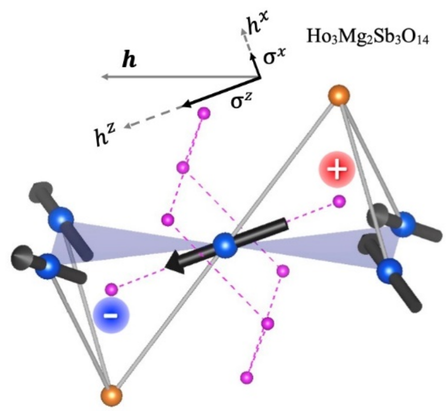
Experimental Realization of Transverse Ising model on kagome and triangular lattice antiferromagnets

Zhiling Dun[1]
[1]No affiliation given
dunzhiling@gmail.com

Transverse Ising model on a frustrated lattice is expected to host intriguing quantum disordered states at low temperatures due to the combination of an ice-like magnetic degeneracy and quantum-tunneling terms. We demonstrate that these models can be realized experimentally on rare-earth-based antiferromagnets, specifically, on the tripod kagome magnet Ho3Mg2Sb3O14, and the triangular lattice antiferromagnet TmMgGaO4. In both systems, Ising moments and intrinsic transverse fields originate from the crystal field of a non-Kramer's ion, whose magnitudes can be determined by an effective point charge analysis of the crystal field excitations [1]. Using neutron scattering, magnetic susceptibility, and thermodynamic measurements, (i) in Ho3Mg2Sb3O14, we observe a symmetry-breaking transition at 0.32 K to a partially ordered state which is characterized by a fragmentation of the magnetic moments and persistent inelastic magnetic excitations [2]; (ii) in TmMgGaO4, we found evidence for the existence of an intermediate Kosterlitz-Thouless phase between 0.9 K and 5 K which is characterized by short-range magnetic correlations and binding/unbinding of spin vortex-antivortex pair [3]. Our results point out a practical option to introduce quantum fluctuations in frustrated magnets and call for further experimental explorations of quantum magnets with short-range magnetic order.



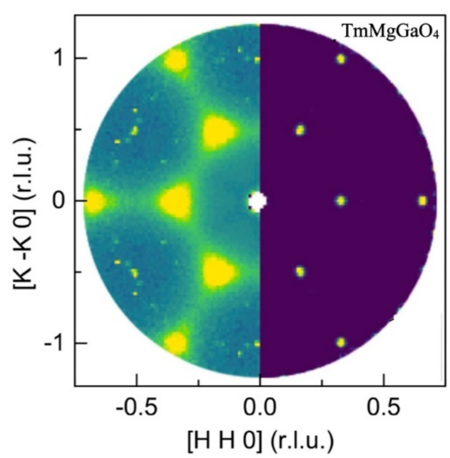


Figure 1