TECHNISCHE UNIVERSITÄT WIEN

INSTITUT FÜR FESTKÖRPERPHYSIK
Institute of Solid State Physics

Wiedner Hauptstr. 8-10/138, 1040 Wien
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# INVITATION to IFP-SEMINAR

## Investigating Quantum Materials using ILL's Neutron Spectroscopy Suite

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**Host**: Silke Bühler-Paschen
**Date**: 12.08.2026, 16:00
**Place**: TU Wien, Freihaus Building
Wiedner Hauptstraße 8-10, 1040 Wien
Seminar Room DC red 07 (red section, 7. OG)
Zoom: https://tuwien.zoom.us/j/65583073066?pwd=gtRK6YsrRnzUvNjDrAcLGCF4X6WvH7.1

Neutron spectroscopy, with its intrinsic sensitivity to magnetism, provides unique insights into quantum materials. The dynamical susceptibility measured with neutrons enables direct validation of microscopic models, such as spin-wave calculations and ab initio theories. Moreover, neutron scattering plays a central role in model-free approaches, which impose demanding experimental conditions: absolute units for elastic and inelastic scattering, low temperatures, and, ideally, polarization control for unambiguous verification.

Concerning methodological developments, I will focus on ILL's cold neutron spectrometer ThALES, which combines high continuous neutron flux with tunable resolution, thanks to its flexible primary spectrometer design and well-conditioned incident beam. ThALES can be operated in both unpolarised and fully polarised modes. A recent addition is the innovative multi-analyser system MARMOT [1], which enhances ThALES' capabilities by enabling efficient mapping of selected regions in momentum and energy space. MARMOT is based on a novel energy-analysis concept: large arrays of bent silicon blades (≈90 per channel) combined with 30 position-sensitive $^3$He detectors of trapezoidal shape specifically designed to minimize dead zones. Angular multiplexing across 30 channels shall provide a scattering-angle coverage of ~75°, while its geometry allows truly continuous energy analysis over a wide dynamic range (3.5 to 7meV). Commissioning is ongoing using an initial configuration which provides ~50% angular coverage. In the first part of my presentation, I will present an overview of the ThALES spectrometer and its MARMOT analyser system.

Afterwards I will highlight recent scientific results that showcase the performance of ILL's spectrometers. To this end, I will put a special emphasis on the collective excitations observed in the cubic heavy Fermion superconductor ($T_c$ = 0.85 K, γ > 1J/molK$^2$) $UBe_{13}$. The influence of crystallographic symmetries and associated microscopic dynamics on superconductivity remains puzzling though antiferromagnetic fluctuations were identified by cold neutron spectroscopy [2]. Their reciprocal space position corresponds to the zone boundary e.g. large phonon DoS as the end point of dispersive excitations. To establish a link between unusual thermoelectric properties and correlated electronic properties, I will report on my recent study of low-lying phonons under applied magnetic field using ILL's thermal spectrometer IN8 [3].

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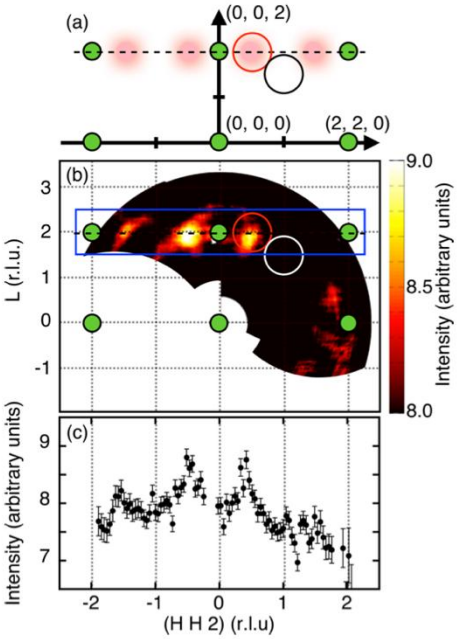
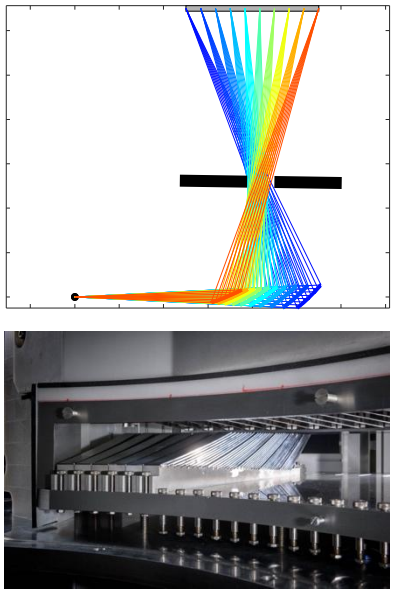
Finally, I shall discuss some experimental strategies that leverage the versatile capabilities of ILL's current and ESS' future neutron spectroscopy suite.




Magnetic fluctuations in $UBe_{13}$



Marmot concept and realisation

[1] https://www.ill.eu/en/about-the-ill/news-and-events/news/marmot-at-full-swing.
[2] A. Hiess, A. Schneidewind, O. Stockert, Z. Fisk, 10.1103/PhysRevB.89.235118 (2014).
[3] A. Hiess, E. Blackburn, U. B. Hansen, M. M. Koza, A. Ivanov, A. Piovano, to be published.

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