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Spin Dynamics of a Canted Antiferromagnet in a Magnetic Field

RANDY FISHMAN, Oak Ridge National Laboratory — The spin dynamics of a canted antiferromagnet with a quadratic spin-wave dispersion near $\mathbf{q} = 0$ possesses a unique signature. When the anisotropy gap is negligible, the spin-wave stiffness $D_{sw}(\mathbf{q}, B) = (\omega_{\mathbf{q}} - B)/q^2$ depends on whether the limit of zero field or zero wavevector is taken first. Consequently, D_{sw} is a strong function of magnetic field at a fixed wavevector. Even in the presence of a sizeable anisotropy gap, the field dependence of the extrapolated $\mathbf{q} = 0$ gap energy $\Delta_0(B)$ distinguishes a canted antiferromagnet from a phase-separated mixture containing both ferromagnetic and antiferromagnetic regions. For a ferromagnet, $d\Delta_0/dB = 1$ whereas for a canted antiferromagnet, $d\Delta_0/dB > 1$. Calculations performed for a generalized Villain model with additional anisotropy terms are used to demonstrate these ideas. These results are used to demonstrate that the "ferromagnetic" regions in Pr manganites are actually canted.

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