Tuning magnetism with pressure in honeycomb and square lattice Iridates

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The connection between quantum spin liquids and possible routes to high Tc superconductivity and topological quantum computing has led to a flurry of activity aimed at generating and detecting these unusual quantum states. Realizing this elusive state of matter in real materials is challenging as it requires fine tuning of exchange (magnetic) interactions to drive a frustrated, dynamically disordered, magnetic state. Unlike chemical doping, applied pressure has the ability to tune interatomic distances and bond angles without adding structural disorder hence providing a unique pathway to balancing exchange interactions and stabilizing exotic magnetic states. Iridates with honeycomb- and square-lattice structures are potential candidates to host quantum spin liquid states, a result of strong spin-orbit coupling and/or large spatial extent of 5d orbitals. We search for possible emergence of spin liquid ground states in Li2IrO3 and Sr2IrO4 under the application of external pressure using polarization-dependent x-ray resonant magnetic scattering and x-ray magnetic circular dichroism measurements. New opportunities afforded by the upcoming APS-U upgrade and feature beamline "Polar" will also be highlighted.

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