Neutron Diffraction Investigation of Magnetic and Orbital Order in FeV$_2$O$_4$

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I will report on neutron powder diffraction measurements of another spinel system, FeV$_2$O$_4$, which additionally has two-fold orbitally degenerate Fe$^{2+}$ cations on the A-site sublattice. Previous x-ray and Mossbauer studies have reported four structural phase transitions in this material and at least one magnetic transition. Our data confirm the existence of three structural transitions and reveal distortions of local polyhedra with important implications for orbital order. We confirm the existence of hypothesized collinear antiferromagnetism below a temperature $T_{N1}=110$K and further identify a second magnetic transition at $T_{N2}=60$K where V$^{3+}$ moments cant away from the Fe$^{2+}$ spin direction to form a 2-in-2-out spin structure on the pyrochlore sublattice. I will discuss these observations in the context of recent predictions for orbital order in vanadate spinels.

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