

Sr_2IrO_4 – a Mott Insulator with $J=1/2$

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Recent theoretical studies suggest the possibility of a Mott instability induced by relativistic spin-orbit coupling, implying an alternative route to metal-insulator transitions and novel correlated electron behaviors in systems generally considered as simple wide band metals. Our studies on less popular 4d and 5d transition metal oxides (in comparison to 3d TMOs) at BL7 (a.k.a. Electronic Structure Factory) resulted in discovery of such spin-orbit coupled Mott instability in Sr_2IrO_4 . By using angle-resolved photoemission, optical conductivity, and x-ray absorption measurements and first principles band calculations, we show that this new Mott state is well described in terms of effective total angular momentum J_{eff} states, and exhibits novel electronic and magnetic behaviors such as the formation of spin-orbit coupled narrow bands and unconventional spin and orbital magnetic moments, suggesting a new class of correlated-electron phenomena.