Multilayer systems studied with Neutron Larmor Precession

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(Misha or Mike)

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Motivation and objectives

- ***The aim of the PhD fellowship:***

  elaboration and implementation of a new method based on the combination of Neutron Spin-Echo technique and Neutron Reflectometry

- ***The main objectives:***

  - to develop the method - Angular Encoding - which will provide similar (to state-of-the-art machines) or even higher angular resolution working at significantly higher beam angular divergence

  - To elaborate further scientific approach extended for Grazing Incidence Small Angle Neutron Scattering

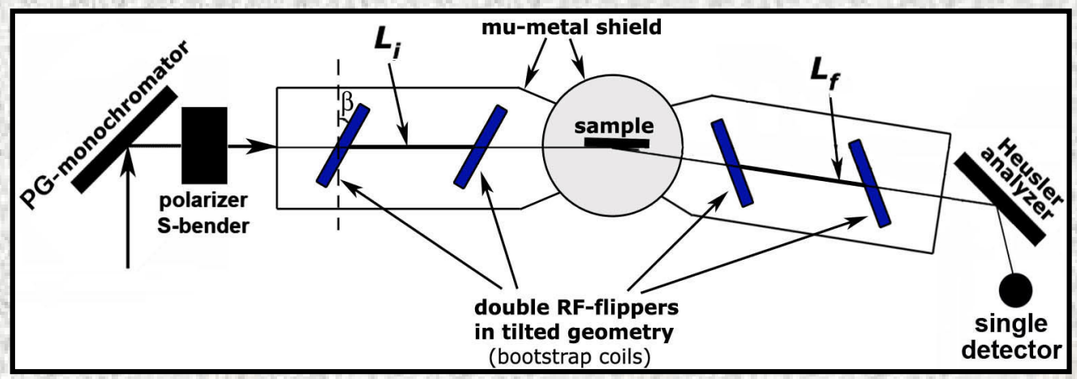
  - Carry out the Angular Encoding experiments on polymer samples (PSd-PBMA & PS-PMMAd block-copolymers) to show the abilities of the method to distinguish different scattering events

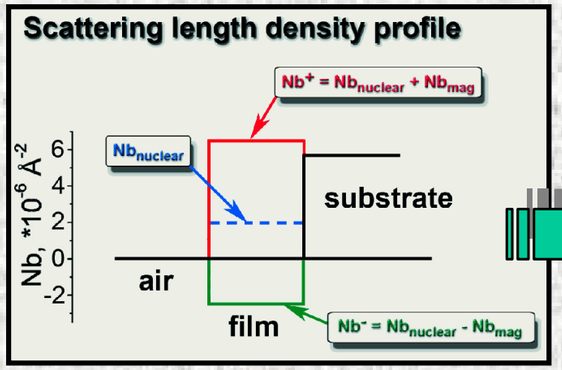
  - To investigate the phenomenon of Larmor Pseudo Precession (LPP) of the neutron polarization in magnetic films and multilayer systems (Fe films and Fe/Cr multilayers) by Spin-Echo Reflectometry

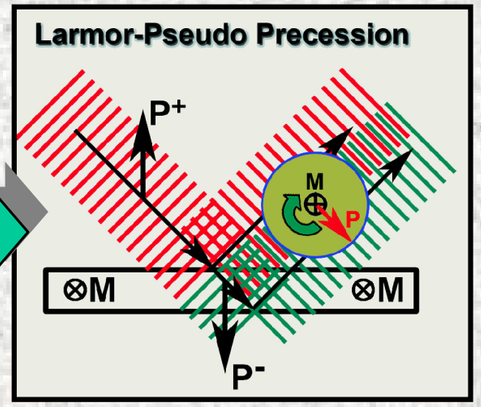
  - In long-range outlook, development of the new method to study the magnetism in thin films and multilayers and the structure and the interfaces in polymer samples

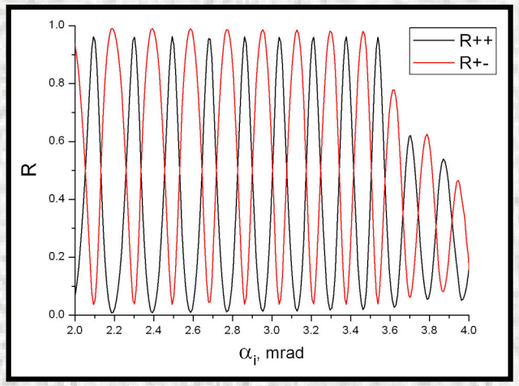
IN3 at the ILL with the ZETA Spin-Echo set-up

Magnetic measurements
Larmor Pseudo-Precession

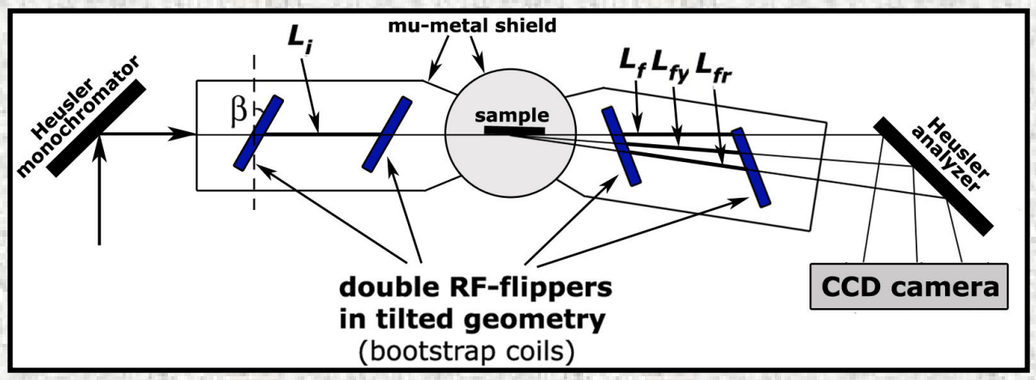


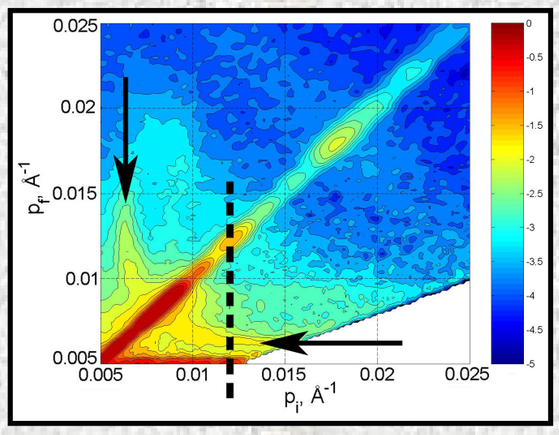


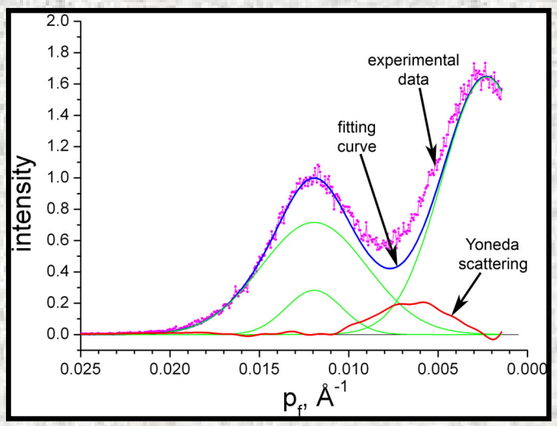


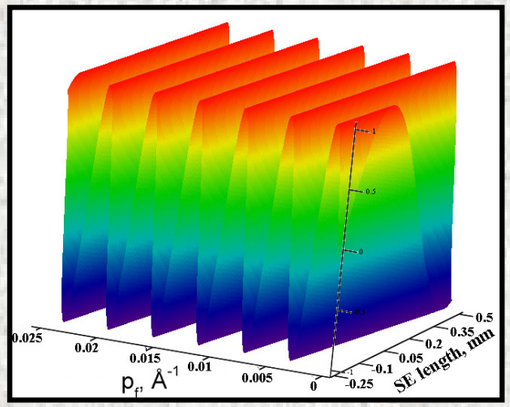


Angular encoding









Mikhail Jernenkov

Students clip session, ILL, 14th February, 2006

Results and summary

- The Angular Encoding vas verified using Yoneda scattering and the reflected beam with an outlook on the full potential of this method for 2D encoding

- Obtained angular resolution of the method is as high as 0.01° which is sufficient even for conventional reflectometry

- We have succeeded in the measurements of the neutron polarization precession at the reflection from a thin ^{57}Fe, ^{56}Fe film by Spin-Echo technique combined with Reflectometry

- We proved that these oscillations arise due to the Larmor Pseudo-Precession of the neutron polarization at reflection from the film and showed for the first time the *direct* experimental evidence on it

- The magnetization of the films was measured by the Larmor Pseudo-Precession. The used formalism allows to determine the distribution of the layer magnetizations in magnetic multilayer films