

Abstract Submitted
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Between ferro- and para- magnetism. Electron magnetic resonance and quantal effects in superparamagnetic nanoparticles NATALIA NOGINOVA, Norfolk State University, Norfolk VA, MAXIM NOGINOV, Cornell University, Ithaca, NY, VADIM A. ATSARKIN, IRE, Moscow, Russia — Nanometer-scale magnetic objects are at the interface between quantum dynamics of several interacting spins and classical thermodynamics of multi-particle systems. We present results of electron magnetic resonance (EMR) studies in suspensions of two different systems with superparamagnetic iron oxide nanoparticles with average size of 5 nm and 9 nm correspondingly. It is shown that both types of particles demonstrate common EMR behavior, including the broad spectral component, temperature-dependent narrow component with g-factor of ~ 2 , and additional low-field signals observed at the fields $B_{0k} = B_0/k$, where B_0 is the resonance field of the main resonance, and $k = 2, 3$, and 4 . These lines correspond to the transitions at the double, triple, etc., resonance frequencies and can be described in terms of the non-secular spin operators arising from the single-particle magnetic anisotropy or/and inter-particle dipole-dipole interactions. These features are common for small quantum systems and not expected in classical case. The relative intensity of the narrow component and low-field signals rapidly decreases with cooling or increase of particle size, marking gradual transition to classical FMR behavior.

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