Neutron and X-ray studies in suppressing orbital order in FeV\textsubscript{2}O\textsubscript{4} with Cr doping.\textsuperscript{1} DALMAU REIG-I-PLESSIS, ZHANGSU WEN, ALEXANDER THALER, U. of Illinois, VASILE O. GARLEA, Oak Ridge National Lab, HAIDONG ZHOU, U. of Tennessee, JACOB RUFF, Cornell U., GREGORY MACDOUGALL, U. of Illinois — FeV\textsubscript{2}O\textsubscript{4} is a spinel compound with an orbitally active V\textsuperscript{3+} cation on a frustrated pyrochlore sublattice and Jahn-Teller active Fe\textsuperscript{3+} on a diamond sublattice. Previous studies show that this material has three structural and two magnetic transitions, and that orbital order leads to coupling between the spin and lattice degrees-of-freedom. The opposite end of the doping series is the multiferroic, FeCr\textsubscript{2}O\textsubscript{4}, which has spin, but no orbital degree of freedom on the Cr\textsuperscript{3+} and only two structural transitions. Although both materials show a higher temperature collinear ferrimagnetic state and a non-collinear phase at lower temperature, the physics must be different since the canting transition in FeV\textsubscript{2}O\textsubscript{4} is associated with the orbital order at the lowest structural transition. In this talk, I will present the results of synchrotron X-ray and neutron powder diffraction studies of the structural and magnetic transitions in the doping series FeV\textsubscript{2-x}Cr\textsubscript{x}O\textsubscript{4}. Specifically, I will comment on the doping-temperature phase diagram we extract from these measurements, and the region of co-existence between distinct non-collinear spin orders which exist at finite doping.

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