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Decoupling of the Antiferromagnetic and Insulating States in Tb doped Sr2IrO4[1] H. ZHENG, Center for Advanced Materials and Department of Physics and Astronomy University of Kentucky, Lexington, KY 40506, USA, J.C. WANG, F. YE, Quantum Condensed Matter Division, Oak Ridge National Laboratory, Oak Ridge, TN 37831, USA, S. ASWARTHAM, J. TERZIC, S.J. YUAN, Center for Advanced Materials and Department of Physics and Astronomy University of Kentucky, Lexington, KY 40506, USA, D. HASKEL, Y. CHOI, Advanced Photon Source, Argonne National Laboratory, Argonne IL 60439, USA, S. CHIKARA, National High Magnetic Field Laboratory, Los Alamos National Laboratory, Los Alamos, NM 87545, USA, P. SCHLOTTMANN, Department of Physics, Florida State University, Tallahassee, FL 32306, USA, R. CUSTELCEAN, Chemical Science Division, Oak Ridge National Laboratory, Oak Ridge, TN 37831, USA, G. CAO, Center for Advanced Materials and Department of Physics and Astronomy University of Kentucky, Lexington, KY 40506, USA — We report results of a comprehensive study of single-crystal $Sr_2Ir_{1-x}Tb_xO_4$ ($0 \leq x \leq 0.03$). This study found that mere 3% (x=0.03) tetravalent Tb^{4+} substituting for Ir^{4+} (rather than Sr^{2+}) completely suppresses the long-range collinear AFM transition but retains the insulating state. Tb doping effectively changes the relative strength of the SOI and the tetragonal CEF and enhances the Hund's rule coupling that competes with the SOI, and destabilizes the AFM state. We observe unconventional correlation between the AFM and insulating states in which the magnetic transition plays no critical role in the formation of the charge gap in the iridate.

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