Abstract:
The supercurrent in Josephson junctions containing ferromagnetic materials (called S/F/S junctions) decays and oscillates rapidly with increasing F layer thickness due to the large exchange splitting between the spin-up and spin-down electron bands in F. In the presence of non-collinear magnetization, Bergeret et al. predicted that spin-triplet pair correlations are generated, which are immune to the exchange field and hence persist over much longer distances in F [1]. Several experimental groups have confirmed the presence of such spin-triplet correlations in a variety of S/F and S/F/S systems. Our own approach is based on Josephson junctions of the form S/F’/F/F”/S, with non-collinear magnetizations in adjacent ferromagnetic layers [2,3]. Such structures provide the possibility to control either the supercurrent amplitude or the phase across the junction (0-state or $\pi$-state) by rotating the magnetization of one of the three ferromagnetic layers. It is also possible to control the amplitude of the supercurrent and the phase across simpler S/F’/F/S junctions, which carry only short-range supercurrent. We will present our recent results with both types of devices, and we will review prospects for using such junctions as elements in a superconducting memory.

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