The Prediction of the Solitary Reentrant Superconductivity in the Asymmetrical Ferromagnet-Superconductor-Ferromagnet Trilayer

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The theory of proximity effect for thin bilayer FS and trilayer FSF, where F is a ferromagnetic metal, and S is superconductor, is investigated on the base of new boundary-value problem for the Eilenberger function. For both systems the dependencies of critical temperature on an exchange field of the F metal, electronic correlations in the S and F metals, and thicknesses of layers F and S are derived. It is shown that the possibility of the Fulde-Ferrell-Larkin-Ovchinnikov (FFLO) state observation is especially increased in the asymmetrical trilayers FSF′ for which **solitary reentrant superconductivity is predicted**.
On the basis of a proximity effect we propose **new method of probe of electronic parameters** of contacting materials. If well known BCS superconductor S is used as a probe, one can determine the exchange field, the electron-electron constant in various magnetics F for the FS structures or else the order parameter symmetry in high-Tc superconductors (HTS) for the HTS/S structures. It allows us to predict the sign and value of the constant of electron-electron interaction in gadolinium and to explain a surprisingly high critical temperature ($T_c \sim 5\,\mathrm{K}$) in the short-periodic Gd/La superlattice[1].
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[1]P. P. Deen, *et al.* J. Phys.: Cond. Matt. **17**, 3305 (2005).