

Microscopy of nanoobjects

Structural nanoinhomogeneities of the domain wall in the magnetic films as quantum mechanical objects

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The study of substructural nanosized inhomogeneities of domain walls (DWs) of domain – containing magnetic films is one of the topical problems in the modern solid state physics. Among elements of the DW's substructure the following are distinguished: the vertical Bloch lines (BLs) and the Bloch point (BPs) [1]. These inhomogeneities are localized vortex – like regions of the DW and considered as promising information – carrying medium in superdense solid – state data – storage device with high performance. Moreover, the structure similar to BLs and BPs are also present in spintronics materials – ferromagnetic nanostripes and nanowires. Bloch lines and BPs can be detected by magneto-optical microscopy methods, one of which is the dark field microscopy.

It should be noted that in the view of the mesoscopic nature of these objects, quantum effects should be taken into account in analysis of DWs structure properties [2,3]. Using general principles of the WKB method, we have established that in the subhelium temperature range, the BL and the BP may tunnel through the pinning barrier formed by the defect. Quantum effect of the BP such as sub – barrier reflection from the defect potential has been established too. The experimental realization of the given phenomena can be basis for the creation of new sensitive methods of the detection and control of nanoinhomogeneities of DWs in magnetic film in low temperatures.

1. *Malozemoff A.P., Slonczewski J.C.* Magnetic domain walls in Bubble materials // New York, Academic Press, 1979.
2. *Shevchenko A.B.* Quantum tunneling of a bloch line in the domain wall of a cylindrical magnetic domain // Techn. Phys.-2007.-**52**, N 10.-P. 128-130.
3. *Shevchenko A.B., Barabash M.Yu.* The bloch point in uniaxial ferromagnets as a quantum mechanical object // Nanoscale Research Letters-2014.-**9**, N 1.-P. 132.