Magnetic and Orbital Excitations in $\alpha$-$A_2\text{IrO}_3$ ($A = \text{Li, Na}$) Probed by Resonant Inelastic X-ray Scattering

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The honeycomb lattice iridates $\text{Na}_2\text{IrO}_3$ and $\text{Li}_2\text{IrO}_3$ 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 $\text{Na}_2\text{IrO}_3$ and $\text{Li}_2\text{IrO}_3$. In $\text{Na}_2\text{IrO}_3$, we observe a new branch of dispersive magnetic excitations, which reaches a maximum energy of $\sim 35$ meV at the $\Gamma$ 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 $\text{Na}_2\text{IrO}_3$ and $\text{Li}_2\text{IrO}_3$ 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.

Work performed in collaboration with H. Gretarsson, J.A. Sears, Y.-J. Kim (University of Toronto), M.H. Upton, J. Kim, Y. Ding, A.H. Said, D. Casa, T. Gog (Argonne National Laboratory), S. Desgreniers (University of Ottawa), Y. Singh (IISER Mohali), S. Manni, P. Gegenwart (University of Gottingen), X. Liu, J.P. Hill (Brookhaven National Laboratory), V.M. Katukuri, L. Hozoi, J. van den Brink (IFW Dresden).