

# **Proximity Effect in Superconductor-Ferromagnet Nanostructures**

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**Abstract.** A strong exchange field acting on the Cooper pairs in the ferromagnetic (F) metal leads to the damping oscillatory behaviour of the superconducting order parameter inside the F layer. In consequence in the superconductor-ferromagnet (S-F) multilayers the critical temperature and Josephson current depend in an oscillatory manner on the exchange field and thickness of ferromagnetic metal. These oscillations are related with the transition into the state where the phase of superconducting order parameter is opposite in S-F-S Josephson junction. The transition to this Pi-state may occur via the states with an arbitrary ground phase difference. The properties of this novel junction occur to be very peculiar. Domain structure in ferromagnet may provoke in S-F bilayer the appearance of the superconductivity localized near the domain wall. Inversely, under certain conditions, the superconductivity could trigger the transition into the short period domain state in the F layer.