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Proximity effect as a probe of electronic correlations and exchange field in dirty ferromagnet/superconductor nanostructures

Terentieva L., Parfenova E., Khusainov M., Proshin Y.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

We investigate the interplay between the BCS and 2D Larkin-Ovchinnikov- Fulde-Ferrell (LOFF) states in the dirty thin ferromagnetic metal/superconductor (FM/S) nanostructures. For the FM/S bilayers we have derived the dependencies of critical temperature on the FM layer exchange field, electronic correlations and thickness. Moreover, in the corresponding FM/S/FM trilayers we predict two new n phase superconducting states with electron-electron repulsion in the FM layers. The 2D modulated LOFF states are possible in such trilayers only in presence of a weak magnetic field and at suitable parameters of the FM and S layers. On this base we originally propose the method of proximity effect probe the magnitude and sign of the electronic correlations, the order parameter symmetry and exchange fields in various FM layers.

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Keywords

Boundary value problem, Electronic correlations, Ferromagnetism, Mutual accommodation, Proximity effect, Superconductivity