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Novel Magnetic and Charge Orders in Dimer-Chain Iridate $Ba_5AlIr_2O_{11}$[1] FENG YE, J. TERZIC, J.C. WANG, Center for Advanced Materials, Department of Physics and Astronomy, University of Kentucky, Lexington, KY 40506, USA, W.H. SONG, Institute of Solid State Physics, Chinese Academy of Sciences, Hefei, China, S.J. YUAN, S. ASWARTHAM, G. CAO, Center for Advanced Materials, Department of Physics and Astronomy, University of Kentucky, Lexington, KY 40506, USA — We report a novel magnetic state coexisting with a charge ordering state in a dimer-chain system $Ba_5AlIr_2O_{11}$. This newly synthesized single-crystal iridate features both tetravalent Ir^{4+} and pentavalent Ir^{5+} ions in each of dimers that are only linked via AlO_4-tetrahedra along the b-axis. Despite the evident one-dimensional characteristic, the dimer-chains undergo an unexpected long-rang order at $T_M = 4.5$ K with a large magnetic anisotropy. The magnetic transition is unusually resilient to magnetic field up to 14 T but more susceptible to even modest hydrostatic pressure up to 10 kbar. Furthermore, a subtle structural change discerned at T_S =200 K marks a charge ordering that accompanies a huge enhancement in the dielectric constant and changes in the electrical resistivity. It is evident that the strong SOC imposes a j=1/2 (Ir^{4+}) and singlet j=0 (Ir^{5+}) states in each dimer, which critically hinges on the orbital and lattice degrees of freedom.

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