Consequences of broken time-reversal symmetry in triplet Josephson junctions

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There has been recently great theoretical interest in the behavior of Josephson junctions involving triplet superconductors[1] [2] . In this contribution, we study the novel Josephson effect between two triplet superconductors that are separated by a thin ferromagnetic layer (so-called TFT junction); in such a case the time reversal-symmetry can be broken due to the misalignment of the two d-vectors. We find that this allows the appearance of an additional spontaneous magnetization of the tunneling barrier, which radically alters the behavior of the junction.[3] In particular, we find that the junction can be stabilized in a fractional state, i.e. the free energy lies at a phase difference intermediate between zero and π (so-called ϕ-junction). Due to the increased transparency through one spin channel, there occurs also a pronounced enhancement of the critical current that should be observable in experiment.[4] Furthermore, we also demonstrate that the d-vector misalignment results in the appearance of a Josephson spin current, even when the equilibrium (conventional Josephson) charge current is vanishing.

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