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Magnetic Excitations in Thin Film Iridates Probed by Resonant Inelastic X-ray Scattering

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We have performed resonant inelastic x-ray scattering (RIXS) measurements on epitaxial thin film samples of the layered perovskite iridates Ba_2IrO_4 and Sr_2IrO_4 . These compounds display a novel $J_{eff} = 1/2$ Mott insulating ground state driven by strong 5d spin-orbit coupling effects. By studying 10 to 50 nm thin film samples grown on a variety of different substrates (GSO, STO, LSAT), we have investigated the impact of applied tensile and compressive strain on the characteristic magnetic and electronic excitations of these materials. Unlike other perturbations, such as doping or applied magnetic field, we find that epitaxial strain does not alter the magnetic structure of Ba_2IrO_4 or Sr_2IrO_4 . However, applied strain does affect the magnetic energy scales of these systems, providing a means of tuning both the ordering temperature (T_N) and the strength of the magnetic exchange interactions (J). Most strikingly, we demonstrate that RIXS can be used to perform detailed magnetic dispersion measurements on thin film samples of 10 nm (~ 4 unit cells) or less.

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