DEVELOPMENT OF COMPLEX FIBONACCI SYSTEMS WITH MIXED SUPERCONDUCTIVITY AND ARTIFICIAL ANTIFERROMAGNETISM

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Fibonacci systems involve the following sequence of layers during nanostructure deposition: A→B, B→BA. As a result, the total number of structural layers forms a Fibonacci sequence (1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89) with increasing order. The layer marked as A has a different thickness and density of the neutron coherent scattering length (SLD) compared to the layer marked as B.

Unlike periodic structures, Fibonacci structures lack translational symmetry [1], which may enable the observation of mixed superconductivity effects and the asymmetry of the critical temperature T_c for structures made of superconducting materials such as Nb, V, Pb, In, Sn, Ta, and high-temperature superconductors like the Pb/Bi alloy [2].

Fibonacci structures with artificial antiferromagnetism, based on ferromagnetic materials like Co, Fe, and diamagnetic materials like Cu, Ru, Cr, exhibit perpendicular magnetic anisotropy, differing from the in-plane magnetization found in periodic structures [3].

It is proposed to manufacture and study Fibonacci structures with layer thicknesses on the order of tens of angstroms and complex magnetic structures at REMUR after determining the optional thicknesses, materials, and number of layers. Theoretical calculations of the neutron reflection coefficient R and a comparison of the Fibonacci structure with a periodic structure have been preliminarily carried out.

[1] Vekilov Y. K., Chernikov M. A. Quasicrystals // Physics-Uspekhi. 2010. T. 53. № 6. C. 537-560 // DOI: 10.3367/ufne.0180.201006a.0561

[2] B. W. Roberts // Survey of Superconductive Materials and Critical Evaluation of selected properties // General Electric Research and Development, Box 8, Schenectady N. Y. 12301

[3] agnetization dynamics of a Fibonacci-distorted kagome artificial spin ice // Ali Frotanpour, Justin Woods, Barry Farmer, Amrit P. Kaphle, and Lance E. De Long Loris Giovannini, Federico Montoncello // Phys. Rev. B 102, 224435 // DOI: https://doi.org/10.1103/PhysRevB.102.224435