TECHNISCHE UNIVERSITÄT DRESDEN

IFMP Institut für Festkörper- & Materialphysik

IFMP Seminar

Date: Tuesday, November 24, 2020, at 14:50
REC/C213 (audience capacity: 11)
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https://selfservice.zih.tu-dresden.de/l/link.php?meeting_id=50290&pin=b4c96a14 (TUD)
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Speaker: **Anton Kulbakov**
Technische Universität Dresden

Title: **Destruction of long-range magnetic order in Cu_2GaBO_5 and Cu_2AlBO_5 ludwigites by an external magnetic field**

Abstract: The quantum spin systems $M_2^{2+}M'BO_5$ (M' = Al, Ga) with the ludwigite crystal structure consist of a structurally ordered Cu^{2+} sublattice in the form of three-leg ladders, interpenetrated by a structurally disordered sublattice with statistically random site occupation by magnetic Cu^{2+} and nonmagnetic Ga^{3+} or Al^{3+} ions. A microscopic analysis based on density-functional-theory calculations for Cu_2GaBO_5 reveals a frustrated quasi-two-dimensional spin model featuring five inequivalent antiferromagnetic exchanges. A broad low-temperature ^{11}B nuclear magnetic resonance points to a considerable spin disorder in the system. In zero magnetic field, antiferromagnetic order sets in below $T_N \approx 4.1$ and ~2.4 K for the Ga and Al compounds, respectively. From neutron diffraction, we find that the magnetic propagation vector in Cu_2GaBO_5 is commensurate and lies on the Brillouin-zone boundary in the (H0L) plane, q_m = (0.45,0,–0.7), corresponding to a complex noncollinear long-range ordered structure with a large magnetic unit cell. Muon spin relaxation is monotonic, consisting of a fast static component typical for complex noncollinear spin systems and a slow dynamic component originating from the relaxation of low-energy spin fluctuations. Gapless spin dynamics in the form of a diffuse quasielastic peak is also evidenced by inelastic neutron scattering. Most remarkably, application of a magnetic field above 1 T destroys the static long-range order, which is manifested in the gradual broadening of the magnetic Bragg peaks. We argue that such a crossover from a magnetically long-range ordered state to a spin-glass regime may result from orphan spins on the structurally disordered magnetic sublattice, which are polarized in magnetic field and thus act as a tuning knob for field-controlled magnetic disorder.

Host: D. Inosov