. VETTER. TmSe and Cerium Compounds Properties. In "Valence Fluctuations in Solids" L.M. Falicov, W. Hanke, M.B. Maple Eds., (North-Holland 1981) pp. 197-207 (1981). Proc. Conf. Santa Barbara, California, Jan. 27-30, 1981.

- 81 CO 250
R. CORDERY, A. GRIFFIN. Surface Critical Exponents Using the Renormalization Group E-Expansion. *Annals of Physics* **134**, 411-435 (1981).
- 81 BO 251
A. BOEUF, J.M. FOURNIER, G. HEGER, N. LEHNER, L. MANES, J. REBIZANT, F. RUSTICHELLI, J.C. SPIRLET. Recent Results on the NpO_2 25 K Transition by Neutron Diffraction. *J. Physique - Lettres* **42**, L-401-L-404 (1981).
- 81 HA 252
J.P. HANSEN. Plasmon Dispersion of the Strongly Coupled one Component Plasma in Two and Three Dimensions. *J. Physique - Lettres* **42**, L-397-L-400.
- 81 BA 253
J.L. BAUDOUR, Y. DELUGEARD, H. CAILLEAU, M. SANQUER, C.M.E. ZEYEN. A Study of the Temperature Variation of Molecular Rotations in Chloranil below T_c . *Acta Crystallographica B* **37**, 1553-1557 (1981).
- 81 CA 254
A. CAPIOMONT, J. LAJZEROWICZ, J.-F. LEGRAND, C.M.E. ZEYEN. Structure de la Phase Ferroélectrique - Ferroélastique du Tanane (Diffraction Neutronique). Evaluation d'Énergies de Réseau. *Acta Crystallographica B* **37**, 1557-1560 (1981).
- 81 CL 255
S. CLOUGH, A.J. HORSEWILL, A. HEIDEMANN. Neutron Scattering Study of Methyl Tunnelling in Pentamethylbenzene. *Chem. Phys. Lett.* **82**, 264-266 (1981).
- 81 KN 256
W. KNOLL, J. HAAS, H.B. STUHRMANN, H.H. FÜLDNER, H. VOGEL, E. SACKMANN. Small-Angle Neutron Scattering of Aqueous Dispersions of Lipids and Lipid Mixtures. A Contrast Variation Study. *J. Appl. Cryst.* **14**, 191-202 (1981).
- 81 RE 257
L.P. REGNAULT, J.P. BOUCHER, J. ROSSAT-MIGNOD, J.P. RENARD, J. BOUILLOT, W.G. STIRLING. Evidence for Soliton Excitations in the One-Dimensional Antiferromagnet TMMC. In "Physics in One-Dimension", J. Bernasconi and T. Schneider Eds. (Springer Series in Solid-State Sciences n° 23). Proc. of an Int. Conf. Fribourg, Switzerland, Aug. 25-29 (1980) (Springer-Verlag, 1981), pp. 161-164.
- 81 GL 258
A. GLACHANT, J.P. COULOMB, M. BIENFAIT, P. THOREL, C. MARTI, J.G. DASH. New Neutron Scattering Results on Methane Adsorbed on Graphite. In "Ordering in Two Dimensions", S.K. Sinha Ed. (North-Holland, 1980), pp. 203-206. Proc. of an Int. Conf., Lake Geneva, Wisconsin, U.S.A. May 28-30, 1980.
- 81 LA 259
H.J. LAUTER, B. CROSET, C. MARTI, P. THOREL. Structures of Monolayers of CF_4 on Graphite. In "Ordering in Two Dimensions", S.K. Sinha Ed. (North-Holland, 1980), pp. 211-214. Proc. of an Int. Conf., Lake Geneva, Wisconsin, U.S.A. May 28-30, 1980.
- 81 LA 260
H.J. LAUTER, H. WIECHERT, R. FEILE. Melting of ^3He Submonolayers and Structures of Adsorbed ^4He on Grafoil. In "Ordering in Two Dimensions", K. Sinha Ed. (North-Holland, 1980), pp. 291-294. Proc. of an Int. Conf., Lake Geneva, Wisconsin, U.S.A., May 28-30, 1980.
- 81 KW 261
H. KWON, F. BOEHM, A.A. HAHN, H.E. HENRIKSON, J.L. VUILLEUMIER, J.F. CAVAIGNAC, D.H. KOANG, B. VIGNON, F.V. FEILITZSCH, R.L. MÖSSBAUER. Search for Neutrino Oscillations at a Fission Reactor. *Phys. Rev. D* **24**, 1097-1111 (1981).
- 81 AL 262
R. ALMAIRAC, J.L. PREFAUT, M. GALTIER, C. BENOIT, A. MONTANER, H.J. LAUTER. Density of States in TTF-TCNQ Measured by Inelastic Neutron Scattering. *Mol. Cryst. Liq. Cryst.* **69**, 177-191 (1981).
- 81 KE 263
U. KEYSER, F. MÜNNICH, B. PAHLMANN, B. PFEIFFER. Critical Survey of Beta-Decay Energies and Nuclear Masses for the Neutron-Rich Rb and Cs Isotopes. Proc. of the 4th Int. Conf. on Nuclei far from Stability, Helsingør, Denmark, 7-13 June 1981 (Ed. L.O. Skolen). Vol. 1, 116-123 (1981).
- 81 KR 264
K.-L. KRATZ, H. OHM, A. SCHRÖDER, H. GABELMANN, W. ZIEGERT, H.V. KLAPDOR, J. METZINGER, T. ODA, B. PFEIFFER, G. JUNG, L. ALQUIST, G.I. CRAWFORD. The Beta Minus Strength Function of Nuclei far from Stability in the A = 90 Mass Region. Proc. of the 4th Int. Conf. on Nuclei far from Stability, Helsingør, Denmark, 7-13 June 1981 (Ed. L.O. Skolen). Vol. 1, 317-326 (1981). (CERN 81-09).
- 81 PF 265
B. PFEIFFER, E. MONNAND, J.A. PINSTON, F. SCHUSSLER, G. JUNG, J. MÜNZEL, H. WOLLNIK. The Level Schemes of Sr and Y Isotopes in the Mass Chains A = 95, 97 and 99. Proc. of the 4th Int. Conf. on Nuclei far from Stability, Helsingør, Denmark, 7-13 June 1981 (Ed. L.O. Skolen). Vol. II, 423-429 (1981). (CERN 81-09).
- 81 SC 266
F. SCHUSSLER, J. BLACHOT, E. MONNAND, J.A. PINSTON, H. LAWIN, K. SISTEMICH, K. KAWADE, K. HEYDE, J. SAU, B. PFEIFFER. Level Scheme of ^{131}Sb . Proc. of the 4th Int. Conf. on Nuclei far from Stability, Helsingør, Denmark, 7-13 June 1981 (Ed. L.O. Skolen). Vol. II, 532-535 (1981). (CERN 81-09)
- 81 MI 267
E. MICHELAKAKIS, W.D. HAMILTON, P. HUNGERFORD, S. SCOTT, G. JUNG, B. PFEIFFER. The Transitional Cerium Isotopes. Proc. of the 4th Int. Conf. on Nuclei far from Stability, Helsingør, Denmark, 7-13 June 1981 (Ed. L.O. Skolen). Vol. II, 581-588 (1981). (CERN 81-09).
- 81 SC 268
F. SCHUSSLER, B. PFEIFFER, H. LAWIN, E. MONNAND, J. MÜNZEL, J.A. PINSTON, K. SISTEMISCH. Nuclear Spectroscopy of Neutron Rich A = 147 Nuclei. Proc. of the 4th Int. Conf. on Nuclei far from Stability, Helsingør, Denmark, 7-13 June 1981 (Ed. L.O. Skolen). Vol. II, 589-597 (1981). (CERN 81-09).
- 81 DE 269
M.G. DESTHULLIERS-PORQUET, M. MEYER, P. QUENTIN, J. SAUVAGE-LETESSIER. Deformation Properties of Even-Even Os, Pt, Hg Nuclei and Spectroscopic Properties of Odd Re, Os, Ir, Pt, Au, Hg Nuclei from Self-Consistent Calculations. Proc. of the 4th Int. Conf. on Nuclei far from Stability, Helsingør, Denmark, 7-13 June 1981 (Ed. L.O. Skolen). Vol. II, 623-627 (1981). (CERN 81-09).
- 81 AR 270
P. ARMBRUSTER, U. QUADE, K. RUDOLPH, H.-G. CLERC, M. MUTTERER, J. PANNICKE, C. SCHMITT, J.P. THEOBALD, W. ENGELHARDT, F. GÖNNENWEIN, H. SCHRADER. The Cold Fragmentation of ^{234}U in ^{233}U (n_{th} , f). Proc. of the 4th Int. Conf. on Nuclei far from Stability, Helsingør, Denmark, 7-13 June 1981 (Ed. L.O. Skolen). Vol. II, 675-679 (1981). (CERN 81-09).
- 81 MA 271
C. MARTI, P. THOREL, B. CROSET, A. BOURDON. Diffraction Pattern of Crystals with Numerous Stacking Faults. *Acta Cryst. A* **37**, 609-616 (1981).
- 81 BE 272
J.P. BEAUFILS, T. CROWLEY, T. RAYMENT, R.K. THOMAS, J.W. WHITE. Tunnelling of Hydrogen in Alkali Metal Intercalation Compounds. I. $\text{C}_{24}\text{Rb}(\text{H}_2)_x$ and $\text{C}_{24}\text{Cs}(\text{H}_2)_x$. *Molecular Physics* **44**, 1257-1269 (1981).
- 81 EM 273
A. EMSALLEM, M. ASGHAR, C. WAGEMANS, H. WEIGMANN. Study of Neutron Induced Charged Particle Reactions on ^{40}K . (I). Thermal Neutrons. *Nucl. Phys. A* **368**, 108-116 (1981).

- 81 WE 274
H. WEIGMANN, C. WAGEMANS, A. EMSALLEM, **M. ASGHAR**. Study of Neutron Induced Charged Particle Reactions on ^{40}K . (II). Resonance Neutrons. Nucl. Phys. A **368**, 117-134 (1981).
- 81 MO 275
J. MOUGEY, R. OST, M. BUENERD, A.J. COLE, C. GUET, D. LEBRUN, J.M. LOISEAUX, P. MARTIN, M. MAUREL, E. MONNAND, H. NIFENECKER, P. PERRIN, J. PINSTON, C. RISTORI, P. DE SAINTIGNON, F. SCHUSSLER, L. CARLEN, B. JAKÖBSSON, A. OSKARSSON, I. OTTERLUND, B. SCHRODER, H.A. GUSTAFSSON, T. JOHANSSON, E. RYDE, J.P. BONDORF, D.B. NIELSEN, G. TIBELL. Projectile Fragments from 86 MeV/Nucleon ^{12}C Induced Reactions. Phys. Lett. **105 B**, 25-29 (1981).
- 81 CO 276
C. COHEN-ADDAD, J.M. SAVARIAULT, **M.S. LEHMANN**. 2-(2-Chlorobenzoylimino)-1,3-thiazolidine: Structure Refinement from Neutron Diffraction Data at 113 K and Charge Density Deformation Maps. Acta Cryst. B **37**, 1703-1706 (1981).
- 81 BE 277
J. BEILLE, J. VOIRON, F. TOWFIQ, **M. ROTH**, Z.Y. ZHANG. Helimagnetic Structure of the $\text{Fe}_x\text{Co}_{1-x}\text{Si}$ Alloys. J. Phys. F **11**, 2153-2160 (1981).
- 81 AS 278
M. ASGHAR, F. CAITUCOLI, B. LEROUX, M. MAUREL, P. PERRIN, G. BARREAU. Fission Fragment Energy Correlation Measurements for $^{238}\text{Pu}(n_{\text{th}}, f)$. Nucl. Phys. A **368**, 319-327 (1981).
- 81 AS 279
M. ASGHAR, F. CAITUCOLI, B. LEROUX, P. PERRIN, G. BARREAU. Fission-Fragment Energy Correlation Measurements for (n_{th}, f) of ^{232}U and ^{233}U . Nucl. Phys. A **368**, 328-336 (1981).
- 81 HE 280
A. HEIDEMANN, W. PRESS, K.J. LUSHINGTON, J.A. MORRISON. Study of the Tunneling Rotations in Phase II of Solid CH_4 with High Resolution Neutron Spectroscopy. J. Chem. Phys. **75**, 4003-4009 (1981).
- 81 LU 281
K.J. LUSHINGTON, K. MAKI, J.A. MORRISON, **A. HEIDEMANN**, W. PRESS. Tunneling States in Phase III of Solid Partially Deuterated Methanes. Determination by Inelastic Neutron Scattering and Correlation with Thermodynamic Data. J. Chem. Phys. **75**, 4010-4024 (1981).
- 81 JO 282
H. JOBIC, R.E. GHOSH, A. RENOUPREZ. The Limited Influence of the Debye-Waller Factor on the Intensities of High Frequency Molecular Modes Measured by Neutron Inelastic Spectroscopy. J. Chem. Phys. **75**, 4025-4030 (1981).
- 81 WA 283
C. WAGEMANS, E. ALLAERT, F. CAITUCOLI, P. D'HONDT, **G. BARREAU**, P. PERRIN. Experimental Study of Some Important Characteristics of the Thermal Neutron induced Fission of ^{237}Np . Nucl. Phys. A **369**, 1-14 (1981).
- 81 CA 284
F. CAITUCOLI, C. WAGEMANS, P. PERRIN, E. ALLAERT, P. D'HONDT, **M. ASGHAR**. Mass and Energy Characteristics of the $^{241}\text{Pu}(n_{\text{th}}, f)$ Fragments. Nucl. Phys. A **369**, 15-24 (1981).
- 81 SO 285
J.L. SOUBEYROUX, J.M. REAU, S. MATAR, P. HAGENMÜLLER, C. LUCAT. Etude par Diffraction de Neutrons de la Solution Solide $\text{Pb}_{1-x}\text{Th}_x\text{F}_{2+2x}$. Solid State Ionics **2**, 215-229 (1981).
- 81 DO 286
B. DORNER. Investigation of Structural Phase Transformations by Inelastic Neutron Scattering. In "Structural Phase Transitions I", K.A. Müller and H. Thomas Eds. (Topics in Current Physics) **23** (Springer-Verlag 1981), pp. 93-130.
- 81 HU 287
P. HUNGERFORD, H.H. SCHMIDT, R. BRISSOT, G. BARREAU, **H.G. BÖRNER**. Precision Measurements of the Lead $K_{\alpha 1}$ and $K_{\alpha 2}$ X-ray Energies. Z. Naturforsch. **36a**, 919 (1981).
- 81 FI 288
K.H. FISCHER. Ultrasound in Spin Glasses. Z. Phys. B **43**, 291-297 (1981).
- 81 AD 289
J.M. ADAMS, **A.W. HEWAT**. Hydrogen Atom Positions in Dickite. Clays and Clay Minerals **29**, 316-319 (1981).
- 81 BE 290
P.J. BENDALL, C.R.A. CATLOW, **B.E.F. FENDER**. The Defect Structure of Strontium Chloride: I. Intrinsic and Lightly Doped Crystals. J. Phys. C **14**, 4377-4392 (1981).
- 81 BO 291
L. BOSIO, R. CORTES, **J.R.D. COPLEY**, W.D. TEUCHERT, J. LEFEBVRE. Phonons in Metastable Beta Gallium: Neutron Scattering Measurements. J. Phys. F **11**, 2261-2273 (1981).
- 81 TA 292
J. TABONY, S.J. ROSER. N.M.R. Studies of Neopentane Adsorbed upon Titanium Dioxide. Mol. Phys. **44**, 329-338 (1981).
- 81 GR 293
A. GRIFFIN. High- and Low-Frequency Behavior of Response Functions in a Bose Condensed Liquid. J. Low Temp. Phys. **44**, 441-451 (1981).
- 81 FI 294
B.N. FIGGIS, P.A. REYNOLDS, G.A. WILLIAMS, **N. LEHNER**. The Crystal Structure of Deuterated trans-Tetraamminedinitronickel (II) at 4.2 K by Neutron Diffraction. Aust. J. Chem. **34**, 993-999 (1981).
- 81 ME 295
F. MEZEL. Study of Relaxation Processes by Neutron Spin Echo. in "Recent Developments in Condensed Matter Physics". Vol. 1. J.T. Devreese, Ed. (Plenum Press 1981), pp. 679-694.
- 81 HA 296
S. HAMMERSCHMIED, H. RAUCH, H. CLERC, **U. KISCHKO**. Measurements of the Coherent Neutron-Tritium Scattering Length and its Relation to the Four Nucleon Problem. Z. Phys. A **302**, 323-328 (1981).
- 81 JO 297
H. JOBIC, A. RENOUPREZ. Neutron Inelastic Spectroscopy of Benzene Chemisorbed on Raney Platinum. Surface Science **111**, 53-62 (1981).
- 81 PR 298
S.M. PRASAD, A.I.M. RAE, **A.W. HEWAT**, G.S. PAWLEY. The Crystal Structure of s-Triazine at 5 K. J. Phys. C. **14**, L 929-L 931 (1981).
- 81 FR 299
P.W. FROST, J.A.K. HOWARD, J.L. SPENCER, D.G. TURNER, **D. GREGSON**. Polyhydrido Platinum Clusters: Synthesis and X-Ray Crystal Structures of $[\text{Pt}_3\text{H}_6(\text{PBu}_3)_3]$, $[\text{Pt}_4\text{H}_2(\text{PBu}_3)_4]$, and $[\text{Pt}_4\text{H}_8(\text{PPr}_2\text{Ph})_4]$. J.C.S. Chem. Comm. 1104-1106 (1981).
- 81 BI 300
J.P. BIRSACK, D. FINK, J. LAUCH, R. HENKELMANN, **K. MÜLLER**. An Instrument for Lattice Location Studies of Light Impurity Atoms by Means of (n, α) -Reactions. Nuclear Instruments and Methods **188**, 411-419 (1981).
- 81 RY 301
H. RYSSEL, G. PRINKE, K. HABERGER, K. HOFFMANN, **K. MÜLLER**, R. HENKELMANN. Range Parameters of Boron Implanted into Silicon. Appl. Phys. **24**, 39-43 (1981).
- 81 JA 302
J. JAHNEL, H. RYSSEL, G. PRINKE, L. HOFFMANN, **K. MÜLLER**, J. BIRSACK, R. HENKELMANN. Description of Arsenic and Boron Profiles implanted in SiO_2 , Si_3N_4 and Si using Pearson Distributions with Four Moments. Nuclear Instruments and Methods **182/183**, 223-229 (1981).

81 FI 303

F. FITTLER, K. IBEL, W. HÖRZ. Accessibility of Metaphase Chromosomes from Chinese Hamster Ovary Cells to DNase II. *FEBS Letters* **132**, 341-343 (1981).

81 AL 304

J.R. ALLIBON, A. FILHOL, M.S. LEHMANN, S.A. MASON, P. SIMMS. Use of a Single-Stage, Closed-Cycle Cryorefrigerator for Routine Measurements at Moderately Low Temperatures on a Four-Circle Neutron Diffractometer. *J. Appl. Cryst.* **14**, 326-328 (1981).

81 BO 305

A. BOEUF, R. COPPOLA, F. RUSTICHELLI, F. ZAMBONARDI, S. MELONE, S. MAGGI, P. PULITI. Small-Angle Neutron Scattering Investigation of $M_{23}C_6$ Precipitation in AISI 304 Stainless Steel. *J. Appl. Cryst.* **14**, 377-344 (1981).

81 HE 306

H. HENSCHER, A. KOHNLE, H. HIPPE, F. GÖNNENWEIN. Absolute Measurement of Velocities, Masses and Energies of Fission Fragments from Californium-252 (SF). *Nuclear Instruments and Methods* **190**, 125-134 (1981).

81 WA 307

C. WAGEMANS, E. ALLAERT, G. BARREAU, A. EMSALLEM, P. D'HONDT. Determination of Atomic Masses Via (n_{th}, p) and (n_{th}, α) Reactions. *Nuclear Instruments and Methods* **190**, 167-170 (1981).

81 DO 308

K. DÖRR, H. ACKERMANN, B. BADER, H.-J. STOCKMANN, P.V. BLANCKENHAGEN. A Multiple Mirror System for Polarization of Thermal Neutrons. *Nuclear Instruments and Methods* **190**, 211-213 (1981).

81 CE 309

D.J. CEBULA, R.H. OTTEWILL, J. RALSTON, P.N. PUSEY. Investigations of Microemulsions by Light Scattering and Neutron Scattering. *J. Chem. Soc., Faraday Trans. I*, **77**, 2585-2612 (1981).

81 JA 310

B. JACROT, G. ZACCAI. Determination of Molecular Weight by Neutron Scattering. *Biopolymers* **20**, 2413-2426 (1981).

81 DA 311

J.M. DANCE, J.-L. SOUBEYROUX, N. KERKOURI, A. TRESSAUD. Structure Magnétique de la Phase $Rb_{0.5}Cs_{0.5}CoF_3$ de type perovskite hexagonale 6 H. *C.R. Acad. Sci. Paris*, **293**, Serie II, 279-282 (1981).

81 ZI 312

K.R.A. ZIEBECK, P.J. WEBSTER, P.J. BROWN, J.A.C. BLAND. The Paramagnetic Response of a Localised Metallic Ferromagnet. *J. of Magnetism and Magnetic Materials* **24**, 258-266 (1981).

81 BO 313

J.X. BOUCHERLE, J. SCHWEIZER. Polarized Neutron Study of the RAl_2 Compound. I. Magnetization density in $NdAl_2$. *J. of Magnetism and Magnetic Materials* **24**, 308-324 (1981).

81 AL 314

P. ALDEBERT, J.P. TRAVERSE. Diffraction et Diffusion Quasiélastique des Neutrons à Haute Température (au-dessus de 2000 K): Aspect Expérimental. *High Temperatures - High Pressures* **13**, 251-262 (1981).

81 SA 315

J. SAUVAGE-LETESSIER, P. QUENTIN, H. FLOCARD. Deformation Properties of Osmium, Platinum, Mercury Isotopes from Self-Consistent Calculations: Influence of the Pairing Treatment. *Nuclear Physics A* **370**, 231-255 (1981).

81 HA 316

J.B. HAYTER. Neutron Scattering from Concentrated Micellar Solutions. *Ber. Bunsenges. Phys. Chem.* **85**, 887-891 (1981).

81 PE 317

D. PETITGRAND, B. HENNION, C. ESCRIBE. Investigation of Spin Waves above T_N in $RbFeCl_3$ by Neutron Scattering. *Physica* **107** B + C, 75-76 (1981). Proc. of the 16th Int. Conf. on Low Temperature Physics (LT-16), Part I, Univ. of California, Los Angeles, 19-25 August 1981.

81 TI 318

C. TIBY, H. WIECHERT, H.J. LAUTER, H. GODFRIN. 3He on Graphite: Second Layer and Nucleation. *Physica* **107** B + C, 209-210 (1981). Proc. of the 16th Int. Conf. on Low Temperature Physics (LT-16), Part I, Univ. of California, Los Angeles, 19-25 August 1981.

81 LA 319

H.J. LAUTER, H. WIECHERT, C. TIBY. Excitations in Helium Films Adsorbed on Grafoil. *Physica* **107** B + C, 239-240 (1981). Proc. of the 16th Int. Conf. on Low Temperature Physics (LT-16), Part I, Univ. of California, Los Angeles, 19-25 August 1981.

81 MC 320

K.A. McEWEN, W.G. STIRLING, C. VETTIER, J.L. RAGAZZONI, D. FORT, D.W. JONES. Multiple-Q Magnetic Structure of Praseodymium at Millikelvin Temperatures. *Physica* **107** B + C, 259-260 (1981). Proc. of the 16th Int. Conf. on Low Temperature Physics (LT-16), Part I, Univ. of California, Los Angeles, 19-25 August 1981.

81 JE 321

C. JEWELL, B. HECKEL, P. AGERON, R. GOLUB, W. MAMPE, P.V.E. McCLINTOCK. Observation of the Storage of Ultra-Cold Neutrons in Liquid Helium. *Physica* **107** B + C, 587-588 (1981). Proc. of the 16th Int. Conf. on Low Temperature Physics (LT-16), Univ. of California, Los Angeles, 19-25 August 1981.

81 WI 322

H. WIECHERT, C. TIBY, H.J. LAUTER. Structure and Phase Transitions of Neon Submonolayers Adsorbed on Basal Plane Graphite. *Physica* **108** B + C, 785-786 (1981). Proc. of the 16th Int. Conf. on Low Temperature Physics (LT-16), Part I, Univ. of California, Los Angeles, 19-25 August 1981.

81 LY 323

J.W. LYNN, R. PYNN, J. JOFFRIN, J.L. RAGAZZONI. Formation of an Oscillatory Magnetization near the Reentrant Superconducting Transition in $HoMo_6S_8$. *Physica* **108** B + C, 801-802 (1981). Proc. of the 16th Int. Conf. on Low Temperature Physics (LT-16), Part II (Univ. of California, Los Angeles, 19-25 August 1981).

81 MU 324

A.P. MURANI, F. MEZEI, J.L. THOLENCE. Neutron Spin Echo, Polarisation Analysis and A.C. Susceptibility. Measurements of Spin Glass Dynamics. *Physica* **108** B + C, 1283-1284 (1981). Proc. of the 16th Int. Conf. on Low Temperature Physics (LT-16), Part II. (Univ. of California, Los Angeles, 19-25 August 1981).

81 HE 325

R. HEMPELMANN, D. RICHTER, A. KOLLMAR. Localized Vibrations of H and D in Ta and Their Relation to the H(D) Potential. *Z. Phys. B* **44**, 159-165 (1981).

81 SO 326

M. SOLTWISCH, D. QUITMANN, H. RUPPERSBERG, J.-B. SUCK. Dynamical Structure Factor of Concentration Fluctuations $S_{cc}(Q, \omega)$ measured in the Heterocoordinated Liquid Alloy $Li_{0.8}Pb_{0.2}$. *Phys. Lett.* **86** A, 241-244 (1981).

81 BU 327

S.K. BURKE, W.G. STIRLING, K.A. McEWEN. A Neutron Polarisation Analysis Study of the "Central" Peak in Single-Crystal Praseodymium. *J. Phys. C*, **14**, L 967-L 972 (1981).

81 FI 328

D. FINK, J.P. BIRSACK, F. JAHNEL, R. HENKELMANN. Untersuchung von Helium, Lithium und Bor in Metallen Mit Hilfe von (N, P) und (N, α)-Reaktionen. In "Analysis of non-metals in metals", G. Kraft Ed. (de Gruyter & Co, Berlin, 1981), pp. 163-171.

81 LE 329

A.J. LEADBETTER, A.A.M. RASHID, N. COLENUTT, A.F. WRIGHT, J.C. KNIGHTS. Nature of the Structural Heterogeneity in SiH Films by Small Angle Neutron Scattering. *Solid State Communications* **38**, 957-960 (1981).

81 SO 330

J.L. SOUBEYROUX, D. FRUCHART, J.C. MARMEGGI, W.J. FITZGERALD, C. DELMAS, G. LE FLEM. Structure Magnétique de $LiCrO_2$. *Phys. Stat. Sol.(a)* **67**, 633-642 (1981).

81 BR 331

P.J. BROWN, J.B. FORSYTH. A Neutron Diffraction Study of Weak Ferromagnetism in Nickel Fluoride. *J. Phys. C* **14**, 5171-5184 (1981).

81 KN 332

W. KNOLL, K. IBEL, E. SACKMANN. Small-Angle Neutron Scattering Study of Lipid Phase Diagrams by the Contrast Variation Method. *Biochemistry*, **20**, 6379-6383 (1981).

- 81 MU 333
G. MÜNNINGHOFF, W. KURTZ, W. TREUTMANN, E. HELLNER, G. HEGER, N. LEHNER, D. REINEN. Structure and Magnetic Order of Cr-Rich $\text{Rb}_2\text{Cr}_{1-x}\text{Mn}_x\text{Cl}_4$ Crystals. *Solid State Communications* **40**, 571-574 (1981).
- 81 SP 334
J.C. SPEAKMAN, M.S. LEHMANN, J.R. ALLIBON, D. SEMMINGSEN. Acetamide Hemihydrochloride, by Neutron Diffraction at 120 K. *Acta Cryst. B* **37**, 2098-2100 (1981).
- 81 RO 335
E.J. ROCHE, M. PINERI, R. DUPLESSIX, A.M. LEVELUT. Small-Angle Scattering Studies of Nafion Membranes. *Journal of Polymer Science* **19**, 1-11 (1981).
- 81 LE 336
A.M. LEVELUT, F. MOUSSA, J. DOUCET, J.J. BENATTAR, M. LAMBERT, B. DORNER. Local Order and Lattice Dynamics in the Ordered Phases of T.B.B.A. (Terephthal-Bis-Butyl-Aniline). *J. Physique* **42**, 1651-1663 (1981).
- 81 HA 337
F.D.M. HALDANE, J. VILLAIN. Commensurate-Incommensurate Transitions of Physisorbed Films on Anisotropic Substrates. *Journal de Physique* **42**, 1673-1690 (1981).
- 81 GR 338
H.A. GRAF, J.R. SCHNEIDER, A.K. FREUND, M.S. LEHMANN. Direct Observation of TDS Profiles from Perfect Silicon Single Crystals on a Neutron Diffractometer. *Acta Crystallographica A* **37**, 863-871 (1981).
- 81 KU 339
W.F. KUHS, M.S. LEHMANN. Bond-Lengths, Bond Angles and Transition Barrier in Ice Ih by Neutron Scattering. *Nature*, **294**, 432-434 (1981).
- 81 MU 340
A.P. MURANI. Korringa relaxation rates of Mn ion in noble metal hosts. *Journal of Magnetism and Magnetic Materials* **25**, 68-76 (1981).
- 81 MU 341
J. MÜNZEL, H. WOLLNIK, B. PFEIFFER, G. JUNG. A high-temperature ion source for the on-line separator OSTIS. *Nuclear Instruments and Methods* **186**, 343-347 (1981).
- 81 BU 342
A. BULOUE, J. NOUET, W. KLEEMAN, F.J. SCHÄFER, A.W. HEWAT. The structures and the improper ferroelastic phase transition of RbAlF_4 . *Ferroelectrics* **36**, 407-410 (1981). Proc. of the Fifth Int. Meeting on Ferroelectricity, Part II, Pennsylvania State University, U.S.A., August 17-21, 1981.
- 81 RI 343
C. RIDOU, M. ROUSSEAU, J. BOUILLOT. Critical neutron scattering near the 50 K phase transition in RbCaF_3 . *Ferroelectrics* **36**, 463-465 (1981). Proc. of the Fifth Int. Meeting on Ferroelectricity, Part II, Pennsylvania State University, U.S.A., August 17-21, 1981.
- 81 JA 344
B. JANNOT, J. BOUILLOT, C. ESCRIBE-FILIPPINI. Phonons in cubic BaTiO_3 and $\text{Ba}_{0.8}\text{Sr}_{0.2}\text{TiO}_3$. *Ferroelectrics* **37**, 511-512 (1981). Proc. of the Fifth Int. Meeting on Ferroelectricity, Part III, Pennsylvania State University, U.S.A., August 17-21, 1981.
- 81 PE 345
D. PETITGRAND, B. HENNION, P. RADHAKRISHNA, C. ESCRIBE, S. LEGRAND. Spinwaves in the pseudo 1-d ferromagnetic RbFeCl_3 . In "Recent Developments in Condensed Matter Physics", Vol. 4. J.T. Devreese & al. Eds (Plenum Press, 1981) pp. 205-211.
- 81 GI 346
D. GIGNOUX, R. LEMAIRE, P. MOLHO, F. TASSET. Thermal spontaneous magnetization in Y_2Ni_7 . In "Recent Developments in Condensed Matter Physics" Vol. 4. J.T. Devreese & al. Eds. (Plenum Press, 1981), pp. 259-263.
- 81 BO 347
R.A. BOND, D.K. ROSS, C.J. CARLILE, I.S. ANDERSON. Low temperature order-disorder transitions in palladium deutride. In "Recent Developments in Condensed Matter Physics" Vol. 4. J.T. Devreese & al. Eds. (Plenum Press, 1981), pp. 359-363.
- 81 CE 348
D.J. CEBULA, R.K. THOMAS, J.W. WHITE. Diffusion of water in Li-Montmorillonite studied by quasielastic neutron scattering. *Clays and Clay Minerals* **29**, 241-248 (1981).
- 81 BE 349
G.A. BENTLEY, J.T. FINCH, A. LEWIT-BENTLEY, M. ROTH. The crystal structure of the nucleosome core particle by neutron diffraction: an analysis using the contrast variation technique. In "Structural Aspects of Recognition and Assembly in Biological Macromolecules", M. Balaban, J.L. Sussman, W. Traub & A. Yonath Eds., (Balaban ISS, 1981), pp. 683-688.
- 81 CO 350
J.M.D. COEY, O. BALLEET, A. MOUKARIKA, J.L. SOUBEY-ROUX. Magnetic properties of sheet silicates; 1: 1 layer minerals. *Physics and Chemistry of Minerals* **7**, 141-148 (1981).
- 81 BE 351
G.A. BENTLEY, S.A. MASON. The crystal structure of triclinic lysozyme by neutron diffraction. In "Structural Studies on Molecules of Biological Interest", G. Dodson, J.P. Glusker, D. Sayre Eds. (Clarendon Press, 1981) pp. 246-255.
- 81 PY 352
R. PYNN, M. STEINER, W. KNOP, K. KAKURI, J. KJEMS. Solitons in the one-dimensional planar ferromagnet CsNiF_3 . In "Non-linear Phenomena at Phase Transitions and Instabilities". T. Riste Ed. (Plenum Press, 1981).
- 81 HI 353
J.S. HIGGINS, L.K. NICHOLSON, J.B. HAYTER. Dynamics of single polymer chains investigated in solution and the melt by new high resolution neutron scattering techniques. *Polymer Preprints*, **22**, 86-88 (1981).
- 81 HA 354
J.B. HAYTER. Quasielastic Neutron Spin-Echo Spectroscopy. In "Scattering Techniques applied to Supramolecular and non-equilibrium Systems", S.H. Chen, B. Chu, R. Nossal Eds. (Plenum Press, 1981), p. 49-73. Proc. of the NATO Advanced Institute Series B Vol. 73. Wellesley College, Massachusetts, U.S.A., August 3-15, 1980.
- 81 BA 355
J. BARUCHEL, M. SCHLENKER, K. KUROSAWA, S. SAITO. Antiferromagnetic S-domains in NiO. I. Neutron magnetic investigation. *Philosophical Magazine B* **43**, 853-860 (1981).
- 81 BA 356
J. BARUCHEL, M. SCHLENKER, K. KUROSAWA, S. SAITO. Antiferromagnetic S-domains in NiO. II. Effect of crystallographic twinning of the visibility of domains by x-ray topography. *Philosophical Magazine B* **43**, 861-868 (1981).
- 81 MA 357
G. MARIOLOPOULOS, J.P. BOCQUET, R. BRISSOT, H. NIFENECKER, Ch. RISTORI, A. PEQUET, J. GIRARD. A new experimental method to measure the charge distributions of fission products. *Nuclear Instruments and Methods* **180**, 141-146 (1981).
- 81 VA 358
B.J. VARLEY, J.E. KITCHING, W. LEO, J. MISKIN, R.B. MOORE, K.D. WUNSCH, R. DECKER, H. WOLLNIK, G. SIEGERT. Investigations of the response of germanium detectors to monoenergetic electron, positron and gamma ray beams. *Nuclear Instruments and Methods* **190**, 543-554 (1981).
- 81 FE 359
R. FELD, M.S. LEHMANN, K.W. MUIR, J.C. SPEAKMAN. The Crystal Structure of Benzoic Acid: A Redetermination with X-Rays at Room Temperature; A Summary of Neutron-Diffraction Work at Temperatures down to 5 K. *Zeitschrift für Kristallographie* **157**, 215-231 (1981).
- 81 NI 360
G.G. NILSSON, M. ROTH. Small-angle neutron scattering investigation of voids in creep-deformed alloy 800. *Materials Science and Engineering* **50**, 101-108 (1981).
- 81 BE 361
L. BERNARD, A. FITCH, A.F. WRIGHT, B.E.F. FENDER, A.T. HOWE. Mechanisms of hydrogen diffusion and conduction in $\text{DUO}_2\text{AsO}_4 \cdot 4\text{D}_2\text{O}$. *Solid State Ionics* **5**, 459-462 (1981).
- 81 GE 362
P. GERLACH, W. PRANDL, A. HEIDEMANN, J. LEFEBVRE. Sind plastische Kristalle Modelle des überdämpften Einsteinoszillators? *Zeitschrift für Kristallographie* **156**, 45 (1981).

81 SI 363

C. SIGNARBIEUX, M. MONTOYA, M. RIBRAG, C. MAZUR, C. GUET, P. PERRIN, M. MAUREL. Evidence for nucleon pair breaking even in the coldest scission configurations of ^{234}U and ^{236}U . *Journal de Physique. Lettres* **42**, L-437-L-440 (1981).

81 JA 364

J.F. JAL, P. CHIEUX, J. DUPUY. Structural order in metallic K-KCl solutions. In "Molten Salts", Proc. of the Third Int. Symposium. G. Mamantov, M. Blander, G.P. Smith Eds. (The Physical Electro-Chemistry Division, The Electrochemical Society, 1981). Vol. 81-9, pp. 115-122.

81 FO 365

M. FORTE, B.R. HECKEL, N.F. RAMSEY, K. GREEN, G.L. GREENE, J. BYRNE, J.M. PENDLEBURY. First measurement of parity-nonconserving neutron-spin rotation: the tin isotopes. *Physical Review Letters* **45**, 2088-2092 (1980).

81 CH 366

M. CHARLIER, J.C. MAURIZOT, G. ZACCAI. Neutron Scattering Studies of Lac Repressor: A Low Resolution Model. *J. Mol. Biol.* **153**, 177-182 (1981).

81 LA 367

P. LAGGNER, G.M. KOSTNER, U. RAKUSCH, D. WORCES-TER. Neutron Small Angle Scattering on Selectively Deuterated Human-Plasma Low Density Lipoproteins. The location of Polar Phospholipid Headgroups. *J. of Biological Chemistry* **256**, 11832-11839 (1981).

81 LE 368

J.L. LEVIEL, G. AUVERT, J.M. SAVARIAULT. Hydrogen Bond Studies. A Neutron Diffraction Study of the Structures of Succinic Acid at 300 and 77 K. *Acta Cryst. B* **37**, 2185-2189 (1981).

81 HA 369

F.D.M. HALDANE. Effective Harmonic-Fluid Approach to Low-Energy Properties of One-Dimensional Quantum Fluids. *Phys. Rev. Lett.* **47**, 1840-1843 (1981).

81 DO 370

K. DÖRR, H.-J. STÖCKMANN, B. BADER, P. FREILÄNDER, H. GRUPP, H. ACKERMANN, W. BUTTLER, P. HEITJANS, G. KIESE (n, γ)-Induced Point Defects in Silver Halides. *Hyperfine Interactions* **10**, 727-734 (1981).

81 GR 371

H. GRUPP, K. DÖRR, H.-J. STOCKMANN, H. ACKERMANN, B. BADER, W. BUTTLER, P. HEITJANS, G. KIESE, H. LAUTER. Spin-Lattice Relaxation of ^{116}In in InP and InSb in the Presence of (n, γ)-Induced Point Defects. *Hyperfine Interactions* **10**, 765-768 (1981).

81 ZA 372

G. ZACCAI. Applications of Small Angle Neutron Scattering to Biological Systems. In "Scattering Techniques applied to Supramolecular and Non-Equilibrium Systems", S.H. Chen, B. Chu, R. Nossal Eds. (Plenum Press, 1981), p. 615-638. Proc. of the NATO Advanced Institute Series B Vol. 73, Wellesley College, Massachusetts, U.S.A. August 3-15, 1980.

81 PL 373

V.P. PLAKHTI, Yu. P. CHERNENKOV, J. SCHWEIZER, M.N. BEDRIZOVA. Mise en Evidence Expérimentale de Composantes de Faible Antiferro-magnétisme dans l'orthoferrite d'Yttrium (en russe). *J.E.T.P. Ph.* **80** (1981) 2465-2474.

81 AN 374

R. ANDERS, K. STIERSTADT. Experimental Determination of the Critical Exponent η for Nickel. *Solid State Communications* **39**, 185-188 (1981).

81 AN 375

R. ANDERS. Determination of the Critical Exponents ν , ν and η from the Critical Magnetic Scattering of Neutrons from Nickel. *Colloid and Polymer Sci.* **259**, 675-676 (1981).

81 MA 376

W. MAMPE, P. AGERON, R. GÄHLER. Ultra Cold Neutron Life Times in Glow Discharge Cleaned Bottles. *Z. Phys. B* **45**, 1-14 (1981).

81 GR 377

A. GRIFFIN, H. JOBIC. Theory of the Effective Debye-Waller Factor in Neutron Scattering from High Frequency Molecular Modes. *J. Chem. Phys.* **75**, 5940-5943 (1981).

81 PO 378

J.G. POWLES, J.C. DORE, E.K. OSAE, J.H. CLARKE, P. CHIEUX, S. CUMMINGS. The Structure of Liquid Deuterium Bromide by Slow-Neutron scattering. *Molecular Physics* **44**, 1131-1136 (1981).

81 HA 379

A. HAMWI, P. TOUZAIN, L. BONNETAIN, A. BOEUF, A. FREUND, C. RIEKEL. Kinetic Studies of Potassium Intercalation in HOPG observed by means of Gamma-Ray Diffraction. Proceedings 3rd International Conference on Carbon, Baden-Baden, June 80, p. 91, Ed. by Deutsche Keramische Gesellschaft.

81 GR 380

A. GRIFFIN, E. TALBOT. Theory of Neutron Scattering from Thermally Excited Quasiparticles in Superfluid ^4He . *Phys. Rev. B* **24**, 5075-5085 (1981).

81 SH 381

A.R. SHARP, M.M. PINTAR. Cross Relaxation Dispersion and Temperature Dependence of Nuclear Spin Dipolar and Rotating Frame Zeeman Energies: A Study of Ammonium Halides. *J. Chem. Phys.* **75**(6), 2652-2662 (1981).

author index of publications

From 1 to 100 : Internal Reports (T = Technical Report, S = Scientific Report)

From 101 : Publications in books, periodicals, conference Proceedings...

| | | | | | |
|--------------------|--|---------------------|---------------------------------|--------------------|-------------------------------|
| ACKERMANN H. | 81DO308 81DO370 81GR371 | BARREAU G. | 81OE104 81WA178 81EG205 | BIERSACK J.P. | 81BI300 81JA02 81FI328 |
| ADAMS J.M. | 81AD165 81AD289 | | 81AS278 81AS279 | BINDER K. | 81RI214 |
| ADLHART W. | 81AD222 | | 81WA283 | BJOERNSTAD T. | 81EG205 |
| AGERON P. | 81JE321 | | 81HU287 | BLACHOT J. | 81MA169 81SC266 |
| ALASTUEY A. | 81MA376 81AL101 81AL141 | BARTHELEMY A. | 81WA307 81BA022T 81BA023T | BLAKEWAY S.J. | 81GE166 |
| ALDEBERT P. | 81AL160 | BARUCHEL J. | 81BA247 | BLANCKENHAGEN P.V. | 81DO308 |
| ALLAERT E. | 81AL314 81WA178 81WA283 | | 81BA355 81BA356 | BLAND J.A.C. | 81BR137 81ZI180 81ZI312 |
| | 81CA284 | BASTIE P. | 81BA136 | BLEY F. | 81LE158 |
| ALLEN G. | 81WA307 | BATS J.W. | 81FU217 | BOCQUET J.P. | 81MA169 81MA357 |
| ALLIBON J.R. | 81TA127 | BAUDOUR J.L. | 81CA114 81BA253 | BOEHM F. | 81KW261 |
| | 81AL018T | BAUMGAERTNER A. | 81RI214 | BOERNER H.G. | 81BO052 81DA145 |
| | 81AL304 | BEAUFILS J.P. | 81BE173 81BE272 | | 81SC198 81EG205 |
| ALMAIRAC R. | 81SP334 81MA231 81AL237 | BECK H. | 81SU152 81SU196 81SU207 | BOEUF A. | 81HU287 81BO223 81BO251 |
| ALQUIST L.J. | 81AL262 81JU107 | BECKER P.J. | 81BE174 | | 81BO305 81HA379 |
| ANDERS R. | 81KR264 81AN374 81AN375 | BEDRIZOVA M.N. | 81PL373 | BOGDANOVIC M. | 81DA145 |
| ANDERSON I.E. | 81AN375 | BEILLE J. | 81BE277 | BOHN H.G. | 81BO192 |
| ANDERSON I.S. | 81SU234 81BO119 81BO347 | BELLAMY A. | 81DE131 | BOKHENKOV E.L. | 81SC135 81CH182 |
| ANGELL C.A. | 81SU234 | BELLISSENT-FUNEL M. | 81MA212 | | 81RA213 |
| ANNE M. | 81RO233 | BENATTAR J.J. | 81LE336 | BOMCHIL G. | 81BO119 |
| ARMBRUSTER P. | 81AR270 | BENDALL P.J. | 81BE290 | BOND R.A. | 81BO347 |
| ASGHAR M. | 81EM273 81WE274 81AS278 81AS279 | BENOIT A. | 81HO153 81BE249 | BONDORF J.P. | 81MO275 |
| | 81CA284 | BENOIT C. | 81AL262 | BONNETAIN L. | 81HA379 |
| AUVERT G. | 81LE368 | BENTLEY G.A. | 81BE112 81BE130 81BE349 | BOOTH J.G. | 81ZI180 81CO186 81BO191 |
| BADER B. | 81DO308 81DO370 81GR371 | BERNARD L. | 81BE351 81BE235 81BE361 | BOSIO L. | 81BO291 |
| | 81CO350 | BERNERON M. | 81WR156 | BOUCHER J.P. | 81BO187 81RE257 |
| BALLET O. | 81LA181 | BERTAGNOLLI H. | 81BE149 | BOUCHERLE J.X. | 81BO199 81BE249 |
| BANDYOPADHYAY A.K. | 81BE173 | BERTHIER Y. | 81ME148 | | 81BO313 |
| BARBAUX Y. | | BIENFAIT M. | 81GL258 | | |

| | | | | | |
|------------------|--|---|---|---|--|
| BOUILLOT J. | 81BO187 81RE257 81RI343 81JA344 | CHOWDHURY M.R. CHRISTENSEN A.N. | 81CH171 81CH118 81NO179 81CH241 | DORNER B. | 81DO110 81SC135 81CH182 81BO192 |
| BOULOUX J.C. | 81BO204 81BO246 81MA271 | CIMMINO A. | 81KL154 81KL194 81EG205 | | 81ST215 81DO286 81LE336 |
| BOURDON A. | 81BR168 | CIZEWSKI J.A. | 81PO378 | DOUCET J. | 81LE336 |
| BRACK M. | 81FI209 | CLARKE J.H. | 81HA296 | DULTZ W. | 81DU243 |
| BRAVIC G. | 81BR019T | CLERC H. | 81AR270 | DUPLESSIX R. | 81RO335 |
| BRESSON A. | 81JO040S | CLERC H.G. | 81CL134 | DUPUY J. | 81JA364 |
| BRIGGS G. | 81BR044T | CLOUGH S. | 81CL210 81CL255 | DWORKIN A. | 81CA114 |
| BRISSOT R. | 81MA169 81HU287 81MA357 | COEY J.M.D. | 81TA128 81CO350 | EGIDY T.V. | 81EG205 |
| | 81BR048T | COHEN-ADDAD C. | 81CO276 | EISENRIEGLER E. | 81BU242 |
| BROWN P.J. | 81BR137 81ZI180 81CO186 81FA228 81ZI312 | COLE A.J. COLENUTT N. COMES R. CONVERT P. | 81MO275 81LE329 81ME164 81CH118 81WI172 | EMSALLEM A. | 81WA178 81EM273 81WE274 81WA307 |
| | 81BR331 | COPLEY J.R.D. | 81BO291 | ENGELHARDT W. | 81AR270 |
| BUENERD M. | 81MO275 | COPPOLA R. | 81BO223 | EPAUD F. | 81MU034T 81EP035T |
| BUEVOZ J.L. | 81ME148 81KN176 81BO199 81DU243 81BU342 81FU217 81EG205 81BU039S | CORDERY R. CORTES R. COSTA M.M.R. COULOMB J.P. COX S. CRANCON J. CRAWFORD G.I. CROPLEY M. CROSET B. | 81BO305 81CO250 81BO291 81CO186 81GL258 81LE111 81MA169 81KR264 | ESCRIBE (FILIPPINI) C. | 81AL237 81PE317 81PE345 81JA344 81TA128 81RI214 81FA228 81BR044T 81FA045S 81SC117 |
| | 81BU124 81BU327 81BU132 81BU183 81BU242 81WI172 81WI240 81DO370 81GR371 81FO365 81CA114 81BA253 81AS278 81AS279 81WA283 81CA284 81GA142 81CA184 81CA254 81MO275 81BO119 81BO347 81DA145 81GE166 81BE290 81KW261 81CE020S 81CE021S 81BU039S 81CE146 81CE159 81CE309 81CE348 81CH182 81CE159 81CH366 81ME230 81FI209 81PL373 81DO110 81CH001T 81JO040S 81BE149 81CH171 81PO245 81JA364 81PO378 81CH054S | CORDERY R. CORTES R. COSTA M.M.R. COULOMB J.P. COX S. CRANCON J. CRAWFORD G.I. CROPLEY M. CROSET B. CROWLEY T. CUILLEL M. CUMMINGS S. CURRAT R. D'HONDT P. DACHS H. DAMIEN J.C. DANCE J.M. DAOUDI A. DASH J.G. DAUBERT J. DAVIDSON W.F. DAY P. DE CLERQ A. DECKER R. DECMAN D. DELAPALME A. DELMAS C. DELUGEARD Y. DEMAZEAU G. DENOYER F. DEPORTES J. DERUYTTER A. DESTHULLIERS-PORQUET M.G. DIANOUX A.J. DOERR K. DORE J.C. | 81CR038S 81LA259 81MA271 81BE272 81CU150 81PO378 81CU015T 81DE131 81WA178 81WA283 81CA284 81WA307 81AL018T 81WI162 81TR138 81LO157 81DA311 81BO246 81GL258 81NU143 81SU152 81DA145 81EG205 81DA140 81ST215 81DA239 81WA178 81DE226 81VA358 81EG205 81FA228 81SO330 81BA253 81TR220 81DE131 81DE189 81WA178 81DE269 81TA127 81VO195 81DO308 81DO370 81GR371 81CH171 81PO245 81PO378 | FAYARD M. FEILE R. FEILITZSCH F.V. FELD R. FELSCH W. FELTIN D. FENDER B.E.F. FIELDING P.E. FIGGIS B.N. FILHOL A. FINCH J.T. FINK D. FISCHER K.H. FITCH A.N. FITTLER F. FITZGERALD W.J. FLOCARD H. FLOUQUET J. FLYNN E.R. FONTANA M.P. FORSYTH J.B. FORT D. FORTE M. FOURNIER J.M. FOURQUET J.L. FREILAENDER P. FREUND A.K. FREY F. FROST J.C. FROST P.W. FRUCHART D. FUELDNER H.H. | 81LE158 81LA260 81SC117 81KW261 81FE359 81HO206 81KO036T 81BE235 81BE290 81BE361 81WI120 81WI120 81FI294 81TH008T 81FI209 81AL304 81BE130 81BE349 81BI300 81FI328 81FI197 81FI219 81FI288 81BE235 81BE361 81FI303 81SO330 81SA315 81HO153 81BE249 81EG205 81MA212 81WI163 81BR331 81MC320 81FO65 81BO251 81NO106 81DO370 81FR04S 81GR338 81HA379 81AD222 81FR115 81FR299 81SO330 81KN256 |
| BULOOU A. | | | | | |
| BURGER N. | | | | | |
| BURKE D.G. | | | | | |
| BURKE S.K. | | | | | |
| BURKHARDT T.W. | | | | | |
| BURLET P. | | | | | |
| BUTTLER W. | | | | | |
| BYRNE J. | | | | | |
| CAILLEAU H. | | | | | |
| CAITUCOLI F. | | | | | |
| CALVARIN G. | | | | | |
| CAPELLMANN H. | | | | | |
| CAPIOMONT A. | | | | | |
| CARLEN L. | | | | | |
| CARLILE C.J. | | | | | |
| CASTEN R.F. | | | | | |
| CATLOW C.R.A. | | | | | |
| CAVAIGNAC J.F. | | | | | |
| CEBULA D.J. | | | | | |
| CHAPLOT S.L. | | | | | |
| CHARLES S.W. | | | | | |
| CHARLIER M. | | | | | |
| CHARPAK G. | | | | | |
| CHASSEAU D. | | | | | |
| CHERNENKOV YU.P. | | | | | |
| CHERNYSHOV A.A. | | | | | |
| CHEVALIER R. | | | | | |
| CHIEUX P. | | | | | |
| CHILDS F. | | | | | |

| | | | | | |
|------------------|----------|---------------------|----------|-------------------|----------|
| FUESS H. | 81 U217 | HALDANE F.D.M. | 81HA102 | HOLLAND-MORITZ E. | 81HO153 |
| GABELMANN H. | 81KR264 | | 81LI155 | HOLTZBERG F. | 81BE249 |
| GAEHLER R. | 81GA151 | | 81HA211 | HORN S. | 81HO153 |
| | 81KL154 | | 81HA248 | | 81BO199 |
| | 81KL170 | | 81HA337 | | 81HO206 |
| | 81KL194 | | 81HA369 | HORSEWILL A.J. | 81CL210 |
| | 81MA376 | HAMELIN C. | 81MA169 | | 81CL255 |
| GALERA R.M. | 81PI125 | HAMILTON W.D. | 81JU107 | HOWARD J.A.K. | 81FR299 |
| | 81GA221 | | 81MI267 | HOWE A.T. | 81BE235 |
| GALTIER M. | 81AL262 | HAMMERSCHMIED S. | 81HA296 | | 81BE361 |
| GARDNER P. | 81WI163 | HAMWI A. | 81HA379 | HUKIN D.A. | 81WI167 |
| GARITO A.F. | 81ME164 | HANSEN J.P. | 81HA133 | HUNGERFORD P. | 81HU012T |
| GAULTIER J. | 81FI209 | | 81HA229 | | 81JU107 |
| GAVARRI J.R. | 81GA142 | | 81HA252 | | 81MI267 |
| GEHRING G.A. | 81BE174 | HAPPEK U. | 81ST215 | | 81HU287 |
| GEICK R. | 81RA216 | HARLEY R.T. | 81LO108 | IBEL K. | 81IB007S |
| GELLETLY W. | 81DA145 | HARTMANN-BOUFRON F. | 81ME148 | | 81FI303 |
| | 81GE166 | HAWERKAMP K. | 81SC117 | | 81KN332 |
| GELTENBORT P. | 81FA045S | HAYTER J.B. | 81HA005S | ILL | 81IN006S |
| | 81OE104 | | 81CH054S | | 81IN027T |
| GEORGES R. | 81TA128 | | 81LE111 | | 81IN028T |
| GERLACH P. | 81GE362 | | 81HI116 | | 81IN047T |
| GHOSH R.E. | 81GH024T | | 81HA121 | JACOBE J. | 81KO036T |
| | 81OS025T | | 81HA193 | | 81ME230 |
| | 81GH026T | | 81RI214 | JACROT B. | 81JA113 |
| | 81GH029T | | 81NI218 | | 81CU150 |
| | 81BE174 | | 81HA232 | | 81JA310 |
| | 81JO282 | | 81HA316 | JAHNEL F. | 81JA302 |
| GIGNOUX D. | 81GI190 | | 81HI353 | | 81FI328 |
| | 81GI346 | | 81HA354 | JAKOBSSON B. | 81MO275 |
| GIRARD J. | 81MA357 | HAZELL R.G. | 81NO179 | JAL J.F. | 81JA364 |
| GIVORD D. | 81DE189 | HEATHMAN S.P. | 81HE031S | JANCOVICI B. | 81AL101 |
| GLACHANT A. | 81GLO258 | | 81WR156 | | 81AL141 |
| GLAESER W. | 81SU152 | HECKEL B.R. | 81JE321 | | 81AL160 |
| GODFRIN H. | 81TI318 | | 81FO365 | JANNOT B. | 81JA344 |
| GOELTZ G. | 81KE177 | HEGER G. | 81BO251 | JANSSEN D. | 81JA236 |
| | 81SE225 | | 81MU333 | JAUSLIN H.R. | 81LO188 |
| GOENNENWEIN F. | 81BR044T | HEIDEMANN A. | 81CL134 | JAYASOORIYA U.A. | 81JA139 |
| | 81FA045S | | 81RO175 | JENKIN G.T. | 81LE111 |
| | 81OE104 | | 81CL210 | JEWELL C. | 81JE321 |
| | 81AR270 | | 81PR227 | JEX H. | 81NU143 |
| | 81HE306 | | 81RO233 | JINDAL V.K. | 81CH182 |
| GOLUB R. | 81GO037T | | 81CL255 | JOBIC H. | 81JO282 |
| | 81JE321 | | 81HE280 | | 81JO297 |
| GRAF H.A. | 81GR338 | | 81LU281 | | 81GR377 |
| GREEN K. | 81FO365 | | 81GE362 | JOFFRIN J. | 81JO040S |
| GREENE G.L. | 81FO365 | HEITJANS P. | 81DO370 | | 81LY105 |
| GREENWOOD G. | 81GH024T | | 81GR371 | | 81LY323 |
| GREGSON D. | 81FR299 | HELLNER E. | 81MU333 | JOHANSSON T. | 81MO275 |
| GREVAZ M. | 81GR002T | HEMPELMANN R. | 81HE325 | JONES D.W. | 81MC320 |
| | 81GR003T | HENKELMANN R. | 81BI300 | JUNG G. | 81JU107 |
| | 81GR013T | | 81RY301 | | 81KR224 |
| GRIFFIN A. | 81GR244 | | 81JA302 | | 81DE226 |
| | 81CO250 | | 81FI328 | | 81KR264 |
| | 81GR293 | HENNION B. | 81PE317 | | 81PF265 |
| | 81GR377 | | 81PE345 | | 81MI267 |
| | 81GR380 | HENRIKSON H.E. | 81KW261 | | 81MU341 |
| GROS Y. | 81ME148 | HENSCHEL H. | 81HE306 | JUST W. | 81CH241 |
| GRUPP H. | 81DO370 | HEWAT A.W. | 81HE051T | KAFFREL N. | 81EG205 |
| | 81GR371 | | 81GA142 | KAISER W. | 81KA041T |
| GUENTHERODT H.J. | 81SU152 | | 81AD165 | KAKURAI K. | 81ST215 |
| | 81SU196 | | 81AD289 | KAKURI K. | 81PY352 |
| | 81SU207 | | 81PR298 | KALUS J. | 81SC135 |
| GUET C. | 81MO275 | | 81BU342 | | 81CH182 |
| | 81SI363 | HEYDE K. | 81SC266 | KAWADE K. | 81SC266 |
| GUKASOV A.G. | 81OK200 | HIGGINS J.S. | 81HI116 | KEARLEY G.J. | 81JA139 |
| GUNSSER W. | 81WI240 | | 81NI218 | KEARNEY P.D. | 81KL154 |
| GUSTAFSSON H.A. | 81MO275 | | 81HI353 | | 81KL170 |
| HAAS J. | 81KN256 | HIGHFIELD R.R. | 81HA193 | KERKOURI N. | 81DA311 |
| HABERGER K. | 81RY301 | HIPP H. | 81HE306 | KERR S.A. | 81HU012T |
| HAGENMULLER P. | 81TR138 | HOERZ W. | 81FI303 | | 81BO052S |
| | 81LO157 | HOFFMANN K. | 81RY301 | KETTLE S.F.A. | 81JA139 |
| | 81BO204 | | 81JA302 | KETTUNEN P.O. | 81KE177 |
| | 81SO285 | HOHLWEIN D. | 81HO122 | KEYSER U. | 81KE202 |
| HAHN A.A. | 81SC117 | | 81HO144 | | 81KE263 |
| | 81KW261 | | | KIESE G. | 81DO370 |
| | | | | | 81GR371 |

| | | | | | |
|-----------------|----------|-------------------|----------|------------------|----------|
| KISCHKO U. | 81HA296 | | 81SP334 | MEISTER H. | 81BA136 |
| KITCHING J.E. | 81VA358 | | 81GR338 | MELCHART G. | 81ME230 |
| KJEMS J. | 81PY352 | | 81KU339 | MELONE S. | 81BO305 |
| KLAPDOR H.V. | 81KR264 | | 81FE359 | METZINGER J. | 81KR264 |
| KLEEMANN W. | 81BU342 | LEHNER N. | 81RA216 | MEYER C. | 81ME148 |
| KLEIN A.G. | 81GA151 | | 81BO251 | MEYER J. | 81ME109 |
| | 81KL154 | | 81FI294 | MEYER M. | 81DE269 |
| | 81KL170 | | 81MU333 | MEZEI F. | 81ME295 |
| | 81KL194 | LEMAIRE R. | 81GI190 | | 81MU324 |
| KLESSE R. | 81KL030T | | 81GI346 | MICHEL K.H. | 81RO175 |
| | 81MU034T | LEO W. | 81VA358 | MICHELAKAKIS E. | 81MI267 |
| KNIGHTS J.C. | 81LE329 | LEPISTO T. | 81KE177 | MIGLIARDO P. | 81MA212 |
| KNOLL W. | 81KN256 | LEROUX B. | 81AS278 | MISKIN J. | 81VA358 |
| | 81KN332 | | 81AS279 | MOESSBAUER R.L. | 81KW261 |
| KNOP W. | 81ST215 | LESLIE M. | 81LE111 | MOISY-MAURICE V. | 81CH241 |
| | 81PY352 | LEVELUT A.M. | 81RO335 | MOLHO P. | 81GI190 |
| | 81KN176 | | 81LE336 | | 81GI346 |
| KNORR K. | 81KW261 | LEVESQUE D. | 81HA229 | MONNAND E. | 81JU107 |
| KOANG D.H. | 81RA216 | LEVIEL J.L. | 81LE368 | | 81PF265 |
| KOEHLER H. | 81DE226 | LEWIS J.D. | 81CL210 | | 81SC266 |
| KOGLIN E. | 81HE306 | LEWIT-BENTLEY A. | 81BE130 | | 81SC268 |
| KOHNBLE A. | 81DA145 | | 81BE349 | | 81MO275 |
| KOICKI S. | 81KO036T | LICCIARDELLO D.C. | 81LI155 | MONTANER A. | 81AL262 |
| KOLLMAR A. | 81WI167 | LOEWENHAUPT M. | 81HO153 | MONTOYA M. | 81SI363 |
| | 81BO192 | | 81BO199 | MOORE M.W. | 81DA239 |
| | 81HE325 | | 81HO206 | MOORE R.B. | 81VA358 |
| KOSTNER G.M. | 81LA367 | LOIDL A. | 81HO176 | MORIN P. | 81MO208 |
| KOSTORZ G. | 81KE177 | LOISEAUX J.M. | 81MO275 | MORLEVAT J.P. | 81BO223 |
| KRATZ K.L. | 81KR224 | LORIN D. | 81LO157 | MORRISON J.A. | 81HE280 |
| | 81KR264 | LOVELUCK J.M. | 81LO188 | | 81LU281 |
| | 81DU243 | LOVHOIDEN G. | 81EG205 | MOUDDEN A.H. | 81DE131 |
| KRAUSE H. | 81KU339 | LOWDE R.D. | 81LO108 | MOUGEY J. | 81BR044T |
| KUHS W.F. | 81EG205 | LUCAT C. | 81SO285 | | 81MO275 |
| KURCEWICZ W. | 81BA355 | LUSHINGTON K.J. | 81HE280 | MOUKARIKA A. | 81CO350 |
| KUROSAWA K. | 81BA356 | | 81LU281 | MOUSSA F. | 81CA114 |
| | 81MU333 | LYNN J.W. | 81LY105 | | 81LE336 |
| KURTZ W. | 81KW261 | | 81BO323 | MUECKENHEIM W. | 81SC198 |
| KWON H. | 81LA181 | MAGGI S. | 81BO305 | MUELLER K. | 81BI300 |
| LABARBE P. | 81LA367 | MAIER B. | 81SP203 | | 81RY301 |
| LAGGNER P. | 81CA254 | MAISANO G. | 81MA212 | | 81JA302 |
| LAJZEROWICZ J. | 81DE131 | MAKI K. | 81LU281 | MUELLNER M. | 81NU143 |
| LAMBERT M. | 81LE336 | MALETTA H. | 81MA185 | MUENNICH F. | 81KE202 |
| | 81FA228 | MAMPE W. | 81JE321 | | 81KE263 |
| LANDER G.H. | 81TR220 | | 81MA376 | MUENNINGHOFF G. | 81MU333 |
| LANGLAIS F. | 81EG205 | MANES L. | 81BO251 | MUENZEL J. | 81DE226 |
| LARYSZ J. | 81BI300 | MARIOLOPOULOS G. | 81MA169 | | 81PF265 |
| LAUCH J. | 81GR371 | | 81MA357 | | 81SC268 |
| LAUTER H. | 81JA139 | MARION G. | 81MA231 | MUIR L.W. | 81MU341 |
| LAUTER H.J. | 81TI147 | MARMEGGI J.C. | 81SO330 | MUNNIER J. | 81FE359 |
| | 81LA259 | MARTI C. | 81GL258 | | 81MU010T |
| | 81LA260 | | 81LA259 | | 81MU017T |
| | 81AL262 | | 81MA271 | | 81MU034T |
| | 81TI318 | MARTIN P. | 81MO275 | | 81MU043T |
| | 81LA319 | MARTINS A.F. | 81VO195 | MURANI A.P. | 81PI125 |
| | 81WI322 | MASON R. | 81WI120 | | 81MU126 |
| LAWIN H. | 81SC266 | MASON S.A. | 81BE112 | | 81GA221 |
| | 81SC268 | | 81WI120 | | 81MU324 |
| LE FLEM G. | 81BO204 | | 81HO122 | | 81MU340 |
| | 81BO246 | | 81AL304 | MUTTERER M. | 81AR270 |
| | 81SO330 | | 81BE351 | NAGEL D. | 81NA042T |
| LEADBETTER A.J. | 81FR115 | MASSENET O. | 81TA128 | NATKANIEC I. | 81SC135 |
| | 81LE329 | MATAR S. | 81SO285 | | 81CH182 |
| LEBRUN D. | 81MO275 | MATTHEWMAN J.C. | 81BR048T | NICHOLSON L.K. | 81HI116 |
| LEFEBVRE J. | 81WI162 | MAUREL M. | 81MO275 | | 81NI218 |
| | 81MA231 | | 81AS278 | | 81HI353 |
| | 81BO291 | | 81SI363 | NIELSEN O.B. | 81MO275 |
| | 81GE362 | MAURIZOT J.C. | 81CH366 | NIFENECKER H. | 81MA169 |
| LEFEBVRE S. | 81LE158 | MAY R.P. | 81MA016S | | 81MO275 |
| LEFEBVRE Y. | 81LE009T | | 81TI053S | | 81MA357 |
| | 81LE014T | MAZUR C. | 81SI363 | NILSSON G.G.. | 81NI360 |
| | 81LE046T | MCCLINTECK P.V.E. | 81JE321 | NOUET J. | 81NO106 |
| LEGRAND J.F. | 81CA254 | MCEWEN K.A. | 81MC103 | | 81AL237 |
| LEGRAND S. | 81PE345 | | 81MC320 | | 81BU342 |
| LEHMANN M.S. | 81AL018T | | 81BU327 | NOVION C.H. DE | 81CH241 |
| | 81CH118 | MCKENZIE G.A. | 81SC135 | NOZIERES P. | 81NO238 |
| | 81WR161 | MCLEEN G. | 81ST215 | NUECKER N. | 81NU143 |
| | 81NO179 | MCMULLEN A.I. | 81HA193 | | 81RA216 |
| | 81CO276 | MEGTERT S. | 81ME164 | NYBO K. | 81EG205 |
| | 81AL304 | MEINNEL J. | 81CA114 | NYMAN G. | 81EG205 |

| | | | | | |
|-----------------|----------|------------------|----------|----------------------|----------|
| ODA T. | 81KR264 | PULITI P. | 81BO305 | RUDOLPH K. | 81AR270 |
| OED A. | 81FA045S | PULLMAN B.J. | 81HA193 | RULLHUSEN P. | 81SC198 |
| | 81OE104 | PUSEY P.N. | 81CE309 | RUMYANTSEV A. YU | 81DO110 |
| OHM H. | 81KR224 | PUSHKAREV V.V. | 81DO110 | RUNOV V.V. | 81OK200 |
| | 81KR264 | PYNN R. | 81HA005S | RUPPERSBERG H. | 81SO326 |
| OKOROKOV A.I. | 81OK200 | | 81LY105 | RUSH J.J. | 81RO175 |
| OPAT G.I. | 81KL154 | | 81DO110 | RUSTICHELLI F. | 81BO223 |
| | 81KL170 | | 81ME164 | | 81BO251 |
| | 81KL194 | | 81RO175 | | 81BO305 |
| ORR G.B. | 81DA145 | | 81ST215 | RYDE H. | 81MO275 |
| OSAE E.K. | 81PO245 | | 81LY323 | RYSSEL H. | 81RY301 |
| | 81PO378 | | 81PY352 | | 81JA302 |
| OSBORN I. | 81OS025T | QUADE U. | 81AR270 | SABATIER R. | 81TR138 |
| OSKARSSON A. | 81MO275 | QUENTIN P. | 81QU050S | SACKMANN E. | 81KN256 |
| OST R. | 81MO275 | | 81BR168 | | 81KN332 |
| OTTERLUND I. | 81MO275 | | 81QU201 | SAINT-JAMES D. | 81NO238 |
| OTTEWILL R.H. | 81CE146 | | 81DE269 | SAINTIGNON P. DE | 81MO275 |
| | 81CE309 | | 81SA315 | SAITO S. | 81BA355 |
| OTTO H.H. | 81DU243 | QUITMANN D. | 81SO326 | | 81BA356 |
| PAHLMANN B. | 81KE202 | RADHAKRISHNA P. | 81PE345 | SANQUER M. | 81BA253 |
| | 81KE263 | RAE A.I.M. | 81PR298 | SATO M. | 81LO108 |
| PALEY M.N.J. | 81CL134 | RAGAZZONI J.L. | 81LY105 | SAU J. | 81SC266 |
| | 81CL210 | | 81MC320 | SAULI F. | 81ME230 |
| PALMER S.B. | 81BA247 | | 81LY323 | SAUNDERS G.A. | 81LO108 |
| PANNETIER J. | 81NO106 | RAKUSCH U. | 81LA367 | SAUVAGE-LETESSIER J. | 81DE269 |
| PANNICKE J. | 81AR270 | RALSTON J. | 81CE309 | | 81SA315 |
| PAWLEY G.S. | 81SC135 | RAMDAS V. | 81AD165 | SAVARIAULT J.M. | 81CO276 |
| | 81CH182 | RAMSEY N.F. | 81FO365 | | 81LE368 |
| | 81PR298 | RASHID A.A.M. | 81LE329 | SCHAAB J. | 81TI147 |
| PENDLEBURY J.M. | 81FO365 | RAUCH H. | 81HA296 | SCHAEFER F.J. | 81BU342 |
| PENFOLD J. | 81CH054S | RAUH H. | 81RA216 | SCHAERPF O. | 81SE225 |
| | 81HA121 | RAYMENT T. | 81RA213 | SCHERM R. | 81LO108 |
| | 81HA193 | | 81BE272 | SCHEUER H. | 81HO153 |
| | 81HA232 | REAU J.M. | 81SO285 | | 81WI172 |
| PEQUET A. | 81MA357 | REBIZANT J. | 81BO251 | | 81MA185 |
| PEREPEZKO J.H. | 81SU234 | REGIS M. | 81AL237 | | 81BO199 |
| PERRIN P. | 81OE104 | REGNAULT L.P. | 81BO187 | | 81HO206 |
| | 81MO275 | REINEN D. | 81RE257 | | 81WI240 |
| | 81AS278 | | 81MU333 | SCHLENKER M. | 81BA247 |
| | 81AS279 | RENARD J.P. | 81BO187 | | 81BA355 |
| | 81WA283 | | 81RE257 | | 81BA356 |
| | 81CA284 | RENKER B. | 81JO040S | SCHMELZER U. | 81SC135 |
| | 81SI363 | RENOUPREZ A. | 81JO282 | SCHMIDT H.H. | 81HU287 |
| PETERSEN G. | 81ME230 | | 81JO297 | SCHMITT C. | 81AR270 |
| PETITGRAND D. | 81PE317 | REYNOLDS P.A. | 81FI294 | SCHMITT D. | 81MO208 |
| | 81PE345 | RIBET M. | 81MA231 | SCHNEIDER J.R. | 81GR338 |
| PFEIFFER B. | 81JU107 | RIBRAG M. | 81SI363 | SCHNEIDER T. | 81LO188 |
| | 81KE202 | RICHARDSON R.M. | 81FR115 | SCHRADER H. | 81AR270 |
| | 81KR224 | | 81WI162 | SCHRECKENBACH K. | 81SC117 |
| | 81KE263 | RICHTER D. | 81RI214 | | 81DA145 |
| | 81KR264 | | 81HE325 | | 81GE166 |
| | 81PF265 | RIDOU C. | 81RI343 | SCHRODER B. | 81MO275 |
| | 81SC266 | RIEKEL C. | 81HA379 | SCHROEDER A. | 81KR224 |
| | 81MI267 | RIMMER D.E. | 81RI033T | | 81KR264 |
| | 81SC268 | RISTORI C. | 81OE104 | SCHUCK P. | 81QU050S |
| | 81MU341 | | 81MA169 | | 81JA236 |
| PIERRE J. | 81PI125 | | 81MO275 | SCHUMACHER M. | 81SC198 |
| | 81GA221 | | 81MA357 | SCHUSSLER F. | 81JU107 |
| PINERI M. | 81RO335 | ROBERT A. | 81KA041T | | 81KR224 |
| PINSTON J.A. | 81JU107 | ROCHE E.J. | 81RO335 | | 81PF265 |
| | 81PF265 | ROGAN P.K. | 81RO129 | | 81SC266 |
| | 81SC266 | ROSER S.J. | 81TA292 | | 81SC268 |
| | 81SC268 | ROSS D.K. | 81BO199 | | 81MO275 |
| | 81MO275 | | 81BO347 | SCHWEIZER J. | 81SC032S |
| PINTAR M.M. | 81SH381 | ROSSAT-MIGNOD J. | 81BO187 | | 81BO199 |
| PLAKHTI V.P. | 81PL373 | | 81RE257 | | 81BE249 |
| POPPLWELL J. | 81CE159 | ROTH M. | 81LE158 | | 81BO313 |
| POWLES J.G. | 81PO245 | | 81OK200 | | 81PL373 |
| | 81PO378 | | 81MA212 | SCOTT S.M. | 81JU107 |
| PRAGER M. | 81PR227 | | 81BE277 | | 81MI267 |
| PRANDL W. | 81GE362 | | 81BE349 | SEIFERT R. | 81SE225 |
| PRANGE R.E. | 81CA184 | | 81NI360 | SEMMINGSSEN D. | 81SP334 |
| PRASAD S.M. | 81PR298 | ROTH W.L. | 81RO233 | SHAPIRO S.M. | 81MA185 |
| PREFAUT J.L. | 81AL262 | ROURE M. | 81RO011T | SHARP A.R. | 81SH381 |
| PRESS W. | 81PR227 | ROUSSEAU M. | 81RI343 | SHEKA E.F. | 81SC135 |
| | 81HE280 | ROWE J.M. | 81RO175 | | 81CH182 |
| | 81LU281 | RUDIN H. | 81SU152 | SHELINE R.K. | 81EG205 |
| PRINKE G. | 81RY301 | | 81SU196 | | |
| | 81JA302 | | 81SU207 | | |

| | | | | | |
|-----------------|----------|-------------------|----------|-----------------|-----------|
| SIEGERT G. | 81DE226 | THOLENCE J.L. | 81MU324 | WEIGMANN H. | 81EM273 |
| | 81VA358 | THOMAS M. | 81TH008T | | 81WE274 |
| SIGNARBIEUX C. | 81SI363 | THOMAS R.K. | 81HA193 | WENGER D. | 81BO223 |
| SIMIC J. | 81DA145 | | 81RA213 | WHITE J.W. | 81LE111 |
| SIMMS P. | 81SI123 | | 81BE272 | | 81RA213 |
| | 81AL304 | | 81CE348 | | 81BE272 |
| SINCLAIR F. | 81WI163 | THOREL P. | 81GL258 | | 81CE348 |
| SISTEMICH K. | 81SC266 | | 81LA259 | WIECHERT H. | 81TI147 |
| | 81SC268 | | 81MA271 | | 81LA260 |
| SLETTEN G. | 81EG205 | THORSTEINSEN T.F. | 81EG205 | | 81TI318 |
| SMEND F. | 81SC198 | TIBBELL G. | 81MO275 | | 81LA319 |
| SOLTWISCH M. | 81SO326 | TIBY C. | 81TI147 | | 81WI322 |
| SOUBEYROUX J.L. | 81TA128 | | 81TI318 | WIEDENMANN A. | 81WI172 |
| | 81TR138 | | 81LA319 | | 81WI240 |
| | 81LO157 | | 81WI322 | WILKINSON C. | 81WI163 |
| | 81BO204 | TIMMINS P.A. | 81TO055S | | 81DA239 |
| | 81TR220 | | 81TI053S | WILLIAMS D.E.G. | 81WI167 |
| | 81BO246 | TOUHARA H. | 81TR220 | WILLIAMS G.A. | 81WI120 |
| | 81SO285 | TOURET- | | | 81FI294 |
| | 81DA311 | POINSIGNON C. | 81TO055S | WILLIAMS W.G. | 81CH054S |
| | 81SO330 | TOUZAIN P. | 81HA379 | WINDSOR C.G. | 81WI162 |
| | 81CD350 | TOWFIQ F. | 81BE277 | WINZER K. | 81HO206 |
| SPEAKMAN J.C. | 81FE 359 | TRANQUI D. | 81RO233 | WOLLNIK H. | 81JU107 |
| | 81SP334 | TRAVERSE J.P. | 81AL314 | | 81DE226 |
| SPENCER J.L. | 81FR299 | TREIMER W. | 81KL194 | | 81PF265 |
| SPIRLET J.C. | 81BO251 | | 81SE225 | | 81MU341 |
| SPRINGER T. | 81SP049S | TRESSAUD A. | 81TR138 | | 81VA358 |
| | 81SP203 | | 81LO157 | WORCESTER D. | 81LA367 |
| STEGLICH F. | 81HO153 | | 81TR220 | WRIGHT A.F. | 81HO144 |
| | 81BO199 | | 81DA311 | | 81WR156 |
| | 81HO206 | TREUTMANN W. | 81MU333 | | 81WR161 |
| STEIN D.L. | 81LI155 | TURNER D.G. | 81FR299 | | 81LA181 |
| STEINER M. | 81BE174 | UNDERHILL C. | 81LO108 | | 81BE235 |
| | 81ST215 | VALLADE M. | 81BA136 | | 81LE329 |
| | 81PY352 | VAN ASSCHE P.H.M. | 81EG205 | | 81BE361 |
| STELTS M.L. | 81DA145 | VARLEY B.J. | 81VA358 | WUENSCH K.D. | 81DE226 |
| STIERSTADT K. | 81AN374 | VETTIER C. | 81DE131 | | 8181VA358 |
| STIRLING W.G. | 81JO040S | | 81BA136 | ZACCAI G. | 81ME109 |
| | 81MC103 | | 81DA140 | | 81RO129 |
| | 81BO187 | | 81ME164 | | 81JA310 |
| | 81RE257 | | 81MO208 | | 81CH366 |
| | 81MC320 | | 81FI209 | | 81ZA372 |
| | 81BU327 | | 81BE249 | ZAMBONARDI F. | 81BO223 |
| STOECKMANN H.J. | 81DO308 | | 81MC320 | | 81BO305 |
| | 81DO370 | VIEIRA V.R. | 81BU183 | ZARZYCKI J. | 81LA181 |
| | 81GR371 | VIGNON B. | 81KW261 | ZEILINGER A. | 81GA151 |
| STOJANOVIC M. | 81DA145 | VIGOUROUX J.P. | 81GA142 | | 81KL194 |
| STOLL E. | 81LO188 | VILLAIN J. | 81HA337 | ZEYEN C.M.E. | 81CA114 |
| STROTHMANN H. | 81SE225 | VOGEL H. | 81KN256 | | 81BA136 |
| STUEHN B. | 81KN176 | VOIRON J. | 81BE277 | | 81AD222 |
| STUHRMANN H.B. | 81KN256 | VOLINO F. | 81VO195 | | 81BA253 |
| SUCK J.B. | 81NU143 | VUILLEUMIER J.L. | 81SC117 | | 81CA254 |
| | 81SU152 | | 81KW261 | ZHANG Z.Y. | 81BE277 |
| | 81SU196 | WAGEMANS C. | 81WA178 | ZIEBECK K.R.A. | 81BR137 |
| | 81SU207 | | 81EM273 | | 81WI167 |
| | 81SU234 | | 81WE274 | | 81ZI180 |
| | 81SO326 | | 81WA283 | | 81CO186 |
| | 81TA127 | | 81CA284 | | 81DE189 |
| SUZUKI S. | 81TA292 | | 81WA307 | | 81BO191 |
| TABONY J. | 81TA127 | WANDERLINGH F. | 81MA212 | | 81DA239 |
| TAKEUCHI H. | 81GR380 | WANKLYN B.M.R. | 81TR138 | | 81ZI312 |
| TALBOT E. | 81TA128 | | 81WI163 | ZIEGERT W. | 81KR264 |
| TARASCON J.M. | 81GI190 | WARNER D.D. | 81DA145 | ZINN W. | 81MA185 |
| TASSET F. | 81GI346 | | 81EG205 | | 81BO192 |
| | 81BO291 | WARNER G. | 81LE111 | ZULAUF M. | 81CU150 |
| TEUCHERT W.D. | 81AR270 | WEBSTER P.J. | 81BR137 | | |
| THEOBALD J.P. | | | 81ZI312 | | |

list of publications accepted

Papers with ILL authors and co-authors which have been accepted for publication (arranged by subject- in alphabetical order).

1. Neutron instruments and Methods

A. BOEUF, R. CACIUFFO, A. FREUND, A. HAMWI, P. TOUZAIN, F. RUSTICHELLI, Preliminary Neutron Study of Graphite Intercalation Compounds in View of Application as Monochromators. Proc. Int. Symposium on Neutron Scattering, Argonne, Aug. 1981. Amer. Inst. Phys. Conf. Ser. 1982.

J.X. BOUCHERLE, B. GILLON, J. SCHWEIZER, Spin Densities in Non Centro Symmetric Structures. Proc. Int. Symposium on Neutron Scattering, Argonne, Aug. 1981. Amer. Inst. Phys. Conf. Ser. 1982.

R. DECKER, K.D. WÜNSCH, H. WOLLNIK, G. JUNG, É. KOGLIN, G. SIEGERT, A Hyperpure Germanium-Detector for Precise Beta Endpoint Energy Determinations. Nucl. Instrum. & Methods.

F. MEZEL. Recent Neutron Spin Echo Experiments. Proc. Int. Symposium on Neutron Scattering, Argonne, Aug. 1981. Amer. Inst. Phys. Conf. Ser. 1982.

O. SCHÄRPF. Recent Advances with Supermirror Polarisers. Proc. Int. Symposium on Neutron Scattering, Argonne, Aug. 1981. Amer. Inst. Phys. Conf. Ser. 1982.

O. SCHÄRPF. Diffuse Scattering with Spin Analysis using a Supermirror Polariser and 5 Supermirror Analysers: Results on Paramagnetic Scattering, Crystal Field Transitions, Separation of Coherent and Incoherent Scattering in Liquid Sodium using Time-of-flight Analysis. Proc. Int. Symposium on Neutron Scattering, Argonne, Aug. 1981. Amer. Inst. Phys. Conf. Ser. 1982.

R.F.D. STANSFIELD. Multidetector Development: Tests with a Phthalocyanine Crystal. Proc. Int. Symposium on Neutron Scattering, Argonne, Aug. 1981. Amer. Inst. Phys. Conf. Ser. 1982.

C.M.E. ZEYEN. A Neutron Spin Echo Device to Improve the Energy Resolution of Triple Axis Spectrometers. Proc. Int. Symposium on Neutron Scattering, Argonne, Aug. 1981. Amer. Inst. Phys. Conf. Ser. 1982.

C.M.E. ZEYEN. Improved Energy Resolution with Neutron Spin Echo Triple-Axis Spectrometers. Int. Conf. on Phonon Physics, Bloomington, Sept. 81. J. de Physique-Colloques.

2. Theory

C. ASLANGUL, M. SCHOTT. Frenkel Excitons Interacting with Free Electrons in a Doped One-Dimensional Organic Semiconductor. J. Phys. C.

T.W. BURKHARDT, J.M.J. VAN LEEUWEN, 1. Progress and Problems in Real-Space Renormalization. To appear in "Real-Space Renormalization", ed. by T.W. Burkhardt and J.M.J. van Leeuwen, Springer-Verlag.

T.W. BURKHARDT, 2. Bond-Moving and Variational Methods in Real-Space Renormalization. To appear in "Real-Space Renormalization", ed. by T.W. BURKHARDT and J.M.J. van Leeuwen, Springer-Verlag.

T.W. BURKHARDT, E. EISENRIEGLER, Universal and Nonuniversal Critical, Behavior of the n -Vector Model with a Defect Plane in the Limit $n \rightarrow \infty$. Phys. Rev. B.

H. CAPELLMANN, V. R. VIEIRA, The Magnetic Properties of Ferromagnetic Transition Metals above T_C : Qualitative Aspects. Phys. Rev. B.

H. CAPELLMANN, V.R. VIEIRA, Strong Short Range Magnetic Order in Ferromagnetic Transition Metals above T_C : A Theoretical Explanation. Phys. Rev. B.

Y.K. GAMBHIR, P. RING, P. SCHUCK. Microscopic Investigations of the Structure of the Bosons and the Hamiltonian of the Interacting Boson Model. Nucl. Phys.

Y.K. GAMBHIR, P. RING, P. SCHUCK, Interacting Bosons close to and far from Magic Nuclei. Proc. 4th Int. Symposium on Neutron Capture Gamma-Ray Spectroscopy and Related Topics, Grenoble, Sept. 81. Inst. Phys. Conf. Ser. 62.

F.D.M. HALDANE. Calculation of Correlation Exponents of the Anisotropic (XYZ) Heisenberg Chain using a "Luttinger Liquid" Description. Phys. Rev. Lett.

F.D.M. HALDANE. Umklapp Processes and Soliton Dynamics in the 1-D Spinless Fermi Gas and $S = 1/2$ XY-Heisenberg-Ising Chain. Phys. Rev. Lett.

F.D.M. HALDANE. Critical Ground State Properties of the 1-D $S = 1/2$ Heisenberg Antiferromagnet; An example of the "Luttinger Liquid" Density-Wave Instability. J. Phys. C.

F.D.M. HALDANE. "Luttinger Liquid" Theory of 1-D Quantum Fluids: Low Energy Properties of the Bose Fluid. Phys. Rev. Lett.

F.D.M. HALDANE. Itinerant Magnetism Approach for Understanding One-Dimensional Antiferromagnets. Invited talk Taniguchi Int. Symposium on "Electron Correlation and Magnetism in Narrow Band Systems", Susono-Shi, Japan, Nov. 1-5, 1980.

F.D.M. HALDANE. The Quantum Harmonic Chain: Not "Phonons", but the Canonical 1-D Quantum Fluid? J. Phys. C. Lett.

F.D.M. HALDANE. Quantum Fluid Ground State of the Sine-Gordon Model with finite Soliton Density: Exact Results. J. Phys. A.

F.D.M. HALDANE. Sutherland's Soluble 1-D Quantum Fluid with Inverse-Square Interactions: A Test of the "Luttinger Liquid Theory" of 1-D Quantum Fluids. Phys. Lett. A.

F.D.M. HALDANE. Continuum Description of Planar Ferromagnetic Spin Chains with Arbitrary Spin: the 1-D Quantum "Spin-Fluid". Z. Phys. B.

F.D.M. HALDANE. Ground State Properties of Antiferromagnetic Chains with Unrestricted Spin; Integer Spin Chains as Realizations of the $O(3)$ Non-Linear Sigma Model. Phys. Rev. Lett.

J.P. HANSEN, L. SJÖGREN. Plasma Oscillations and Sound Waves in Collision-Dominated Two-Component Plasmas. Physics of Fluids.

J. LIBERT, P. QUENTIN. A Self-Consistent Description of Heavy Nuclei: I. Static Properties of Some Even Nuclei. *Phys. Rev. C*.

J. LIBERT, M. MEYER, P. QUENTIN, A Self-Consistent Description of Heavy Nuclei: II. Spectroscopic Properties of Some Odd Nuclei. *Phys. Rev. C*.

J. LIBERT, P. QUENTIN. A General Solution of the Bohr Collective Hamiltonian. *Z. Phys. A*.

J. MEYER, P. QUENTIN, B.K. JENNINGS. The Isovector Dipole Mode: A Simple Sum Rule Approach. *Nucl. Phys. A*.

P. NOZIERES, *Liquides et solides quantiques*. *J. de Physique*.

P. QUENTIN, J. LIBERT, M. MEYER, J. SAUVAGE-LETESSIER, Low Energy Collective and Single Particle Excitations. Proc. 4th Int. Symposium on Neutron-Capture Gamma-Ray Spectroscopy and Related Topics, Grenoble, Sept. 81, Inst. Phys. Conf. Ser. 62.

P. RING, Y.K. GAMBHIR, S. IWASAKI, P. SCHUCK, Microscopic Theory of Interacting Bosons. Proc. Int. Workshop on Interacting Bosons, Granada, Spain, Sept. 1981.

M. ROGER, J.H. HETHERINGTON, J.M. DELRIEU, Magnetism in Solid ^3He . *Rev. of Mod. Phys.*

P. SCHUCK, W. BRENIG. Quantum Effects in Electron Stimulated Desorption of Hydrogen. *Z. Phys.*

P. SCHUCK, S. IWASAKI, P. RING, (Dyson) Boson Expansion and its Relation to Nuclear Field Theory. Proc. Int. Nuclear Physics Workshop, Trieste, Oct. 1981.

V.R. VIEIRA. Electron Transport Properties of Metallic Glasses. Congrès de la Société Française de Physique, Clermont-Ferrand, juin-juillet 1981. *J. de Physique*.

F. WELING, A. GRIFFIN, Finite Size Effects on the Static Structure Factor of Two-Dimensional Crystals. *Phys. Rev. B*.

3. Fundamental and Nuclear Physics

M. ASGHAR, Deformation and Intrinsic Excitation in Low Energy Fission. Proc. Int. Symposium on Nuclear Fission and Related Collective Phenomena and Properties of Heavy Nuclei, Bad Honnef, oct. 1981.

M. ASGHAR, A. EMSALLEM, An Indication of Interference Effect in the Alpha-Particle Channel. Proc. 4th Int. Symposium on Neutron-Capture Gamma-Ray Spectroscopy, Grenoble, Sept. 1981. Inst. Phys. Conf. Ser. 62.

M. ASGHAR, F. CAÏTUCOLI, B. LEROUX, M. MAUREL, P. PERRIN, G. BARREAU, Fission Fragment Energy Correlation Measurements for $^{229}\text{Th}(n, f)$. *Nucl. Phys. A*.

M. ASGHAR, V.S. RAMAMURTHY, Scission Configuration in Fission. Proc. Int. Symposium on Nuclear Fission and Related Collective Phenomena and Properties of Heavy Nuclei, Bad Honnef, Oct. 1981.

A. BÄCKLIN, G. HEDIN, B. FOGELBERG, M. SARACENO, R.C. GREENWOOD, C.W. REICH, H.R. KOCH, H.A. BAADER, H.D. BREITIG, O.W.B. SCHULT, K. SCHRECKENBACH, T. VON EGIDY, W. MAMPE, Levels in ^{156}Gd studied in the (n, γ) reaction. *Nucl. Phys. A*.

M.K. BALODIS, P.T. PROKOFJEV, N.D. KRAMER, L.I. SIMONOVA, K. SCHRECKENBACH, W.F. DAVIDSON, J.A. PINSTON, D.D. WARNER, P. HUNGERFORD, H.H. SCHMIDT, H.J. SCHEERER, T. VON EGIDY, P.H.M. VAN ASSCHE, A.J.M. SPITS, Some Rotational Bands in ^{154}Eu . Proc. 4th Int. Symposium on Neutron-Capture Gamma-Ray Spectroscopy, Grenoble, Sept. 1981. Inst. Phys. Conf. Ser. 62.

G. BARREAU, R. BRISSOT, P. GELTENBORT, F. GÖNNENWEIN, J. MOUGEY, H. NIFENECKER, A. OED, P. PERRIN, C. RISTORI, The *Cosi fan tutte* Project. Proc. Int. Symposium on "Nuclear Fission and Related Collective Phenomena and Properties of Heavy Nuclei, Bad Honnef, Oct. 1981.

H. G. BÖRNER, G. BARREAU, S.A. KERR, K. SCHRECKENBACH, Relevance of High Precision Spectroscopy in Nuclear Structure Research. Proc. 4th Int. Symposium on Neutron-Capture Gamma-Ray Spectroscopy, Grenoble, Sept. 1981. Inst. Phys. Conf. Ser. 62.

M. BOGDANOVIC, R. BRISSOT, G. BARREAU, K. SCHRECKENBACH, S. KERR, I.A. KONDUROV, Yu. E. LOGINOV, V.V. MARTYNOV, P.A. SUSHKOV, The Level Scheme of ^{134}Cs . Proc. Int. Symposium on Neutron-Capture Gamma-Ray Spectroscopy, Grenoble, Sept. 1981. Inst. Phys. Conf. Ser. 62.

U. BONSE, U. KISCHKO, Neutron-Interferometric Measurement of the Coherent Scattering Length of the Isotopes of Silver. *Z. Phys. A*.

W.F. DAVIDSON, C.W. REICH, R.C. GREENWOOD, H.R. KOCH, Curved-crystal study of de-excitation gamma rays in ^{184}W following neutron capture. Proc. 4th Int. Symposium on Neutron Capture Gamma-Ray Spectroscopy and Related Topics, Grenoble, Sept. 81. Inst. Phys. Conf. Ser. 62.

P. D'HONDT, C. WAGEMANS, E. ALLAERT, A. DE CLERCQ, G. BARREAU, A. EMSALLEM, The (n_{th}, α) Reaction in the Actinide Region. Proc. 4th Int. Symposium on Neutron-Capture Gamma-Ray Spectroscopy, Grenoble, Sept. 1981. Inst. Phys. Conf. Ser. 62.

T. VON EGIDY, H. DANIEL, B. KRUSCHE, K.P. LIEB, G. BARREAU, H.G. BÖRNER, R. BRISSOT, C. HOFMEYER, R. RASCHER, Precise Gamma Ray Energies and Complete ^{36}Cl Level Scheme from the Reaction $^{35}\text{Cl}(n, \gamma)$. *Nucl. Instrum. & Methods*.

A. EMSALLEM, M. ASGHAR, C. WAGEMANS, P. D'HONDT. The (n_{th}, α) reaction on deformed nuclei. Proc. 4th Int. Symposium on Neutron-Capture Gamma-Ray Spectroscopy, Grenoble, Sept. 1981. Inst. Phys. Conf. Ser. 62.

H.R. FAUST, Spin Assignment of the Lowest Octupole Bandhead in ^{236}U . Proc. 4th Int. Symposium on Neutron-Capture Gamma-Ray Spectroscopy, Grenoble, Sept. 1981. Inst. Phys. Conf. Ser. 62.

H. FAUST, P. GELTENBORT, F. GÖNNENWEIN, A. OED. Determination of the Isobaric Elemental Yields in Velocity Selected Fission Products. *Nucl. Instrum. & Methods*.

R. GÄHLER, J. KALUS, W. MAMPE, Experimental limit for the charge of the free neutron. *Phys. Rev. D*.

R. GÄHLER, J. KALUS, W. MAMPE, A New Experimental Limit for the Neutron Charge. Proc. 2nd Int. Conf. on Precision Measurements and Fundamental Constants, Gaithersburg 1981.

G.L. GREENE. A New Method for the Accurate Determination of the Proton Gyromagnetic Ratio. *IEEE - Transactions on Instrumentation and Measurement*.

G.L. GREENE, N.F. RAMSEY, W. MAMPE, J.M. PENDLEBURY, K. SMITH, W.B. DRESS, P.D. MILLER, P. PERRIN, Determination of the Neutron Magnetic Moment. Proc. 2nd Int. Conf. on Precision Measurements and Fundamental Constants, Gaithersburg 1981.

W.D. HAMILTON, P. HUNGERFORD, H. POSTMA, S.M. SCOTT, M. SNELLING, D.D. WARNER, K.E. WILCOCK, Gamma-Ray Directional Distribution and Correlation Measurements in ^{60}Co . Proc. 4th Int. Symposium on Neutron-Capture Gamma-Ray Spectroscopy, Grenoble, Sept. 1981. Inst. Phys. Conf. Ser. 62.

W.D. HAMILTON, P. HUNGERFORD, S.M. SCOTT, D.D. WARNER, K.E. WILCOCK, Neutron Capture by Oriented Dysprosium. Proc. 4th Int. Symposium on Neutron-Capture Gamma-Ray Spectroscopy, Grenoble, Sept. 1981. Inst. Phys. Conf. Ser. 62.

R.W. HOFF, W.F. DAVIDSON, D.D. WARNER, H.G. BÖRNER, T. VON EGIDY, Energy Levels of ^{249}Cm from Measurements of Thermal Neutron Capture Gamma Rays. Phys. Rev. C.

R.W. HOFF, R.W. LOUGHEED, G. BARREAU, H.G. BÖRNER, W.F. DAVIDSON, K. SCHRECKENBACH, D.D. WARNER, T. VON EGIDY, D.H. WHITE, Neutron Capture Gamma-Ray Spectroscopic Measurements in the Actinide Region. Proc. 4th Int. Symposium on Neutron Capture Gamma-Ray Spectroscopy, Grenoble, Sept. 1981. Inst. Phys. Conf. Ser. 62.

R. W. HOFF, W. RUHTER, L. MANN, J. LANDRUM, R. DUPZYK, S. DRISSI, J. KERN, W. STRASSMANN, H.G. BÖRNER, G. BARREAU, K. SCHRECKENBACH, Excited Levels of ^{238}Np from Spectroscopic Measurements of the $^{237}\text{Np}(n, \gamma)^{238}\text{Np}$ Reaction and ^{242}Am Alpha Decay. Proc. 4th Int. Symposium on Neutron Capture Gamma-Ray Spectroscopy, Grenoble, Sept. 1981. Inst. Phys. Conf. Ser. 62.

P. HUNGERFORD, H.H. SCHMIDT, T. VON EGIDY, H.J. SCHEERER, A. MHEEMEED, K. SCHRECKENBACH, G. BARREAU, H.R. FAUST, H.G. BÖRNER, R. BRISSOT, M. STELTS, The Level Scheme of ^{114}Cd up to 3.5 MeV from (d, p) and (n, γ) Measurements. Proc. 4th Int. Symposium on Neutron Capture Gamma-Ray Spectroscopy, Grenoble, Sept. 1981. Inst. Phys. Conf. Ser. 62.

W.R. KANE, R.F. CASTEN, D.D. WARNER, K. SCHRECKENBACH, H. FAUST, S. BLAKEWAY, Strengths of E0 Transitions in ^{188}Os and ^{196}Pt and the Structure of IBA Wave Functions in the Os-Pt Transition Region. Proc. 4th Int. Symposium on Neutron Capture Gamma-Ray Spectroscopy, Grenoble, Sept. 1981. Inst. Phys. Conf. Ser. 62.

K. KAWADE, G. BATTISTUZZI, H. LAWIN, H.A. SELIC, K. SISTEMICH, F. SCHUSSLER, E. MONNAND, J.A. PINSTON, B. PFEIFFER, G. JUNG, Excited O^+ -levels in ^{98}Zr . Z. Phys.

S.A. KERR, P. HUNGERFORD, K. SCHRECKENBACH, Precise Intensity Measurement of Primary γ -rays from the $^{197}\text{Au}(n_{\text{th}}, \gamma)^{198}\text{Au}$ Reaction. Nucl. Instrum. & Methods.

B. KRUSCHE, K.P. LIEB, L. ZIEGLER, H. DANIEL, T. VON EGIDY, R. RASCHER, G. BARREAU, H.G. BÖRNER, D.D. WARNER, Nuclear Structure of ^{41}K by the $^{40}\text{K}(n, \gamma)$ Reaction. Proc. 4th Int. Symposium on Neutron-Capture Gamma-Ray Spectroscopy, Grenoble, Sept. 81. Inst. Phys. Conf. Ser. 62.

W. MAMPE, Experiments with Cold and Ultracold Neutrons at the ILL, Grenoble. Proc. 4th Int. Symposium on Neutron-Capture Gamma-Ray Spectroscopy, Grenoble, Sept. 81, Inst. Phys. Conf. Ser. 62.

A. MHEEMEED, K. SCHRECKENBACH, G. BARREAU, T. VON EGIDY, J. VALENTIN, H.R. FAUST, H.G. BÖRNER, R. BRISSOT, M. STELTS, Investigation of Intruder States in ^{114}Cd . Proc. 4th Int. Symposium on Neutron-Capture Gamma-Ray Spectroscopy, Grenoble, Sept. 81, Inst. Phys. Conf. Ser. 62.

T. MITSUNARI, T.D. MAC MAHON, H. SEYFARTH, K. SCHRECKENBACH, W.R. KANE, I.A. KONDUROV, P. SUSHKOV, Y. LOGINOV, M. BOGDANOVIC, The $^{107}\text{Ag}(n, \gamma)^{108}\text{Ag}$ Reaction. Proc. 4th Int. Symposium on Neutron-Capture Gamma-Ray Spectroscopy, Grenoble, Sept. 81, Inst. Phys. Conf. Ser. 62.

U. QUADE, K. RUDOLPH, P. ARMBRUSTER, H.-G. CLERC, W. LANG, M. MUTTERER, J. PANNICKE, C. SCHMITT, J.P. THEOBALD, H. SCHRADER, F. GÖNNENWEIN, D. ENGELHARDT, Cold Fragmentation of ^{234}U and ^{236}U . Proc. Int. Symposium on Nuclear Fission and Related Collective Phenomena and Properties of Heavy Nuclei, Bad Honnef, Oct. 1981.

V.S. RAMAMURTHY, M. ASGHAR, S.K. KATARIA, Surface Corrections to the Macroscopic Level Density Parameters of Nuclei. Proc. Int. Symposium on Nuclear Fission and Related Collective Phenomena and Properties of Heavy Nuclei, Bad Honnef, Oct. 1981.

H.H. SCHMIDT, P. HUNGERFORD, H. DANIEL, T. VON EGIDY, S. KERR, R. BRISSOT, G. BARREAU, H.G. BÖRNER, C. HOFMEYER, K.P. LIEB, Precise Gamma Energies up to 8 MeV and Complete (n, γ) Level Scheme of ^{28}Al . Nucl. Instrum. & Methods.

H.H. SCHMIDT, P. HUNGERFORD, H. DANIEL, T. VON EGIDY, B. KRUSCHE, K.P. LIEB, R. BRISSOT, G. BARREAU, H.G. BÖRNER, S. KERR, C. HOFMEYER, R. RASCHER, Precise Gamma Energies up to 8 MeV and Complete (n, γ) Level Schemes of ^{28}Al and ^{36}Cl . Proc. 4th Int. Symposium on Neutron-Capture Gamma-Ray Spectroscopy, Grenoble, Sept. 81. Inst. Phys. Conf. Ser. 62.

K. SCHRECKENBACH, Atomic Physics Information from (n, γ) Experiments. Proc. 4th Int. Symposium on Neutron-Capture Gamma-Ray Spectroscopy, Grenoble, Sept. 81. Inst. Phys. Conf. Ser. 62.

K. SCHRECKENBACH, H. FAUST, S. BLAKEWAY, W. GELLETLY, W.F. DAVIDSON, R.F. CASTEN, D.D. WARNER, M.F. STELTS, The $^{135}\text{Ba}(n, \gamma)^{136}\text{Ba}$ Reaction. Proc. 4th Int. Symposium on Neutron Capture Gamma-Ray Spectroscopy and Related Topics, Grenoble, Sept. 81. Inst. Phys. Conf. Ser. 62.

K. SCHRECKENBACH, A.I. NAMENSON, W.F. DAVIDSON, T. VON EGIDY, H.G. BÖRNER, J.A. PINSTON, R.K. SMITHER, D.D. WARNER, R.F. CASTEN, M.L. STELTS, D.H. WHITE, W. STÖFFL, Rotational-Vibrational Band Structure in ^{155}Sm . Nucl. Phys. A.

M. SCHUMACHER, F. SMEND, P. RULLHUSEN, W. MÜCKENHEIM, H.G. BÖRNER, Recent Developments in Elastic Photon Scattering in the Energy Range between 0.1 and 10 MeV. Proc. 4th Int. Symposium on Neutron Capture Gamma-Ray Spectroscopy and Related Topics, Grenoble, Sept. 81. Inst. Phys. Conf. Ser. 62.

A.M.J. SPITS, P.H.M. VAN ASSCHE, H.G. BÖRNER, W.F. DAVIDSON, D.D. WARNER, Investigation of the Reactions $^{152}\text{Gd}(n, \gamma)^{153}\text{Gd}$ and $^{153}\text{Gd}(n, \gamma)^{154}\text{Gd}$. Proc. 4th Int. Symposium on Neutron-Capture Gamma-Ray Spectroscopy, Grenoble, Sept. 81. Inst. Phys. Conf. Ser. 62.

P.A. SUSHKOV, V.L. ALEXEEV, L.P. KABINA, I.A. KONDUROV, D.D. WARNER, Precision Determination of γ -Ray Energies from $^{27}\text{Al}(n, \gamma)$ Reaction and the Level Scheme of ^{28}Al . Proc. 4th Int. Symposium on Neutron-Capture Gamma-Ray Spectroscopy, Grenoble, Sept. 81. Inst. Phys. Conf. Ser. 62.

P.A. SUSHKOV, I.A. KONDUROV, M. BOGDANOVITCH, T. MITSUNARI, T.D. MAC MAHON, H.A. BAADER, D. BREITIG, R. BRISSOT, G. BARREAU, S. KERR, H. FAUST, K. SCHRECKENBACH, Level Scheme of ^{110}Ag from the (n, γ) Reaction. Proc. 4th Int. Symposium on Neutron-Capture Gamma-Ray Spectroscopy, Grenoble, Sept. 81. Inst. Phys. Conf. Ser. 62.

Y. TOKUNAGA, H.G. BÖRNER, H. SEYFARTH, G. BARREAU, K. SCHRECKENBACH, H. FAUST, Ch. HOFMEYER, R. WEINREICH, O.W.B. SCHULT, Study of Low Spin States in $^{75,77}\text{Se}$ Populated in Slow Neutron Capture. Proc. 4th Int. Symposium on Neutron-Capture Gamma-Ray Spectroscopy, Grenoble, Sept. 81. Inst. Phys. Conf. Ser. 62.

D.D. WARNER, H.G. BÖRNER, G. BARREAU, R.F. CASTEN, The Nuclear Structure of ^{195}Pt . Proc. 4th Int. Symposium on Neutron-Capture Gamma-Ray Spectroscopy, Grenoble, Sept. 81. Inst. Phys. Conf. Ser. 62.

4. Inelastic scattering in simple solids

M.R. ANDERSON, M.B.M. HARRYMAN, D.K. STEINMAN, J.W. WHITE, R. CURRAT, Phonon Dispersion Curves and Elastic Properties of Polyoxymethylene Single Crystals. Polymer.

S.D. BADER, S.K. SINHA, B.P. SCHWEISS, B. RENKER, Phonons in Ternary Molybdenum Chalcogenide Superconductors. Chapt. 6 of Superconductivity in Ternary Compounds, Vol. 1.

F. BATALIAN, I. ROSENMANN, Ch. SIMON, G. FURDIN, H.J. LAUTER, Phonons in Graphite Intercalated with Bromine. Int. Conf. on Phonon Physics, Bloomington, Sept. 81. To be published in J. de Physique-Colloques.

J.P. BENOIT, G. HAURET, J. LEFEBVRE, Transition de phase ferroélastique de Hg_2Cl_2 ; Etude par diffusion des neutrons; Mode mou et pic central. J. de Physique.

R. CURRAT, The Role of Phonons in Incommensurate Phase Transitions. Int. Conf. on Phonon Physics, Bloomington, Sept. 1981. J. de Physique-Colloques.

F. DENOYER, A.H. MOUDDEN, R. CURRAT, C. VETTER, A. BELLAMY, M. LAMBERT, The Effect of Hydrostatic Pressure on the Modulated Structures in Thiourea. Phys. Rev. B.

B. DORNER, Coherent Inelastic Neutron Scattering in Lattice Dynamics. Springer Tracts in Modern Physics n° 93, Ed. G. Höhler, Springer-Verlag.

B. DORNER, E.L. BOKHENKOV, E.F. SHEKA, S.L. CHAPLOT, G.S. PAWLEY, J. KALUS, U. SCHMELZER, I. NATKANIEC, Phonon Dispersion Curves in the Molecular Crystals Naphthalene and Anthracene Measured by Inelastic Neutron Scattering. Int. Conf. on Phonon Physics, Bloomington, Sept. 1981. J. de Physique-Colloques.

B. DORNER, E.L. BOKHENKOV, S.L. CHAPLOT, J. KALUS, I. NATKANIEC, G.S. PAWLEY, U. SCHMELZER, E.F. SHEKA. The 12 External - and the 4 Lowest Internal Phonon Dispersion Branches in d_{10} -Anthracene at 12 K. J. Phys. C.

B. DORNER, H. BOYSEN, F. FREY, H. GRIMM, On the Si-O-Si Bond Angle in α - and β -Quartz. Int. Conf. on Phonon Physics, Bloomington, Sept. 1981. J. de Physique-Colloques.

B. DORNER, A.A. CHERNYSHOV, V.V. PUSCHKAREV, A. Yu. RUMYANTSEV, Electron-Phonon Coupling in the Non-Transition Metal Cadmium. Int. Conf. on Phonon Physics, Bloomington, Sept. 1981. J. de Physique-Colloques.

J. KALUS, B. DORNER, V.K. JINDAL, N. KARL, I. NATKANIEC, G.S. PAWLEY, W. PRESS, E.F. SHEKA. Some Phonon-Shifts and -Widths in d_8 -Naphthalene. Phys. Stat. Sol. (b).

A. LOIDL, K. KNORR, C. VETTER, Magnetic Excitations in TbP under Hydrostatic Pressure. Proc. Conf. on Crystalline Electric Field and Structural Effects in f-electron Systems, Wrocław, Poland, Sept. 1981, Plenum Press.

K.A. McEWEN, W.G. STIRLING, C. VETTER, Singlet Ground State and Combined Electron Nuclear Magnetism in Praseodymium. Proc. Conf. on Crystalline Electric Field and Structural Effects in f-Electron Systems, Wrocław, Poland, Sept. 1981, Plenum Press.

A. MAGERL, H. ZABEL, Phonons in Graphite Intercalation Compounds Measured by Neutron Scattering. Proc. Int. Conf. on Physics of Intercalation Compounds, Trieste, Italy, July 1981.

G.M. MEYER, R.J. NELMES, F.R. THORNLEY, W.G. STIRLING, An Inelastic Neutron Scattering Study of the Improper Ferroelectric Transition in Copper Chlorine Boracite. J. Phys. C.

M. QUILICHINI, J.P. MATHIEU, M. LE POSTOLLEC, N. TOUPRY, Compared Raman Study of the Phase Transitions in K_2ZnCl_4 with those of Rb_2ZnCl_4 , Rb_2ZnBr_4 , K_2SeO_4 . J. de Physique.

L.P. REGNAULT, J.P. BOUCHER, J. ROSSAT-MIGNOD, J.P. RENARD, J. BOUILLLOT, W.G. STIRLING, A Neutron Investigation of the Soliton Regime in the One-Dimensional Planar Antiferromagnet $(CD_3)_4NMnCl_3$. J. Phys. C.

B. RENKER, N.M. BUTT, N.E. MASSA, Phonon Dispersion Relations in the Mixed Crystal K_5Rb_5I . Int. Conf. on Phonon Physics, Bloomington, Sept. 81. J. de Physique-Colloques.

B. RENKER, L. BERNARD, C. VETTER, R. COMES, B.P. SCHWEISS, Neutron Scattering Study of the Metal Semiconductor Phase Transition in $K_2Pt(CN)_4Br_{3.3}D_2O$ under pressure. Solid State Commun.

W.C. SCHMIDT, C. ESCRIBE-FILIPPINI, K.R.A. ZIEBECK, Investigations of the Magnetic and Lattice Vibrations in $CoBr_2$ using Neutron Scattering. J. de Physique.

J. SCHNECK, J.C. TOLEDANO, C. JOFFRIN, J. AUBREE, B. JOUKOFF, A. GABELOTAUD, Neutron Scattering Study of the Tetragonal-to-incommensurate Ferroelastic Transition in Barium Sodium Niobate. Phys. Rev. B.

H. ZABEL, A. MAGERL, Inelastic Neutron Measurement of Phonons in Graphite-Alkali Intercalation Compounds. Phys. Rev. B.

5. Crystallographic and magnetic structures

J.P. AIME, J. LEFEBVRE, M. BERTAULT, M. SCHOTT, J.O. WILLIAMS, Studies of a Polymerizable Crystal: I. Structure of Monomer pTS (bis-p-toluenesulphonate of 2,4-hexadiyne 1,6-diol) by Neutron Diffraction at 120 and 221K. J. de Physique.

P. ALDEBERT, J.P. TRAVERSE, Structural Characteristics and Ionic Mobility of $\alpha-Al_2O_3$ at High Temperature. A Neutron Diffraction Study. J. Amer. Ceram. Soc.

R.R. ARONS, W. SCHAEFER, J. SCHWEIZER, Antiferromagnetic Ordering of TbH_{2+x} . 27th MMM Conf., Sheraton, Atlanta, Nov. 1981. J. Appl. Phys.

P. BECKER, Refinement Techniques: High Accuracy Case in "Computing in Crystallography", D. Sayre (IBM) Ed., Proc. Ottawa Summer School, Aug. 1981.

P. BECKER, Dynamical Calculations: on the Meaning of Extinction Models. in "Computing in Crystallography", D. Sayre (IBM) Ed. Proc. Ottawa Summer School, Aug. 1981.

T. BIRCHALL, G. DENES, K. RUEBENBAUER, J. PANNETIER, A ^{119}Sn Mössbauer Spectroscopic Study of a Single Crystal of $\alpha-SnF_2$ and Partially Oriented $\alpha-PbSnF_4$. J. Chem. Soc.

T. BIRCHALL, G. DENES, K. RUEBENBAUER, J. PANNETIER, A ^{119}Sn Mössbauer Study of the Phase Transitions in SnF_2 . J. Chem. Soc.

A. BOEUF, J.M. FOURNIER, L. MANES, F. RUSTICHELLI, Study of a Structural Phase Transition on a UMn_2 Single Crystal by α -Ray Diffraction. Proc. 11^e Journées des Actinides, Jesolo Lido, Italie, May 1981.

J.X. BOUCHERLE, D. GIVORD, A. GREGORY, J. SCHWEIZER, Form Factor Analysis in Rare Earth Intermetallics: evidence for 5d Polarization and Higher-order Exchange Terms. 27th MMM Conf., Sheraton, Atlanta, Nov. 1981. J. Appl. Phys.

J.X. BOUCHERLE, J. SCHWEIZER, Thermal Variations of the Conduction Electron Polarization in $HoAl_2$. 27th MMM Conf., Sheraton, Atlanta, Nov. 1981. J. Appl. Phys.

J. BROS, M. GAUNE-ESCARD, A.W. HEWAT, Structural Transitions in UCl_4 Anticipating Melting. Acta Cryst. A.

P.J. BROWN, J.B. FORSYTH, A.W. HEWAT, Structural and Magnetic Transitions in K_2ReCl_6 . Phase Transitions.

P.J. BROWN, K.R.A. ZIEBECK, P. RADHAKRISHNA, The Spin Density Distribution in $CrCl_3$ and $CrBr_3$. Proc. Int. Symposium on Neutron Scattering, Argonne, Aug. 1981. Amer. Inst. Phys. Conf. Ser. 1982.

M. FAUCHER, J. PANNETIER, Y. CHARRAIRE, P. CARO, Refinement of the Nd_2O_3 Structures at 4K. Acta Cryst.

A. FILHOL, B. GALLOIS, J. LAUGIER, P. DUPUIS, C. COULON, Neutron Diffraction Evidence of Structural Phase Transitions at 150K and 90K in Trimethylammonium-iodide-7,7,8,8, Tetracyano p-Quinodimethane $TCNQ^{2/3}$, $(I_3)_{1/3}$. Mol. Cryst. Liq. Cryst.

A. FILHOL, J. GAULTIER, C. HAUW, B. HILTI, C.W. MAYER, Etude par la diffraction des rayons X et des neutrons du bis-tetrathiotetracène-triiodé ($\text{TTT}_{2(3+\delta)}$): description des sous-réseaux ordonnés et désordonnés des atomes d'iodes; évolution structurale en fonction de la température. *Acta Cryst.*

A.N. FITCH, B.E.F. FENDER, A.F. WRIGHT, The Structure of $\text{LiUO}_2\text{AsO}_4 \cdot 4\text{D}_2\text{O}$ by Powder Neutron Diffraction. *Acta Cryst. B.*

D. GROULT, J. PANNETIER, B. RAVEAU, Neutron Diffraction Study of the Defect Pyrochlores $\text{TaWO}_{5.5}$. *J. Solid State Chem.*

A.W. HEWAT, T.M. SABINE, Profile Refinement of Single Crystal and Powder Data - the Accuracy of crystallographic Parameters. *Aust. J. Phys.*

G.H. LANDER, Neutron Scattering Studies of the Actinides. *Proc. Int. Conf. on Actinides*, Pacific Grove, Calif., Sept. 1981, Pergamon Press.

A. LEBLE, J.J. ROUSSEAU, J.C. FAYET, J. PANNETIER, J.L. FOURQUET, R. DE PAPE, Order Disorder of NH_4AlF_4 through EPR Investigation. *Phys. Stat. Sol.*

C. VETTIER, Neutron Scattering Studies of Materials under Pressure. *Proc. Int. Symposium on Neutron Scattering*, Argonne, Aug. 1981. *Amer. Inst. Phys. Conf. Ser.* 1982.

C. VETTIER, Neutron Scattering Studies of Solids under Stress and Pressure. 8th AIRAPT & 19th EHPRG Conf. "High Pressure in Research and Industry".

W. WICKELHAUS, A. SIMON, K.W.H. STEVENS, P.J. BROWN, K.R.A. ZIEBECK, A Crystallographic Study of the Phase Transition at 185 K in Eu_3S_4 . *Phil. Mag.*

6. Fluids and Amorphous substances

J.M. DUBOIS, G. LE CAER, P. CHIEUX, J. GOULON, Polarized Neutron Diffraction, Exafs and Mössbauer Spectroscopy Studies of Amorphous $\text{Co}_{1-x}\text{B}_x$ ($x=0.185; 0.22; 0.26$) Alloys. *Int. Conf. on Amorphous Systems investigated by Nuclear Methods*, Balatonfüred, Hungary (1981). *Nucl. Instrum. & Methods.*

S. EISENBERG, J.F. JAL, J. DUPUY, P. CHIEUX, W. KNOLL, Neutron Diffraction Determination of the Partial Structure Factors in Molten CuCl . *Phil. Mag. A.*

F. MEZEL, μ eV Resolution Study of Excitations in Superfluid ^4He by Neutron Spin Echo. *Phys. Rev. Lett.*

A.P. MURANI, J.P. REBOUILLAT, Spin Dynamics of an Amorphous $\text{Y}_{.33}\text{F}_{.67}$ Alloy. *J. Phys. F.*

K.S. PEDERSEN, K. CARNEIRO, F.Y. HANSEN, The Dynamics of Liquid N_2 Studied by Neutron Inelastic Scattering. *Phys. Rev. B.*

J. SCHWEIZER, Polarized Neutron Scattering Studies on Amorphous Solids. *Int. Conf. on Amorphous Systems investigated by Nuclear Methods*, Balatonfüred, Hungary, 1981. *Nucl. Instrum. & Methods.*

A.F. WRIGHT, Small Angle Scattering from Heterogeneities in Glasses. *Proc. Int. Symposium on Neutron Scattering*, Argonne, Aug. 1981. *Amer. Inst. Phys. Conf. Ser.* 1982.

A.F. WRIGHT, Traitement thermique et cristallisation des verres. *Congrès de la Société Française de Physique*, Clermont-Ferrand, juin-juillet 1981, *J. de Physique.*

7. Imperfections

J.C. ACHARD, A.J. DIANOUX, C. LARTIGUE, A. PERCHERON-GUEGAN, F. TASSET, Structure of Al, Cu and Si substituted LaNi_5 and of the corresponding β -deuterides from powder neutron diffraction. Localized diffusion mode of hydrogen in LaNi_5 and Al and Mn substituted compounds from quasi-elastic neutron scattering. 15th Rare Earth Research Conf., Rolla, Missouri, June 81, in "The Rare Earth in Modern Science and Technology", G.J. MacCarthy, J.J. Rhyne, eds., Vol. 3, Plenum Press, N.Y.

V. BUTLER, C.R.A. CATLOW, B.E.F. FENDER, The Defect Structure of Anion Deficient ZrO_2 . *Solid State Ionics.*

W. BUTTLER, H.-J. STÖCKMANN, H. ACKERMANN, K. DÖRR, F. FUJARA, H. GRUPP, P. HEITJANS, G. KIESE, A. KÖRBLEIN, D. DUBBERS, Point Defects in Alkaline-Earth Fluorides after Thermal Neutron Irradiation. *Z. Phys. B.*

D. FINK, J.P. BIRSACK, J. RIEDERER, F. JAHNEL, R. HENKELMANN, Bor und Lithium in antiker und moderner Keramik. *Berichte der Deutsch. Keram. Gesellschaft.*

D. FINK, J.P. BIRSACK, K. TJAN, F. JAHNEL, V.K. CHENG, Ranges of ^3He , ^6Li and ^{10}B in various solids. *Proc. 9th Int. Conf. on Atomic Collisions in Solids*, Lyon, July 1981.

R.M. GALERA, J. PIERRE, A.P. MURANI, Anomalous Behaviour of Cerium in RMg_3 and RInAg_2 Compounds. *Proc. 4th Int. Conf. on Crystal Fields and Structural Effects in f-Electron Systems*, Wrocław, Sept. 1981. Plenum Press.

G. GÖLTZ, H. KRONMÜLLER, A. SEEGER, H. SCHEUER, W. SCHMATZ, Investigation of Dislocation Structures in Fe using Neutron Magnetic Small Angle Scattering. *J. of Material Science and Engineering.*

J. LAMLOUMI, C. LARTIGUE, A. PERCHERON-GUEGAN, J.C. ACHARD, G. JEHANNO, Thermodynamic and Magnetic Properties of $\text{LaNi}_{5-x}\text{Fe}_x$ compounds and their hydrides. *Proc. 15th Rare Earth Research Conf.*, Rolla, Missouri, June 81, in "The Rare Earth in Modern Science and Technology", G.J. MacCarthy, J.J. Rhyne, eds., Vol. 3, Plenum Press N.Y.

M. LOEWENHAUPT, G.H. LANDER, A.P. MURANI, A. MURASIK, Measurement of the Magnetic Response Function in UAs. *J. Phys. C.*

A. PASTUREL, C. CHATILLON-COLINET, C. LARTIGUE, A. PERCHERON-GUEGAN, Détermination de l'enthalpie de formation du composé LaNi_4Mn par calorimétrie de dissolution. *Annales de Chimie.*

M. ROTH, La diffusion aux petits angles des neutrons appliquée à la métallurgie. *Ecole sur l'utilisation des neutrons en métallurgie*, Aussois, Janv.-Février 1981. Ed. J. Joffrin.

H. WEHR, K. KNORR, A.P. MURANI, Crystal Field Excitations in $\text{CeAg}_{1-x}\text{In}_x$ Compounds. *Proc. 4th Int. Conf. on Crystal Field and Structural Effects in f-Electron Systems*, Wrocław, Sept. 1981. Plenum Press.

A.F. WRIGHT, Etude de nucléation et cristallisation des verres par diffusion aux petits angles. *Ecole sur l'utilisation des neutrons en métallurgie*, Aussois, Janv.-Février 1981. Ed. J. Joffrin.

8. Biology

H.D. BARTUNIK, P. JOLLES, J. BERTHOUD, A.J. DIANOUX. Intramolecular low-frequency vibrations in lysozyme by neutron time-of-flight spectroscopy. *Biopolymers*.

M. CHABRE, D. L. WORCESTER. X-ray and Neutron Diffraction Studies of the Binding of Initiator tRNA(Met) to *E. coli* Trypsin-modified Methionyl-tRNA Synthetase. *J. Mol. Biol.*

P. DESSEN, G. FAYAT, G. ZACCAÏ, S. BLANQUET, Neutron Scattering of tRNA-induced Aggregation of *E. coli* Tyrosyl-tRNA Synthetase. *Biochimie*.

P. DESSEN, G. ZACCAÏ, S. BLANQUET, Identification by Neutron Scattering of tRNA-induced Aggregation of *E. coli* Tyrosyl-tRNA Synthetase. *Biochimie*.

G.F. ELLIOTT, Z. SAYERS, P.A. TIMMINS, Neutron Diffraction Studies of the Corneal Stroma. *J. Mol. Biol.*

J. KRÜSE, P.A. TIMMINS, J. WITZ, A Neutron Scattering Study of the Structure of Compact and Swollen Forms of Southern Bean Mosaic Virus. *Virology*.

M.S. LEHMANN, G. ZACCAÏ, Small Angle Scattering Study of Water Bound to a Protein. *Proc. Conf. Biophysics of Water*, Cambridge, June-July 1981.

R.P. MAY, K. IBEL, J. HAAS, The Forward Scattering of Cold Neutrons by Mixtures of Light and Heavy Water. *J. Appl. Cryst.*

F. PODO, R. STROM, C. CRIFO, C. BERTHET, M. ZULAUF, G. ZACCAÏ, The Interaction with Phospholipids of Bee Venom Melittin. A Structural Study of the Peptide and Lipid Components. 3rd Biophysical Discussion "Protein-Lipid Interactions in Membranes", oct. 1981, Biophysical Society, Airlie, Virginia.

D.L. WORCESTER. The Role of Neutron Scattering in Molecular and Cellular Biology. *Proc. Int. Symposium on Neutron Scattering*, Argonne, Aug. 1981. *Amer. Inst. Phys. Conf. Ser.* 1982.

9. Chemistry

B. ALEFELD, I.S. ANDERSON, A. HEIDEMANN, A. MAGERL, S.F. TREVINO, The Measurement of Tunnel States in Solid CH_3NO_2 and CD_3NO_2 . *Communication in J. Chem. Phys.*

J.P. BEAUFILS, Y. BARBAUX, Study of Adsorption on Powders by Surface Differential Diffraction Measurements Argon on Co_3O_4 . *J. Appl. Cryst.*

G. BOMCHIL, C. RIEKEL, Neutron Diffraction Studies of Surface Electrochemical Formation of Copper on Platinum. *The Electrochem. Soc. Meeting*, Denver, Colorado, USA, Oct. 1981.

B. CABANE, R. DUPLESSIX, Organisation of Surfactant Micelles Adsorbed on a Polymer Molecule in Water: A Neutron Scattering Study. *J. de Physique*.

D.J. CEBULA, D.Y. MYERS, R.H. OTTEWILL, Studies on Microemulsions. Scattering on Studies on Water-in-Oil Microemulsions (Part. I). *Colloid & Polymer Science*.

D.J. CEBULA, M.C. OWEN, C. SKINNER, W.G. STIRLING, R.K. THOMAS, Observations of Longitudinal Acoustic Phonons in Magnesium Vermiculite and Muscovite by Neutron Inelastic Scattering. *Clay Minerals*.

A.J. DIANOUX, M. PINERI, F. VOLINO, Neutron Incoherent Scattering Law for Restricted Diffusion inside a Volume with an Anisotropic shape: Application to the Problem of Water Absorbed in Nafion R Membranes. *Mol. Phys.*

H. ESTRADE-SZWARKOPF, J. CONARD, C. POINSIGNON, A.J. DIANOUX, N.M.R. and N.Q.S. Study on Hectorite: Proton's Motion in First Steps of Clay Hydration. *Proc. Danish-French Workshop on "Solid State Materials for Low to Medium Temperature Fuel Cells and Monitors, with special emphasis on Proton Conductors"*, Ecole Polytechnique, Décembre 1981.

E. GEISSLER, A.M. HECHT, R. DUPLESSIX, Comparison between Neutron and Quasielastic Light Scattering by Polyacrylamide Gels. *J. Polymer Science*.

H.W. HÄSSLIN, C. RIEKEL, A Real Time Neutron Diffraction Study on the reaction of AsF_5 with Deuterated Poly-Paraphenylene. *Synthetic Metals*.

H.W. HÄSSLIN, C. RIEKEL, X-Ray and Neutron Diffraction of PolyParaPhenylene. A Structural Kinetic Investigation of the Doping with AsF_5 . *MACRO 81*, Strasbourg, July 1981.

H. JOBIC, Neutron Inelastic Scattering from Oriented and Polycrystalline Polyethylene: Observation and Polarisation Properties of the Optical Phonons. *J. Chem. Phys.*

H. REBBAH, J. PANNETIER, B. RAVEAU. Localization of Hydrogen in the Layer Oxide HTiNbO_5 . *J. Solid State Chem.*

A. RENOUPREZ, G. CLUGNET, H. JOBIC, The Interaction between Benzene and Nickel, A Neutron Inelastic Spectroscopy Study. *J. Catal.*

P. TERECH, A.J. DIANOUX, R. RAMASSEUL, F. VOLINO, Aspect linéaire de la structure d'un gel stéroïde. *C.R. Acad. Sci.* (Note).

C. TIBY, H.J. LAUTER, A Neutron Scattering Study of the Structures and Phase Transitions of ^{36}Ar . Submonolayers on Grafoil. *Surface Science*.

F. VOLINO, M. PINERI, A.J. DIANOUX, A. DE GEYER, Water Mobility in a Water Soaked Nafion Membrane: A High Resolution Neutron Quasi-Elastic Study. *J. Polymer Science*.

ACKNOWLEDGEMENT

The Institut Laue-Langevin wishes to thank
all contributors to the compilation of the

ANNUAL REPORT 1981

Edited and compiled by the
Scientific Secretary of the ILL
Bernd P. Maier

Translations by D. Gray, ILL

Lay-out and styling by
Roger David - Graphiste - Grenoble
Printed in France by Dardelet 112069 Grenoble

Photographs: Alsthom-Atlantique,
A. Freund, A. Bresson, B. Maier



ISSN 0181-751