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Interplay of 3d-5d interactions in high-T_C osmium-based double perovskites A.E. TAYLOR, S. CALDER, Quantum Condensed Matter Division, Oak Ridge National Laboratory, R. MORROW, P.M. WOODWARD, Department of Chemistry, The Ohio State University, J.Q. YAN, Materials Science & Technology Division, Oak Ridge National Laboratory, B. WINN, M.D. LUMSDEN, A.D. CHRISTIANSON, Quantum Condensed Matter Division, Oak Ridge National Laboratory — In 3d-5d systems the strongly magnetic 3d orbitals and extended 5d orbitals with enhanced spin-orbit coupling lead to a range of high T_C magnetic states and novel behavior not present in systems consisting solely of 3d or 5d ions. The two distinct octahedral sites in double perovskites A_2BB'O_6 allow an ordered 3d-5d structure to form, providing a variety of systems to be investigated. Unravelling the interactions controlling these systems, however, is an open challenge. The highest known T_C in such a system, 725K, is found in insulator Sr_2CrOsO_6. This questions the theory for high-T_Cs in systems such as T_C=400K Sr_2FeReO_6 which relies on half-metallic behavior. To unravel the nature of the interactions in 3d-5d systems, we have studied the series of compounds Sr_2XOsO_6. We have utilized elastic and inelastic neutron scattering to probe the spin states in the systems, and therefore test predictions that the magnetic interactions are controlled by a frustrated AFM Heisenberg model [1]. By studying the series, we are able to relate changes in the spin wave spectrum to dramatic changes in the magnetic order from $T_N = 95$K antiferromagnetism to $T_C = 725$K ferrimagnetism.

[1] O. N. Meetei et al, PRL 110, 087203(2013)

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