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Orbital degeneracy near the itinerant electron limit in CoV2O4[1]

D. REIG-I-PLESSIS, D. CASAVANT, University of Illinois, V. O. GARLEA, A. A. ACZEL, M. FEYGENSON, J. NEUEFEIND, Oak Ridge National Lab, H. D. ZHOU, University of Tennessee, S. E. NAGLER, Oak Ridge National Lab, G. J. MACDOUGALL, University of Illinois — Vanadium spinels, AV_2O_4 have both magnetic frustration and orbital degeneracy on the V^{3+} sublattice, which lead to strong coupling of the orbital, lattice and spin degrees of freedom. Additionally, upon decreasing the V-V distance, the material is predicted to go from a Mott insulator to a metallic phase. Of all the materials in the AV_2O_4 series, CoV_2O_4 is closest to the predicted transition, and it's debated whether it may be fully described by either localized or itinerant electrons pictures. In all other studied vanadium spinels, there is a cubic to tetragonal transition associated with ordering of the degenerate V^{3+} orbitals, consistent with a local orbital picture but, this transition is surprisingly absent from CoV_2O_4 despite being an insulator with local spins. In this talk we present recent high resolution neutron diffraction and inelastic scattering measurements by our group on powders of CoV_2O_4. Diffraction data show there is small but clear first order structural transition present which correlates with canting of the V^{3+} spins, while inelastic data are well described by a local spinwave picture. We discuss how these results contribute evidence of a local orbital ordering phase in the region near electron itinerancy.

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