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General method for finding ground state manifold of classical Heisenberg model¹ ZHAOXI XIONG, Massachusetts Institute of Technology, XIAO-GANG WEN, Massachusetts Institute of Technology and Perimeter Institute — What is the ground state manifold of a classical Heisenberg model for an infinite crystal? It sounds simple, but the intuitive approach gets stuck for more general interaction patterns and higher crystal dimensions. In this paper we present an essentially analytical method that can deal with all systems with one-spin unit cells and a broad class of systems with multi-spin unit cells. We also prove a theorem that guarantees that these systems must have some “spiral ground states,” which are co-planar. The method can be applied to classify all such systems, so that one can read off the ground state manifold of a Hamiltonian from some of its “spectral properties.” It can also be generalized to XY models, finite crystals, and anisotropic couplings, and may be helpful for quantum anomalous Hall effect and spin liquids.

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