Abstract Submitted
for the OSF14 Meeting of
The American Physical Society

Magnetic Phase Diagram of a 2D XY Model with Random Easy Axis Orientation DONALD PRIOUR, Youngstown State University — Using Monte Carlo simulations, we examine the bulk magnetic behavior of classical XY models with a inherently random anisotropy manifested as a randomly oriented easy axis for each pair of interacting spins in the 2D square lattice with magnetic interactions among nearest neighbor spins. Whereas thermally excited spin waves destroy ferromagnetic order in the isotropic XY model for any finite temperature, long-range spin alignment is very effectively stabilized in XY models with collinear easy axes. We examine the extent to which ferromagnetic order is supported for the disordered counterpart with randomly oriented easy axis directions. With Binder cumulants and finite size scaling analyses, we determine the phase diagram for a variety of values of the anisotropy parameter γ, directly related to the relative energetic favorability of alignment along the direction of preferred spin orientation. We consider the possibility of ferromagnetic order for values of γ in the intermediate regime, in principle strong enough to imbue spin waves with a finite energy yet weak enough to avoid a non-ferromagnetic ground state.

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Date submitted: 26 Sep 2014 Electronic form version 1.4