Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

**Magnetic Anisotropy and Quantized Spin Waves in Hematite Nanoparticles** S.N. KLAUSEN, K. LEFMANN, P.-A. LINDGÅRD, L. THEIL KUHN, Materials Science Department, Risø National Laboratory, Roskilde, Denmark, C. FRANDSEN, S. MØRUP, Institute of Physics, Technical University of Denmark, Lyngby, Denmark — Nanoparticles of the canted antiferromagnet hematite ($\alpha$-$Fe_2O_3$) are particularly interesting due to a complicated magnetic structure, which gives rise to rich dynamics. Further, the spin-flop Morin transition observed in the bulk is suppressed in nanoparticles. We present inelastic neutron scattering studies that exemplify aspects of magnetic dynamics of hematite nanoparticles with an average size of 11 nm. Both superparamagnetic relaxation and collective magnetic excitations with a resonance frequency of $\sim$0.26 meV have been studied. Thus detailed information on the relevant anisotropy, relaxation times and life times as well as variations with particle size have been achieved. Further, we report on a previously unobserved magnetic excitation mode with q=0 and a resonance energy of $\sim$1.1 meV, i.e. a second collective magnetic excitation. The lack of dispersion in the mode is a clear evidence of spin wave quantization in the nanoparticles. The related anisotropy remains negative with decreasing temperature, in contrast to the change of sign at the Morin transition in the bulk. This explains the suppression of the Morin transition in hematite nanoparticles.

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Date submitted: 22 Dec 2004 Electronic form version 1.4