X-ray resonant probes of magnetism at high pressures: towards realization of novel quantum spin liquids in 5d oxides

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The connection between quantum spin liquids and possible routes to high Tc superconductivity and 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 has been challenging as it requires fine tuning of exchange (magnetic) interactions driving a frustrated, dynamically-disordered, magnetic state. Unlike chemical doping, applied pressure has the ability to tune interatomic distances and bond angles without adding chemical disorder hence providing a unique pathway to balancing exchange interactions and stabilizing quantum spin liquid states. Third-row transition-metal (5d) oxides with honeycomb- and square- lattice structures have recently emerged as potential candidates to host spin liquid states as a result of strong spin orbit coupling and large spatial extent of 5d orbitals. We investigate the possible emergence of spin liquid ground states in Iridium-based oxides under the application of external pressure using newly developed capabilities for polarization-dependent x-ray resonant magnetic scattering and x-ray magnetic circular dichroism.

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