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Tuning $J_{eff} = 1/2$ Insulating State via Electron Doping and Pressure in Double-Layered Iridates[1] L. LI, Center for Advanced Materials, University of Kentucky, P.P. KONG, C.Q. JIN, Institute of Physics, Chinese Academy of Sciences, T.F. QI, O.B. KORNETA, Center for Advanced Materials, University of Kentucky, S.J. YUAN, Department of Physics, Shanghai University, G. CAO, Center for Advanced Materials, University of Kentucky — $Sr_3Ir_2O_7$ exhibits a novel J_{eff}=1/2 insulating state featuring a splitting between J_{eff}=1/2 and 3/2 bands due to spin-orbit interaction. We report that a metal-insulator transition can be induced by either dilute electron (La^{3+}) doping for Sr^{2+} ions in $Sr_3Ir_2O_7$ or via application of high pressure. The following constitutes the central findings of our recent study of single-crystal $Sr_3Ir_2O_7$ and $(Sr_{1-x}La_x)_3Ir_2O_7$: (1) application of high hydrostatic pressure P results in a drastic drop in the electrical resistivity by four orders of magnitude at a critical pressure, P_C = 13.2 GPa, suggesting a significantly reduced splitting between J_{eff}=1/2 and 3/2 bands, but further increasing P up to 35 GPa produces no fully metallic state at low temperatures; (2) however, slight doping of La^{3+} ions for Sr^{2+} ions in $Sr_3Ir_2O_7$ readily induces a robust metallic state that follows no Fermi liquid behavior; and (3) the magnetic ordering temperature is significantly suppressed from 285 K for x=0 but remains finite for $(Sr_{0.94}La_{0.06})_3Ir_2O_7$ where the metallic state occurs. The results will be discussed along with comparisons drawn with Sr_2IrO_4, a prototype of the J_{eff} = 1/2 insulator.

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