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Transport theory of superconductors in paramagnetic limit MAXIM KHODAS, University of Iowa, ALEX LEVCHENKO, Michigan State University , GIANLUIGI CATELANI, Yale University — We report on the study of the quantum phase transition from metastable normal to superconductive state in thin films driven by in-plane magnetic field. In this system resistivity exhibits hysteresis at low temperature when the strong Zeeman field is gradually turned off and on. Quantum fluctuations smear the transition form the metastable normal state to paramagnetically limited superconductivity. The typical energy scale for fluctuations is $\bar{\Omega} = \sqrt{E_z^2 - \Delta^2}$, where E_z is the Zeeman energy and Δ is zero temperature gap. At the onset of the transition $\bar{\Omega} \to 0$ quantum fluctuations cause non-analytic corrections to the conductivity. The most singular corrections are presented. The result is strongly sensitive to the strength of the spin-orbit scattering. We argue that our theory qualitatively agrees with experimental findings provided the spin-orbit scattering is taken into account.

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