Inelastic Neutron Scattering study of the "Non Fermi Liquid" phenomenon

Pascal GIUDICELLI

Supervisors
Nick BERNHOEFT and Jacques FLOUQUET (CEA-Grenoble)

ILL local responsible
Roland CURRAT

Experimental Team
Anne STUNAULT and Jacques OLLIVIER

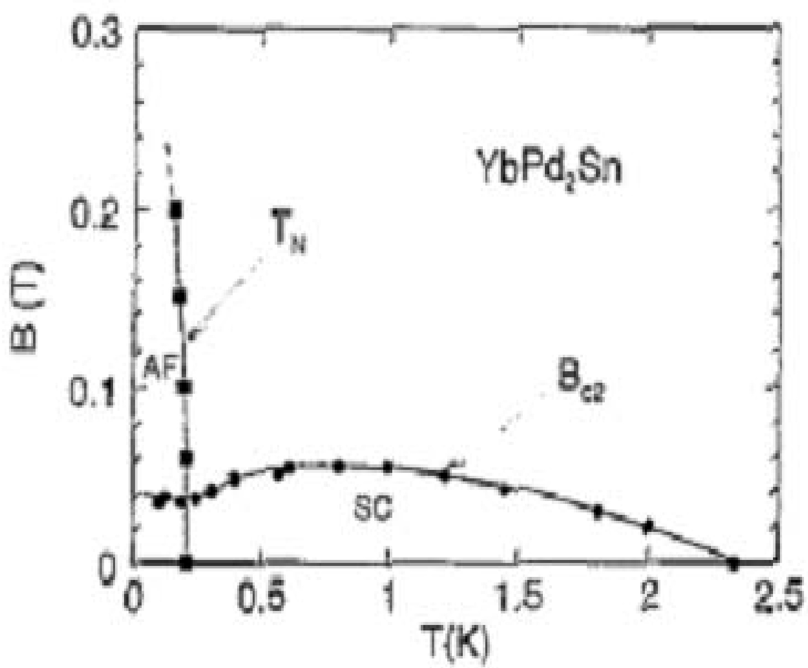
$YbSnPd_2$

an unconventionnal superconductor

→Coexistence between antiferromagnetism and superconductivity ($T_N = 0.22$ K, $T_{sc} = 2.3$ K)

Link between magnetic fluctuations and superconductivity demonstrated by unusual critical magnetic field dependence versus temperature (leading to re-entrant behaviour in B field)

→ To understand the superconductivity in this compound, we need to carefully study the magnetic fluctuations in differents phases of interest.



$YbSnPd_2$ (B,T) phase diagram
Y. AOKI and al.

Experiments on $YbSnPd_2$

Energy scale : $T_N \sim 25$ µeV, $T_{sc} \sim 200$ µeV

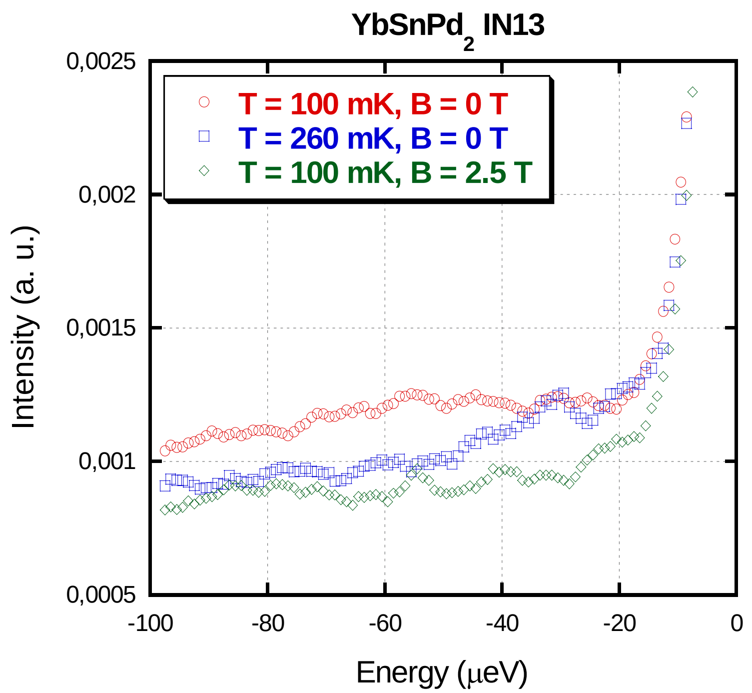
→We used IN6 (? E ~ 90 µeV), IN14 (? E ~ 28 µeV) and IN13 (? E ~ 8 µeV).

Sample environnement

→Cryomagnet + dilution fridge insert

Summary of results

We found unexpected excitations (inelastic). Their temperature and magnetic field dependencies, measured on IN6, provide new understanding of the unexplained specific heat at low temperature.



Magnetic excitations (and background) at T = 100 mK and 260 mK observed on IN13.

UCu_4Pd

a "Non Fermi Liquid"

	Fermi Liquid	Non Fermi Liquid
Specific heat	$C = ? . T + ß . T^3$	$C / T \sim T^{-1/3}$ or $-\ln T$
Resistivity	$\rho = \rho_0 \pm A . T^2$	$\rho \sim 1 \pm T$
Susceptibility	$\chi \sim$ const (Pauli)	$\chi \sim T^{-1/3}$ or $-\ln T$

Many (complicated) theories have been developed to explain the NFL behaviour, but none seems to be totally successful yet. However, it appears that the **dynamical magnetic susceptibility** is an important feature, and that the **disorder** could play a key role.

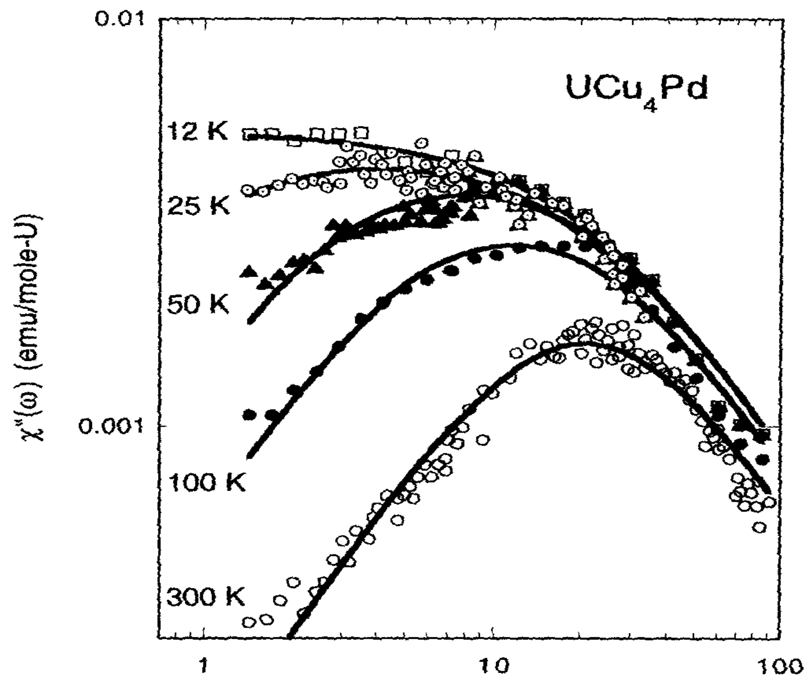
Experiments on UCu_4Pd

<u>Samples:</u> High quality polycrystalline samples one annealed and one as cast. (E.-W. Scheidt, U. Killer)

<u>Experimental aim</u> extending data available from M. Aronson to: **a)** annealed sample, **b)** high temperature ~ 600 K (looking for cross over to FL) **c)** low energy and high magnetic field (to explain the specific heat reduction at low temp. in B field.)

b) → experiments on IN4 and MARI (ISIS), with cryofurnace.

c) → experiments on IN14, IN6 and FOCUS (PSI) with cryomagnet and dilution or ^{3}He insert.



Dynamical magnetic susceptiblity (imaginary part) and fit in N. Bernhoeft's model (data from M. Aronson)

Thanks to …

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IN13 staff

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Proceedings of ICM 2003, JMMM (accepted paper)