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Magnetic Dynamics of Co Nanoparticle Dispersions[1]

MEIGAN ARONSON, University of Michigan

We have used inelastic neutron scattering studies to study the dynamics and spatial correlations of monodisperse suspensions of Co nanoparticles. At high temperatures, the scattering is broad and quasielastic, reflecting the reversal of nanoparticle moments between states separated by an anisotropy barrier. Surprisingly, the scattering is strong even at wave vectors q as large as 2-3 A^{-1}, suggesting that the reversal of the overall nanoparticle moment involves localized and rapid fluctuations of smaller groups of Co moments. Spectral weight is transferred to increasingly small energies as the blocking temperature T_B is approached, with the slowest fluctuations associated with the smallest wave vectors. Below T_B the quasielastic scattering in the magnetically frozen state becomes inelastic, growing in intensity and hardening with decreasing temperature.

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