CONDENSED MATTER SEMINAR SERIES

Short range magnetic correlations in icosahedral-Tb-Cd quasicrystal

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Thursday, August 30

4:00 pm - Rm 184 NSH

Quasicrystals, discovered by Dan Shechtman in 1982, are distinguished by the presence of sharp Bragg reflections with rotational point symmetries that are inconsistent with periodic translational order [1]. In the 30 years since Shechtman's discovery, significant advances have been made in our knowledge of the atomic scale structure, but less progress has been made in our understanding of the consequences of aperiodicity on magnetic properties. Here I will present our studies on the quasicrystal, icosahedral-TbCd (denoted as, i-Tb-Cd) and its related quasicrystalline approximant, TbCd6. Though TbCd6 shows a long-range antiferromagnetic order (TN = 24 K), only spin glass like behavior is observed in i-Tb-Cd with a spin freezing temperature of TF = 6 K. Instead of long-range magnetic ordering, one observes elastic diffuse scattering in i-Tb-Cd associated with the short range magnetic correlations. By studying the local crystal field environment of the Tb atoms, we first found that the Tb moments are Ising-like and are aligned along the 5-fold direction of the icosahedral clusters [2]. Using a simple spin Hamiltonian, we then identified the lowest energy spin configurations on a single icosahedron comprised of Tb3+ ions, in good agreement with the observed magnetic diffuse scattering in i-Tb-Cd [3].

[1] A. I. Goldman, Sci. Technol. Adv. Mater. 15, 044801 (2014). **[2]** P. Das et. al. Phy. Rev. B, 95, 054408 (2017). **[3]** P. Das et. al. submitted for review (2018).

The research was performed at Ames Laboratory and was supported by the Office of the Basic Energy Sciences, Materials Sciences Division, U. S. Department of Energy (DOE). Ames Laboratory is operated for DOE by Iowa State University under contract No. DE-AC02-07CH11358.

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