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Breakdown of the spin-orbit imposed Jeff = 0 singlet state in double-perovskite iridates with Ir5+(5d4) ions[1] JASMINKA TERZIC, Department of Physics and Astronomy and Center for Advanced Materials University of Kentucky, KY, HAO ZHENG, Department of Physics, University of Colorado, Boulder, CO, FENG YE, Quantum Condensed Matter Division, Oak Ridge National Laboratory, Oak Ridge, TN, PEDRO SCHLOTTMANN, Department of Physics, Florida State University, Tallahassee, FL, HENGDI ZHAO, Department of Physics, University of Colorado, Boulder, CO, SHUJUAN YUAN, Department of Physics and Astronomy and Center for Advanced Materials University of Kentucky, KY, GANG CAO, Department of Physics, University of Colorado, Boulder, CO — The strong spin-orbit interaction is expected to impose a nonmagnetic singlet ground state, Jeff = 0, in iridates having pentavalent Ir5+(5d4) ions. We report an exotic magnetic ground state in single-crystal double-perovskite Ba2YIrO6 and Sr doped Ba2YIrO6 with Ir5+(5d4) ions. The magnetic state fits no descriptions of the spin-alone S=1 state in materials with d4 ions as well as the Jeff = 0 singlet state but appears to be situated intermediate between them. The emergence of the magnetic ground state is extraordinary because its occurrence contradicts the highly anticipated Jeff = 0 singlet ground state in presence of the strong spin-orbit interaction and highlights the unusual interplay between the strong spin-orbit interaction, electron-electron correlations and electron hopping.

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