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 $q = 0$ possesses a unique signature. When the anisotropy gap is negligible, the spin-wave stiffness $D_{sw}(q, B) = (\omega_q - B)/q^2$ 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 $q = 0$ 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.