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Dimensional crossover in the quasi-two-dimensional Ising-O(3) model NAOKI KAWASHIMA, Institute for Solid State Physics, University of Tokyo, YOSHITOMO KAMIYA, CRISTIAN BATISTA, Theoretical Division, Los Alamos National Laboratory — We present results of our Monte Carlo simulation of the Ising-O(3) model on the two-dimensional (2D) and quasi-2D lattices. This model is an effective classical model for the stacked square-lattice J_1 - J_2 Heisenberg model where the nearest neighbor (J_1) and next-nearest neighbor (J_2) couplings are frustrated and we assume that J_2 is dominant. We find an Ising ordered phase where the O(3) spins remain disordered in a moderate quasi-2D region. There is a single first order transition for a sufficiently large 3D coupling in agreement with a renormalization group treatment. The subtle region where the single transition splits into two transitions is also discussed and compared against recent measurements of two very close transitions in BaFe₂As₂. Our results can provide a qualitative explanation on the experiments on ferropnictides, namely observed sequence and orders of the structural and magnetic transitions, in terms of the ratio between the inter-layer and intra-layer coupling.

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