Special modes in spin wave spectra of two-dimensional nanodots and nanorings in the vortex state

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We use a microscopic theory taking into account the nearest-neighbour exchange and dipolar interactions to study two-dimensional (2D) magnetic nanodots and nanorings. Magnetic configuration is assumed to form an in-plane vortex (circular magnetization). We examine the dependence of the frequencies and profiles of spin wave excitations on the dipolar-to-exchange interaction ratio d, the size of the dot L, and the symmetry of the 2D lattice, from which the dot is cut. Special attention is paid to some particular modes, including the lowest mode in the spectrum and the fundamental mode, the frequency of which proves almost independent of d. In the case of the lowest mode different profiles are observed: azimuthal, fundamental (quasiuniform) or highly localized, depending on d and L. We also study the hybridization of the modes, show the multi-mode hybridization and explain the selection rules.

References:

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