

Nanoscale Physics

A general method for the determination of the effective mass of the nanoscale structural inhomogeneities of the domain wall in ferromagnets with strong uniaxial magnetic anisotropy

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The study of structural nanoinhomogeneities of the domain walls (DWs) in the domain containing magnetic materials is one of the actual problems of the modern nanoscale physics. In this context of special interest are localized regions of the vector magnetization transformations in the DWs of uniaxial ferromagnets with strong magnetic anisotropy. Many aspects related to the stability, generation and dynamics of these regions have been studied. At the same time, some provisions that characterize the given inhomogeneities require more detailed consideration. One of these problems is to determine the effective masses of these magnetic structures. In this connection, using the concept of a gyrotropic Thiele force, we build a general formalism that allows the determination of the above mentioned characteristics of the nanoscale structural elements of the DW in various domain systems of ferromagnetic materials with strong uniaxial magnetic anisotropy. As shown the effective masses of the magnetic inhomogeneities of the DW depends on the value of the DW gyrotropic band that is created by their movement.

It should be noted that because the parameters of the quantum effects, which take place for the above objects at low temperatures, depends on their effective mass expressions [1,2], then our method is actual to study these phenomenon.

1. *Shevchenko A.B.* Quantum tunneling of a Bloch line in the domain wall of the cylindrical magnetic domain // *Techn Phys.* – 2007.-**52**, N 10.- P. 1376-1378.
2. *Shevchenko A.B., Barabash M.Yu.* The Bloch point in uniaxial ferromagnets as a quantum mechanical object // *Nanoscale Research Letters.*-2014.-**9**.-P. 132.