(invited) Delivering optimised neutron probes to understand the micro and macroscopic structure of materials
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The ISIS facility is a pulsed neutron source which uniquely operates two target stations. The two target stations possess different operating characteristics such as proton power and repetition frequency. This diversity allows us to tailor the neutron instrumentation to provide optimised experimental probes for a wide range of contemporary research in the physical and life sciences.

In this talk we shall highlight recent developments in instrumentation across both target stations and the scientific insight it has enabled. Looking forward we shall describe the development of the ISIS first target station and the instrumentation currently under construction. We will also reinforce the importance of enabling technologies such as software and sample environment in the production of high quality scientific output.

Rendering the complex simple at the SNS liquids reflectometer
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The seemingly simple task of measuring the absolute specular reflectivity of a neutron beam reflected from a film deposited on a flat surface can prove worryingly complex using a modern reflectometer. The combination of precise alignment requirements, high incident neutron flux and delicate detectors, the need for multiple incident angles and wavelength bands, and controlling fidgety sample environments can present a daunting challenge to researchers mainly interested in the structure and properties of their samples. A heavy burden can subsequently fall on beamline staff tasked with facilitating these measurements. We describe a series of recent improvements to the SNS Liquids Reflectometer to implement automated sample changing and alignment, seamless integration of data collection and sample environment equipment into instrument control software, absolute intensity normalization of polychromatic neutron beams using attenuators and transfer functions, and the automated reduction and assembly of specular reflectivity curves from measurements at multiple angles and wavelength bands. That which would be hidden from the user shall be presented here.

A new polarized neutron reflectometer at the intense pulsed neutron source of the materials and life science experimental facility (MLF) of J-PARC
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A new polarized neutron reflectometer (SHARAKU) was installed at the beam line 17 (BL17) of the Material and Life Science Experimental Facility (MLF) in the Japan Proton Accelerator Research Complex (J-PARC). The user program of this reflectometer has been already started in February 2012. We will report the outline design specification, and the basic performance of this new reflectometer.

MARIA: The modern neutron reflectometer of the JCNS optimised for small sample sizes and thin layers

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The JCNS has installed the new, high-intensity reflectometer MARIA in the neutron guide hall of the FRM II reactor in Garching. Unique features of MARIA include (i) vertical focussing with an elliptic guide from 170 mm down to 10 mm at the sample position, (ii) reflectometer and GISANS mode, (iii) polarization analysis over a large 2d position sensitive detector as standard, (iv) adjustable wavelength spread from 10 to 1 % by a combination of velocity selector and chopper, (v) flexible sample table using a Hexapod for magnetic field and low temperature sample environment and (vi) in-situ sample preparation facilities. Together with a 400 x 400 mm² position sensitive detector and a time-stable ³He polarization analyser based on Spin-Exchange Optical Pumping (SEOP), the instrument is dedicated to investigate specular reflectivity and off-specular scattering from magnetic layered structures down to the monolayer regime. In addition the GISANS option can be used to investigate lateral correlations in the nm range. This option is integrated into the reflectometer's collimation, so it can be chosen during the measurement without any realignment.

MARIA is a state of the art reflectometer at a constant flux reactor. It gives you the opportunity to investigate easily reflectivity curves in a dynamic range of up to 7-8 orders of magnitude, off-specular scattering, GISANS and even simple SANS measurement. We will discuss how MARIA can help you to investigate the depth resolved vector information of your magnetic samples or to investigate your soft matter samples.

Frontiers of neutron larmor diffraction

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The TRISP spectrometer at the FRM II is based on the resonance spin-echo technique invented by Golub and Gähler and incorporates the spin-echo phonon focusing proposed by Mezei. Linewidths of dispersive excitations with energies up to 50meV are measured with a resolution in the µeV-range. This instrument also incorporates Rekveldt’s Larmor diffraction (LD) technique, on which we will focus here. In the present configuration, the lattice spacing is measured with a relative resolution of 10⁻⁶, i.e. about two orders of magnitude more sensitive than conventional diffraction techniques. LD also provides the distribution of d values, resulting for example from internal strain, lattice defects, magnetostricion, and small splitting of Bragg peaks due to lattice distortions. Applied to magnetic Bragg peaks, correlation lengths and magnetic domain sizes up to 1µm are resolved. In the present contribution, we will give a short introduction, review recent scientific highlights, and outline the design of a dedicated LD pushing the relative resolution to 10⁻⁷, a limit which is imposed by the Darwin width in perfect crystals. We will also discuss briefly how this notorious continuous technique can be operated efficiently at a pulsed source.

Measuring slow dynamics at interfaces with grazing incidence neutron spin echo spectroscopy

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Recently, the dynamics of microemulsions close to a planar interface has been studied with Grazing Incidence Neutron Spin Echo Spectroscopy (GINSES) [1]. Varying the incident angle and the contrast between silicon block and sample allows retrieving information about membrane fluctuations as a function of scattering depth in the range of some 10-100 nm. So far, classical neutron spin echo spectrometers have been used to measure with a laterally collimated beam in grazing incidence geometry. We show examples of how the dynamics of
microemulsions, membranes and microgels in the vicinity of a rigid interface is modified. Intensity is the key issue for dynamics measurements with an evanescent neutron wave. We present a concept for a dedicated instrument for GINSES experiments, where beam extraction, shielding and sample geometry and sample environment are optimized for such low intensity experiments. A significant gain in intensity would open new possibilities for studying slow dynamics in the vicinity of rigid interfaces.