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High T_c Ferrimagnetism, Multiband Mott Transition and Spin-Orbit Coupling in Double Perovskites[1] ONUR ERTEN, O. NGANBA MEETEI, The Ohio State University, ANAMITRA MUKHERJEE, University of British Columbia, MOHIT RANDERIA, NANDINI TRIVEDI, PATRICK M. WOODWARD, The Ohio State University — The ferrimagnetic insulator Sr_2CrOsO_6 (SCOO), which has the highest $T_c = 725$K among all double perovskites, raises several questions. Why is this material an insulator? What sets the scale for the high T_c? Why is there a net moment given that both Cr and Os have d^3 configurations? What is the role of spin-orbit coupling in Os? Finally, why does SCOO show a highly unusual, non-monotonic magnetization $M(T)$ as a function of temperature? We address all of these questions. First, we describe the charge sector using slave-rotor mean field theory and obtain an analytic Mott criterion $\sqrt{U_{Cr}U_{Os}} > 2.5W$ relating the Hubbard U's to the bandwidth W. We argue that SCCO is a multi-band Mott insulator. Next, we argue that the orbital moment on Os is quenched in SCOO and spin-orbit coupling does not play a major role in this material. Finally, we show that the effective spin Hamiltonian for SCOO has both Cr-Os and Os-Os superexchange interactions that are frustrated. This leads to a canted ground state with a net moment at $T = 0$ and a nonmonotonic magnetization $M(T)$. Our results are in excellent agreement with available data and we make predictions to test our theory.

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