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Critical magnetic fluctuations in Ca_2RuO_4 studied by neutron spin-echo and triple-axis spectroscopy

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We report on comprehensive high-resolution linewidth measurements of critical antiferromagnetic fluctuations in Ca_2RuO_4 (CRO214) performed at the neutron resonance spin-echo spectrometer TRISP at FRM II and the cold triple-axis spectrometer FLEXX at BER II. CRO214 is structurally related to the unconventional superconductor Sr_2RuO_4 [1] and hosts a complex interplay between magnetic and electronic correlations leading to a novel type of soft-magnetism with strong single-ion anisotropy, and ‘Higgs’ amplitude fluctuations in the spin-wave spectrum, as revealed by recent neutron experiments [2].

In contrast to conventional magnetic phase transitions, the magnetic ordering in CRO214 below $T_N \sim 110$ K emerges from exciton condensation [3]. Therefore, since the magnetic fluctuations in proximity to T_N are fundamentally related to the nature of the magnetic correlations in the system, our study can shed new light on the exceptional ‘excitonic’ magnetism in CRO214.

[1] Nat. 372, 532, (1994).

[2] Nat. Phys. 13, 633, (2017).

[3] Phys. Rev. Lett. 111, 197201, (2013).

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