Spin Rotation Technique for Non-Collinear Magnetic Systems: Application to the Generalized Villain Model

J.T. HARALDSEN, R.S. FISCHMAN, Oak Ridge National Laboratory — This work develops a new generalized technique for determining the static and dynamic properties of any non-collinear magnetic system. By rotating the spin operators in the local spin reference frame, we evaluate the zeroth, first, and second order terms in a Holstein-Primakoff expansion, and through a Green’s functions approach, we determine the structure factor intensities for the spin-wave frequencies. To demonstrate this technique, we examine the spin-wave dynamics of the generalized Villain model with a varying interchain interaction. The new interchain coupling expands the overall phase diagram with the realization of two separate spin configurations. The rotational Holstein-Primakoff expansion provides both analytical and numerical results for the spin dynamics and intensities of these phases. Research sponsored by the Division of Materials Sciences and Engineering, U.S. Department of Energy under contract with UT-Battelle, LLC.

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Date submitted: 28 Nov 2008
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