Possible Weyl state near the metal-insulator boundary in pyrochlore iridates

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Despite a rapidly growing theoretical literature on Weyl semi-metallic states, such states are proving elusive in real materials. Promising candidates, initially proposed by Wan et al.[1] and Witczak-Krempa et al. [2], are the pyrochlore iridate systems $R_2\text{Ir}_2\text{O}_7$, where $R$ is a rare earth. In this talk I will review experimental evidence for unconventional normal states near the metal-insulator boundary in these systems, focusing on Eu$_2\text{Ir}_2\text{O}_7$, where we have carried out transport measurements under pressure [3]. In measurements up to 12 GPa, we found a peculiar insulator-to-metal transition near 7 GPa. Across this pressure range magnetic order – a prerequisite for a Weyl state in the pyrochlore lattice – seems to be relatively unaffected, with $T_N \simeq 100 – 120$ K at all pressures. The normal state above 7 GPa is unusual, having a negative temperature derivative of resistance. Magnetoresistance measurements at 10 GPa down to 100 mK suggest the existence of small Fermi pockets. These behaviors may be consistent with a Weyl semi-metallic state near the metal-insulator boundary. Further transport measurements that could help to establish this are currently under way, and will be briefly described.