Magnetic order and spin dynamics of j_{eff} = ½ Ir^{4+} moments on the fcc lattice in La_2BIrO_6 (*B* = Mg, Zn)

A.A. Aczel, Oak Ridge National Laboratory

Magnetism on the face-centered-cubic (fcc) lattice has been widely explored recently in the context of possible geometric frustration. We have performed bulk characterization, x-ray scattering, and neutron scattering measurements to characterize the magnetism in polycrystalline samples of the weakly-distorted fcc double perovskite iridates La_2ZnIrO_6 and La_2MgIrO_6. We find that these materials are j_{eff} = ½, spin-orbit-assisted Mott insulators with A-type antiferromagnetic ground states and significantly lower frustration parameters as compared to ideal fcc double perovskites. Furthermore, the powder inelastic neutron scattering (INS) data on these systems provides clear evidence for gapped spin-wave excitations with very weak dispersion. The INS results and thermodynamic data on these materials can be reproduced by a conventional Heisenberg-Ising model with significant uniaxial Ising anisotropy and sizeable second-neighbor ferromagnetic interactions, or perhaps more tantalizingly, with a Heisenberg-Kitaev model featuring a dominant antiferromagnetic Kitaev exchange. Our findings show that magnetic frustration is drastically suppressed even in weakly-distorted double perovskites, and they also highlight how conventional magnetic orders in heavy transition metal oxides may be driven by highly-directional exchange interactions rooted in strong spin-orbit coupling.

1. **A.A. Aczel**, A.M. Cook, T.J. Williams, S. Calder, A.D. Christianson, G.-X. Cao, D. Mandrus, Yong-Baek Kim, and A. Paramekanti, *Highly-anisotropic exchange interactions of j_{eff} = ½ iridium moments on the fcc lattice in La_2BIrO_6 (B = Mg, Zn)*, Phys. Rev. B **93**, 214426 (2016), ***Editor's suggestion***
2. A.M. Cook, S. Matern, C. Hickey, **A.A. Aczel**, and A. Paramekanti, *Magnetism of j = 1/2 moments on the fcc lattice in double perovskite Mott insulators*, Phys. Rev. B **92**, 020417(R) (2015)