# DIPOLAR SURFACE UNPINNING AND SPIN-WAVE MODES VS. LATERAL SURFACE DIMENSIONS IN THIN FILMS

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In rod samples of circular cross section (magnetized along rod's axis) the character of spatial nonhomogeneity of the demagnetization field strongly depends on the aspect ratio (the diameter to length ratio) of the rod. When the aspect ratio is large the sample can be regarded as a thin film of *finite* lateral dimensions. We show the spatial profile of the demagnetization field in a thin film evolves towards a nearly uniform distribution as the lateral dimensions of the film increase. Therefore, the Surface Inhomogeneity (SI) model, in which the value of surface anisotropy (responsible for surface dipole pinning) is assumed to depend on the lateral dimensions of the surface, can be used for description of magnetic excitations in thin films. Derived in this study, a formula for the dipolar surface anisotropy energy (including its dependence on the lateral dimensions) indicates the dipolar surface anisotropy is caused by interactions which bind a surface dipole with *all* the dipoles in the adjacent subsurface layer. Summing up the energy contributions due to these interactions leads to a surprising result: the dipolar surface energy is found to *grow as the surface lateral dimensions decrease* and in the nanometer range of lateral dimensions this energy increases even by as much as an order of magnitude.

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