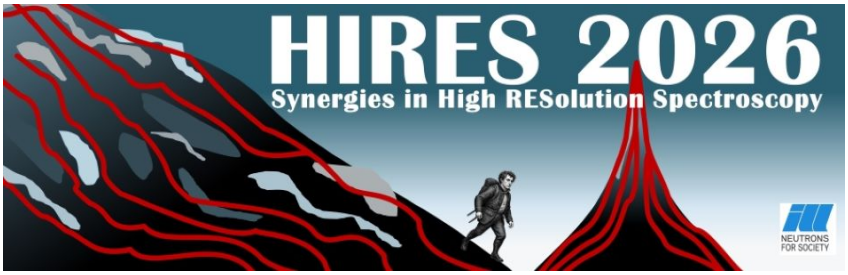

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Portable devices for adding Spatial-Intensity-Modulation-mode capabilities to polarized neutron beams at FRM-II

The Modulated IntEnsity with Zero Effort (MIEZE) resonant spin-echo technique, implemented at the RESEDA instrument at the FRM II, allows measurements of depolarizing samples with high energy resolution and has its optimum resolution at small scattering angles, i.e. SANS geometries. With the recent adaptations towards thermal neutrons, and possibility to move the detector to large scattering angles, a large range of momentum transfers becomes accessible at RESEDA, greatly increasing the flexibility of the instrument. This, however, requires addressing the Larmor phase aberrations originating from the finite sample size, the effect of which becomes prominent outside of the SANS regime. By incorporating Magnetic Wollaston prisms (MWPs), a device which can produce controlled spatial modulations of intensity, it is possible to compensate Larmor phase aberrations, thereby extending the MIEZE resolution to any desired scattering angle. The spatial intensity modulation mode (SIM-mode) device incorporates MWPs with a radio-frequency (RF) spin flipper in a single modular unit, providing great flexibility of achievable modulations. Such SIM-mode devices could be then used at different instruments at FRM II, for example improving resolution of polarized SANS or diffraction instruments, or enabling the study of intra-particle mode-entangled neutron beams which has potential use in probing many-body quantum entanglement in materials [2]. In this contribution, we provide an update on the construction progress of SIM-mode devices intended for use at FRM II, describe the details of their operation, and discuss the various possibilities they offer.

[1] Fankang Li, J. Appl. Cryst. 55, 90-97 (2022).
[2] J. Leiner et. al., Phys. Rev. Appl. 22, L031005 (2024).

Session

Instrumentation

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