

Ultrahigh-resolution neutron spectroscopy of low-energy spin dynamics in UGe₂

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Studying the prototypical ferromagnetic superconductor UGe₂ we demonstrate the potential of the newly developed longitudinal modulated intensity by zero effort (MIEZE) technique for the study of quantum matter. MIEZE is a novel neutron spectroscopy method with ultrahigh energy resolution of at least 1 μ eV at the RESEDA beamline at the Heinz Maier-Leibnitz Zentrum in Garching, Germany. Unlike other spin echo techniques, MIEZE encodes the resolution via a modulation of the neutron beam intensity and is insensitive to depolarization at the sample position and can even be combined with magnetic fields. Further, by performing the experiment in small angle neutron scattering (SANS) geometry, this simultaneously allowed us to resolve momentum transfers down to 0.015 $\text{\AA}^{-1}$. In the case of UGe₂, we reveal purely longitudinal spin fluctuations with a dual nature arising from 5*f* electrons that are hybridized with the conduction electrons. Local spin fluctuations are perfectly described by the Ising universality class in three dimensions, whereas itinerant spin fluctuations occur over length scales comparable to the superconducting coherence length, showing that MIEZE is able to spectroscopically disentangle the complex low-energy behavior characteristic of quantum materials.

[1] F. Haslbeck, et al., Phys. Rev. B 99 014429 (2019)

Level of Expertise

Student

Do you wish to take part in the poster slam

Yes

Travel Funding

No

Speakers Gender

Male

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