MAGNON ASSISTED LONG-RANGE SUPERCONDUCTING PROXIMITY EFFECT IN HALF-METALLIC FERROMAGNETS

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9.7 cm

Recent experiments demonstrate that even in the half-metallic fully-spin-polarized ferromagnets a long-range proximity effect is possible as in normal metals. We consider that at an interface the conversion between singlet pair and triplet one is assisted by a creation of magnon excitation. Such a triplet pair can penetrate the ferromagnet for a long distance while a singlet one cannot. Considering the thermal Bose distribution of magnons we obtain, due to destructive interference between magnons of different momentum, a short range proximity effect. We find that, in the case when a single magnon mode dominates other modes, the long-range proximity effect is possible as well. We suggest two possible scenarios in order to create a single mode behavior. First, via nonequilibrium magnons injected during the coherent precession of the magnetization by tuning the microwave frequency to the ferromagnetic resonance (FMR) frequency in a ferromagnetic Josephson junction. In the second scenario, we consider Bose-Einstein condensation (BEC) of magnons induces by the increase of the magnon chemical potential due to the superconducting proximity free energy. The BEC of magnons will induce a modulation of magnetic order (the inverse proximity effect) - spin superstructure presumably with a weak helical structure that allows for dissipationless spin current.

13.4 cm

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