Metal-Insulator Transition in Epitaxial Pyrochlore Iridates Bi$_2$Ir$_2$O$_7$ thin Films

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Pioneering experiments on bulk polycrystalline and single crystal samples revealed a temperature dependent metal-insulator transition coupled to a long range magnetic order, and the transition temperature can be tuned by either A-site ionic radius or an external pressure. In this talk we present our efforts to understand and control the metal-insulator transition and the underlying electronic structure of pyrochlore iridates via epitaxial Bi$_2$Ir$_2$O$_7$ thin films. Bulk Bi$_2$Ir$_2$O$_7$ is located at the metallic side of the phase diagram. However as the film’s thickness decreases the transport evolves from a metallic to a strongly localized character. Resonant X-ray spectroscopy suggests that the density of states near Fermi level is dominated by the Ir $J_\epsilon ff=1/2$ states. Intriguingly, the magnetoresistance shows a linear field dependence over a wide range of fields at low temperatures, which is possibly consistent with the existence of Dirac nodes.