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Magnetic and Orbital Excitations in α-A_2IrO_3 (A = Li, Na) Probed by Resonant Inelastic X-ray Scattering

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The honeycomb lattice iridates Na_2IrO_3 and Li_2IrO_3 are two of the most promising candidates for the experimental realization of Kitaev-like physics. Although the formation of long-range magnetic order ($T_N \sim 15$ K) excludes a pure Kitaev model, there are many extended Kitaev models (which include contributions such as isotropic Heisenberg exchange, further-neighbor interactions, symmetric off-diagonal exchange, and structural distortions) that may be relevant to these materials. We have performed high-resolution Ir L_3-edge resonant inelastic x-ray scattering (RIXS) measurements to investigate the excitation spectra of Na_2IrO_3 and Li_2IrO_3. In Na_2IrO_3, we observe a new branch of dispersive magnetic excitations, which reaches a maximum energy of $\sim$35 meV at the Γ point [1]. This mode is distinct from the low energy ($\sim$6 meV) magnon mode observed in previous inelastic neutron scattering measurements [2], and implies the presence of a significant bond-dependent Kitaev interaction. The d-d excitations in Na_2IrO_3 and Li_2IrO_3 reveal important information about crystal electric field effects, and the potential impact of trigonal and monoclinic structural distortions [3]. New developments in high pressure RIXS allow us to study the evolution of these excitations up to 6 GPa, providing insight into future prospects for tuning Kitaev interactions via applied pressure.

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[1] H. Gretarsson et al, Phys. Rev. B 87, 220407(R) (2013).
[2] S.K. Choi et al, Phys. Rev. Lett. 108, 127204 (2012).
[3] H. Gretarsson et al, Phys. Rev. Lett. 110, 076402 (2013).