MAGNETIC EXCITATIONS IN MAGNONIC CRYSTALS AND IN SMALL MAGNETIC PARTICLES

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9.7 cm

Magnetic normal modes, vital for the problem of thermal noise in small magnetic elements used in writing/reading devices, are investigated here in finite thin films, cube grains and rods. We show how a strong inhomogeneity of the demagnetizing field in these structures induces amplitude bulk localization of magnetostatic modes. Moreover, a new type of magnetostatic modes (*comb modes*) is found in a spectrum of elongated axially magnetized rods, with two clearly discernible regions: a zone of fast amplitude oscillations inside the rod, and slow-oscillation narrow regions at the borders. Absorbing virtually no energy from an *applied* alternating field, comb modes have no significant contribution to the magnetic noise. A separate issue to be raised in this study is that of magnetic excitations propagating in *magnonic crystals* (MC), *i.e.* hypothetical macrocrystals with periodically inhomogeneous magnetic structure, topologically equivalent to well known photonic crystals [1]. Magnonic spectra are investigated in 1D, 2D and 3D structures, and conditions of opening of energy gaps forbidden to magnonic propagation are determined in particular. A confrontation of our 3D MC theory with recent experimental results (spin-wave spectra measurements through neutron scattering) obtained in certain low-doped manganites allows us to suggest a hypothesis that these materials can be regarded as magnonic crystals *existing in nature*.

[1] H. Puszkarski, M. Krawczyk, "Magnonic Crystals - the Counterpart of Photonic Crystals", Solid State Phenomena, **94**, 125 (2003) and references therein.

13.4 cm

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