

Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Magnetic phase transition and spin dynamics in $\text{Li}(\text{Ni}_{1-x}\text{Fe}_x)\text{PO}_4$

JYING LI, DAVID VAKNIN, JEREL ZARESTKY, Ames Laboratory and Department of Physics and Astronomy, Iowa State University, Ames IA 50011, JAE-HO CHUNG, NIST Center for Neutron Research, National Institute of Standards and Technology, Gaithersburg, MD 20899 — Elastic and inelastic neutron scattering techniques were used to study the magnetic phase transition and spin dynamics in pure and Fe substituted LiNiPO_4 single crystals. Pure LiNiPO_4 undergoes a first-order magnetic phase transition from a long-range ordered incommensurate phase to an antiferromagnetic ground state at $T_N = 20.8$ K. With the substitution of Fe for Ni, the magnetic phase transition changes from first-order to second-order, and moreover, the long-range ordered incommensurate phase of pure LiNiPO_4 between 20.8 K to 21.5 K was suppressed in the $\text{LiNi}_{0.75}\text{Fe}_{0.15}\text{PO}_4$ sample. Inelastic neutron scattering revealed a 2 meV energy gap and an anomalous soft mode in the spin wave dispersion curve along the [010] direction for pure LiNiPO_4 . For $\text{LiNi}_{0.8}\text{Fe}_{0.2}\text{PO}_4$, however, the energy gap was reduced to 0.9 meV and the anomaly along the [010] direction reduced. The spin-wave dispersion curves were simulated using a Heisenberg Hamiltonian with Dzyaloshinski-Moriya interactions.

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Date submitted: 30 Nov 2005

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