Superconducting spintronics: interplay between superconductivity and magnetism

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Abstract

In this lection I will give a review of basic physics underlying the modern works on superconducting spintronics. In particular, we will discuss the mechanisms of interaction of the magnetic and superconducting orderings and possible applications of these mechanisms in different cryoelectronic devices. The review will also include the discussion of the electrodynamic response of superconductor-ferromagnet (SF) and superconductor – normal metal (SN) hybrid structures: (i) electromagnetic proximity effect; (ii) inhomogeneous Fulde-Ferrel-Larkin-Ovchnnikov (FFLO) states in SF multilayers with the order parameter modulation in the plane of the layers; (iii) the effect of the Rashba – type spin-orbit (SO) coupling; (iv) paramagnetic Meissner effect in SN systems originated from the spin-triplet interlayer pairing.
We will also discuss modern approaches aimed to the tuning the symmetry of superconducting correlations in hybrid structures with proximity effect including the engineering of superconducting states with nontrivial topology.