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Effects of magnetic fluctuation on 0-π transition in a superconductor-ferromagnet-superconductor junction MICHIYASU MORI, SHIN'ICHI HIKINO, SABURO TAKAHASHI, SADAMICHI MAEKAWA, Tohoku University — There has been growing interest in a superconductor- ferromagnetic metal-superconductor (SFS) junction, in which the Josephson critical current, $I_{\rm c}$, shows a cusp as a function of thickness of ferromagnetic-layer, d, and/or temperature, T. Such a non-monotonous behavior, which is in marked contrast to $I_{\rm c}$ in a conventional Josephson junction, originates from the fact that the current-phase relation is shifted by π. This is called π-state. We study the influence of magnetic fluctuation on $I_{\rm c}$ in the SFS junction by a tunneling Hamiltonian approach. An analytical formula of $I_{\rm c}$ is given in the fourth order perturbation theory as regards the tunneling matrix element. Electrons propagate diffusively in the FM due to non-magnetic- and magnetic scatterings. The $I_{\rm c}$ exhibits the damped oscillatory dependence on d, and shows the transition between *0*- and π-*states*. When the superconducting transition temperature is comparable to the ferromagnetic Curie temperature, the period of oscillation is elongated by increasing T due to the magnetic fluctuation, which plays an important role in the 0-π transition, in particular, with T. Our results present an appropriate combination of a superconductor and a ferromagnetic metal to control the *0*- and the π-*states*.

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