

# Short-range magnetic correlations and spin-ice rules in quasicrystalline *i*-Tb-Cd

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To date, all of the known quasicrystals with moment bearing elements exhibit frustration and spin glass behavior at low temperatures [1-3], even though there is abundant theoretical evidence that long-range magnetic order is possible. Employing neutron scattering methods, we have identified the local moment configurations on the Tsai-type icosahedral clusters [4] of *i*-Tb-Cd [5] that provide insight into the underlying frustration inherent to these novel systems. Inelastic neutron scattering measurements, on CNCS at ORNL, show that the Tb moments are Ising-like, directed along the fivefold axes of the icosahedral clusters. Our elastic neutron scattering measurements of the magnetic diffuse scattering, performed on CNCS and CORELLI, reveal significant structure consistent with short range magnetic correlations on these clusters. Using a simple spin Hamiltonian, we identified the lowest energy spin configurations for Ising-like moments on a single icosahedron comprised of Tb<sup>3+</sup> ions at the vertices. We find reasonable agreement with our magnetic diffuse neutron scattering measurements for those configurations that follow local spin-ice rules, providing insight into the underlying frustration inherent to these novel systems.

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