2OR-D-8

SUPERCONDUCTING SPIN VALVES BASED ON MAGNETIC SPIRAL REORIENTATION

Pugach N.G.[1,2], *Safonchik M.O.*[3]
[1] Skobeltsyn Institute of Nuclear Physics Lomonosov Moscow State University, Moscow, Russia
[2] National Research University Higher School of Economics, Moscow, Russia
[3] A. F. Ioffe Physical-Technical Institute, St Petersburg, Russia
pugach@magn.ru

Non-collinear magnetic ordering may convert singlet superconducting correlations into long-range triplet correlations (LRTC) [1-3]. The magnetically controlled appearance of such correlation may be used to change the state of low-temperature spintronics devices. The experimental evidence of such triplet correlations was revealed by the recent observation of long-range Josephson effect [1,2,5,6]. All these LRTC magnetic structures [1,2,4-6] contained from 4 to 9 different layers that demand high requirements to technology and magnetic configuration controlling. Recently also spiral (or conical, like Ho) ferromagnets have been used as elements of complex multilayered magnetic structures [5,7,10], and the corresponding proximity effect was calculated for some configurations [8-11].

We propose to use only one magnetic layer with Dzyaloshinsky-Moriya type interaction and intrinsic non-collinear magnetization to create superconducting LRTC spin valves of a new type. The novel of this proposition is that the spin-valve effect may be realized on only one spiral-magnetic layer. It may be easier fabricated and controlled at contemporary technology.

The calculations are based on Green's functions method within the framework of quasiclassical theory of superconductivity in the “dirty” limit using the Usadel equations. Suitable materials for the realization of the proposed structures may be Nb or Al as a superconductor and MnSi like compounds as magnetic material. These structures are promising for application as elements of magnetic memory for low-temperature electronics. The existence of different magnetic orientations separated by a potential well may help to solve the problem of half-select for the magnetic memory switch [12].

Financial support by CPTGA, the Royal Society RFBR International Exchanges Program, Project T3-89 “Macroscopic quantum phenomena at low and ultralow temperatures” of the National Research University Higher School of Economics, Russia is acknowledged.

[1] M. G. Blamire and J. W. A. Robinson, *J. Phys.: Condens. Matter,* **26** (2014) 453201.
[2] J. Linder and J. W. A. Robinson., *Nature Physics,* **11** (2015) 307.
[3] F. S. Bergeret, A. F. Volkov, and K. B. Efetov, *Rev. Mod. Phys*., **77** (2005) 1321.
[4] A. A. Golubov, M. Yu. Kupriyanov, and E. Il’ichev, *Rev. Mod. Phys*., **76** (2004) 411.
[5] J. W. A. Robinson, J. D. S. Witt, and M. G. Blamire, *Science,* **329** (2010) 59.
[6] T. S. Khaire W. P. Pratt, Jr., and N. O. Birge, *Phys. Rev. Lett*., **104** (2010) 137002.
[7] I. Sosnin, H. Cho, V. Petrashov, *Phys. Rev. Lett*., **96** (2006) 157002.
[8] T. Champel, M. Eschrig., *Phys. Rev. B,* **72** (2005) 054523.
[9] C. Wu, O. Valls, K. Halterman. *Phys. Rev. B,* **86** (2012) 184517.
[10] G. Halasz, J. Robinson, M. Blamire, et. al., *Phys. Rev. B,* **79** (2009) 224505, *ibid*. **84** (2011) 024517.
[11] A. F. Volkov, A. Anishchanka, and K. B. Efetov, *Phys Rev. B,* **73** (2006) 104412.
[12] T. Larkin, V. Bol'ginov, V. Ryazanov, et. al., *Appl. Phys. Lett*., **100** (2012) 222601.