Abstract Submitted
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Microscopic theory for a ferromagnetic nanowire/superconductor heterostructure: Transport, fluctuations, and topological superconductivity[1] VICTOR GALITSKI, SO TAKEI, The University of Maryland College Park, THE CONDENSED MATTER THEORY CENTER AND THE JOINT QUANTUM INSTITUTE TEAM — Motivated by the recent experiment of Wang et al. [Nat. Phys. **6**, 389 (2010)], who observed a highly unusual transport behavior of ferromagnetic cobalt nanowires proximity-coupled to superconducting electrodes, we study the proximity effect and temperature-dependent transport in such a mesoscopic hybrid structure. It is assumed that the asymmetry in the tunneling barrier gives rise to the Rashba spin-orbit coupling in the barrier that enables induced p-wave superconductivity in the ferromagnet to exist. We first develop a microscopic theory of Andreev scattering at the spin-orbit-coupled interface, derive a set of self-consistent boundary conditions, and find an expression for the p-wave minigap in terms of the microscopic parameters of the contact. Second, we study the temperature dependence of the resistance near the superconducting transition, and we find that it should generally feature a fluctuation-induced peak. The upturn in resistance is related to the suppression of the single-particle density of states due to the formation of fluctuating pairs, whose tunneling is suppressed. In conclusion, we discuss this and related setups involving ferromagnetic nanowires in the context of one-dimensional topological superconductors.

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