Abstract Submitted
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Nanosized helical magnetic domains in strongly frustrated $Fe_3PO_4O_3$[1] MITCHELL BORDELON, KATE ROSS, GREG TERHO, JAMES NEILSON, Colorado State University — Non-centrosymmetric $Fe_3PO_4O_3$ (space group $R3m$) contains triangular motifs of Fe^{3+} ions coupled by strong antiferromagnetic interactions ($|\Theta_{CW}| > 900$ K). Neutron powder diffraction below $T_N = 163$ K reveals the formation of an ordered helical incommensurate magnetic structure, with helical axis in the hexagonal ab plane and modulation length of ~ 100 . The magnetic structure forms needle-like correlation volumes perpendicular to the ab plane that extend at least to 900 along the c-axis, but are confined to ~ 70 in the ab plane. The refined magnetic moment, supported by magnetization measurements of a magnetically diluted series ($Fe_{3-x}Ga_xPO_4O_3$), indicates a reduced Fe^{3+} moment, suggesting metal-ligand charge transfer. High-resolution synchrotron X-ray diffraction reveals no lattice symmetry change below T_N. Absence of long-range in-plane order below T_N signifies the formation of a high density of defects in the magnetic structure. The defect-rich helical magnetic phase in $Fe_3PO_4O_3$ offers insight into the stabilization of topological spin textures in antiferromagnets.

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Mitchell Bordelon
Colorado State University

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