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Geometric Aspects of Spin Dynamics[1] XIAOCHUAN WU, RAN CHENG, DI XIAO, Carnegie Mellon Univ — Spin dynamics in nano-magnets usually come up with effective descriptions. Known examples are the Landau-Lifshitz equation for ferromagnets and the nonlinear sigma model for two-sublattice antiferromagnets. However, there lacks a generic theory applicable to arbitrary nano-magnets with multi-sub-lattices and complicated ground states, such as the gamma phase of transition metal alloys. Here we formulate a unified theory of spin dynamics for general nano-magnets via the SU(2) coherent state path integral. We find that all geometric features of the spin dynamics are encoded in the quantum geometric tensor consisting of the Berry curvature and the quantum metric, regardless of the ground state configuration. Our theory encapsulates the well-known descriptions Landau-Lifshitz equation and the nonlinear sigma model as certain limiting cases.

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