MAGNETIC DYNAMICS OF Co NANOSPHERES: ORIGIN OF THE ENHANCED ANISOTROPY.

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The present work deals with the observation of enhancement of the magnetic anisotropy of Co nanoparticles and its origin. The samples were granular multilayer samples prepared by sequential deposition, by sputtering, of amorphous Al_2O_3 and Co layers on a Si substrate. Co nanoparticles are self-organized in a quasi-regular spatial order of approximately hexagonal close-packed symmetry. The particles studied range in average diameter $\langle D \rangle$ between 0.7 nm and nearly 5 nm, with a narrow size distribution [1,2]. This well controlled morphology has enabled us to circumvent ambiguities in sample configuration and, by means of a simple model for fluctuating moments, explain the dynamics of the Co particle moments in terms of an activation energy with contributions from anisotropy K_{eff}, dipole-dipole interactions E_{dip}, and a bias magnetic field H. The anisotropy is enhanced by one to two orders of magnitude with respect to the bulk fcc Co due to strong pinning of the surface Co magnetic moments anisotropy, and increase as $1/D$ as the particle diameter decreases. The origin of this enhancement is related to an increase of the orbital magnetic moment at the surface atoms, as seen by XMCD spectroscopy [3]. Capping the Co nanospheres with a Cu film increases further the particle anisotropy and the orbital magnetic moment of the surface atoms Fig. [4].

References
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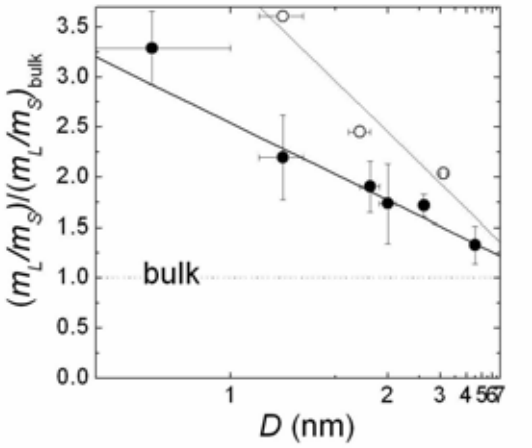

Figure 1. *Size dependence (shown in reciprocal scale of diameters) of the ratio* $\langle m_L \rangle / \langle m_S \rangle$ *scaled to the bulk (full dots) Co/Al_2O_3, (open dots) Co/Al_2O_3/Cu multilayers . Lines are guide to the eyes.*