Complex electronic structure and magnetism of honeycomb iridates at high pressures

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High pressure is a well-established tool to effectively manipulate both magnetic and electronic properties of materials displaying emergent phenomena. Compounds with 5*d* transition metal ions have attracted recent attention due to the prediction and observation of novel forms of topological magnetic and electronic states. Among these, particular attention has been given to the Kitaev quantum spin liquid state that is expected to occur in honeycomb iridates, and which is a potential candidate for topologically protected quantum computing. In this talk I will focus on our study of the Cu_2IrO_3 honeycomb iridate at high pressures using various x-ray spectroscopy and scattering techniques. I will show that low pressures (6-8 GPa) drive the formation of Ir-Ir dimers that largely modify the Ir 5*d* orbitals. Higher pressures lead to a complex phase diagram, which includes a metastable phase marked by Cu to Ir electron transfer that occurs only when pressure is applied at low temperatures. I will discuss the potential consequences for the material properties and compare it to other honeycomb iridates. Finally, I will briefly describe the high-pressure capabilities of the APS-U POLAR beamline, and the potential research avenues it will unleash.