Seminar/Talk

Scale-invariance in quantum spin liquids

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Quantum spin liquids are a new state of matter in which electron spins become strongly entangled and maintain a fluid-like state down to low temperatures. In the search for quantum spin liquids, hopes of realizing the Kitaev model have directed a surge of interest towards 2D and 3D honeycomb networks of effective spin 1/2 moments. It has already been shown that the edge-shared octahedra surrounding the magnetic ions mediate at least some degree of theprerequisite exchange interactions. While a unique spin-anisotropy in the exchange interactions leads to enhanced magnetic frustration, all candidate materials orderantiferromagnetically at low temperatures. Nevertheless, experimental efforts gainedmomentum when a continuum of excitations was identified in RuCl3 by way of neutron scattering and Raman spectroscopy. This feature, characteristic of a spin liquid, persists outside of the ordered state up to a temperature scale that is of order the exchange interaction energy scale (J ~ 150 K). We use a newly-developed probe of magnetic anisotropy resonant torsion magnetometry to explore the competition between the intrinsic energy scales of the exchange interactions in RuCl3 and the external parameters of temperature and magnetic field. Performing measurements up to 65 T, we introduce a Zeeman energy that is comparable to the largest exchange interactions in the system. Over the entire temperature-field phase diagram, we observe a robust and peculiar angle dependence of the magnetic anisotropy that rules out conventional paramagnetism, even at the largest available magnetic fields. While this behavior attests to the presence of a large, underlying J in RuCl3, we find that the measured magnetic anisotropy is entirely controlled by the thermal and magnetic energy scales. Such a scaleinvariant response indicates that the effective exchange interaction energy scale has been driven to zero by strong correlations present in the high-field spin liquid state.

Tuesday, January 29, 2019 10:00am - 11:00am
Big Seminar room Ground floor / Office Bldg West (I21.EG.101)

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