Abstract Submitted
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Nonextensivity in Magnetic Nanocluster Ensembles[1] CHRISTIAN BINEK, Dept. of Physics and Astronomy, SRINIVAS POLISETTY, XI HE, TATHAGATA MUKHERJEE, RAJESH RAJASEKERAN, Dept. of Chemistry, JODY REDEPENNING, University of Nebraska-Lincoln — We study the scaling behavior of dipolar interacting nanoparticles in 3D samples of various sizes but constant particle density. Ferromagnetic γ-Fe_2O_3 clusters embedded in a polystyrene matrix are fabricated by thermal decomposition of metal carbonyls. Transmission electron microscopy reveals a narrow size distribution of 12 nm clusters. They are randomly dispersed in the matrix with an average separation of 80 nm. Magnetization isotherms of these single domain particle ensembles are measured by SQUID magnetometry above the blocking temperature T_B =115K where non-equilibrium effects are avoided. After demagnetization corrections which convert the applied magnetic fields into internal fields, H, a data collapse is achieved when scaling the magnetic moment, m, and H by appropriate factors. The latter are theoretically predicted functions of the number of particles and determined here numerically. Scaling of H takes into account the nonextensive (NE) behavior of dipolar interacting particles. In the case of long range interactions a scaling schema has been proposed by Tsallis and confirmed by simulations. The controversial field of NE thermodynamics requires however experimental evidence provided here.

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