The case for an octupolar ordered ground state in 5d2 Double Perovskites

Speaker: Professor Bruce D. Gaulin
McMaster University
Date: Tuesday 25th of February at 13:00
Room: MAS2.06

Quantum magnetism in d-electron materials often results in ground states in which the magnetic dipole moments order within the material - typically into a Neel state at low enough temperatures. However, other types of order, and in particular multipolar orders, are possible, especially when spin-orbit coupling is relatively strong. We (and others) have been interested in several 5d3, 5d2, and 5d1 based Mott insulators with a Double Perovskite structure. The 5dn degrees of freedom decorate a network of edge-sharing tetrahedra in these materials, which comprise a frustrated Face Centre Cubic lattice.

Indeed a subset of these materials, the 5d3s, display rather conventional Type I antiferromagnetism at low temperatures. Most of my talk, however, will focus on new neutron scattering results on 5d2 double perovskites of the form Ba_2MgOsO_6, Ba_2ZnOsO_6, and Ba_2CaOsO_6. These materials undergo a thermodynamic phase transition at low temperature, which is characterized by the appearance of gapped inelastic magnetic neutron scattering, but no elastic Bragg magnetic scattering. We've recently developed a framework for understanding these and other results in terms of Ferro-Octupolar order in these systems - to our knowledge, the first such concrete proposal for octupolar order in d electron materials.