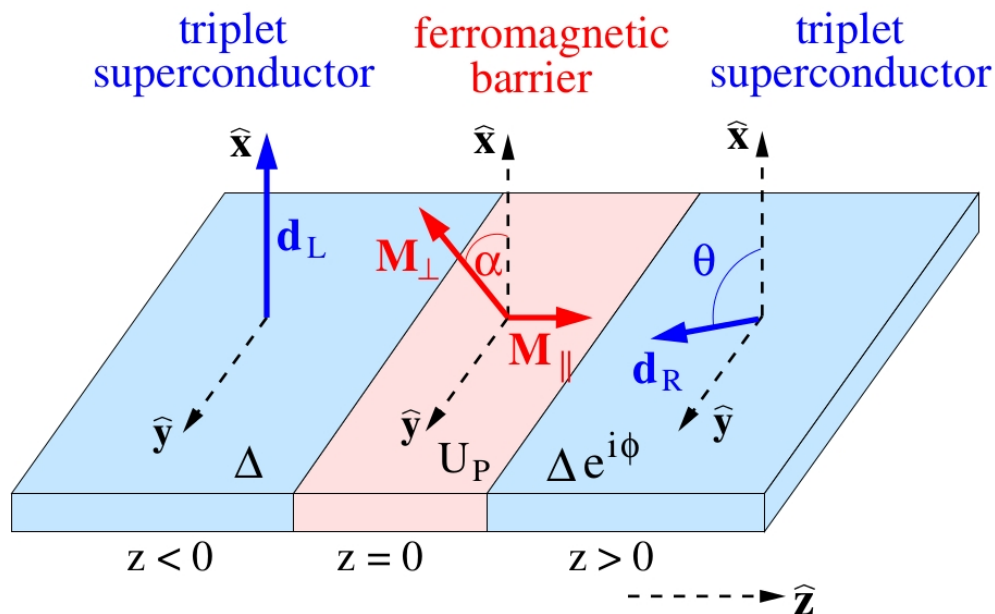


Novel Josephson effect with triplet superconductors: The story begins

Dirk Manske, Max Planck Institute for Solid State Research Quantum Many-Body Theory, Stuttgart, Germany, http://www.fkf.mpg.de/546045/15_Manske

Josephson junctions with magnetic tunneling barriers provide an excellent opportunity to observe the interplay of ferromagnetism and superconductivity in a controlled setting. Using a tunneling Hamiltonian approach, we predict a universal $0-\pi$ transition (sign reversal) of the charge current as the orientation of the barrier magnetic moment is varied [1,2]. Furthermore, in the theoretical study of Josephson junctions, it is usually assumed that the properties of the tunneling barrier are fixed. This assumption breaks down when considering tunneling between two triplet superconductors with misaligned d-vectors in a TFT-junction (triplet-ferromagnet-triplet) [1,3]. Such a situation breaks time-reversal symmetry, which radically alters the behaviour of the junction, stabilizing it in a fractional state, i.e. the free energy minimum lies at a phase difference intermediate between 0 and π . Fractional flux quanta are then permitted at the junction [2]. A further consequence of the d-vector misalignment is the appearance of a Josephson spin current [4-6]. Finally, we contrast the prototype TFT-junction [7] with both a TFS (triplet-ferromagnet-singlet) and NCS-I-S (noncentrosymmetric-insulator-singlet) Josephson junction in which the d-vector misalignment is absent [8]. Recent experimental progress allows to fabricate thin films of the triplet superconductor Sr₂RuO₄ which opens the route for these devices.



- [1] B. Kastening, D.K. Morr, D. Manske, and K.H. Bennemann, Phys. Rev. Lett. 96, 047009 (2006)
- [2] P.M.R. Brydon, C. Iniotakis, D. Manske, and M. Sigrist, Phys. Rev. Lett. 104, 197001 (2010).
- [3] P.M.R. Brydon, B. Kastening, D. K. Morr and D. Manske, Phys. Rev. B 77, 104504 (2008).
- [4] P.M.R. Brydon, D. Manske and M. Sigrist, J. Phys. Soc. Japan 77, 103714 (2008)
- [5] P.M.R. Brydon, C. Iniotakis, and D. Manske, New J. Phys. 11, 055055 (2009).
- [6] P.M.R. Brydon and D. Manske, Phys. Rev. Lett. 103, 147001 (2009).
- [7] P. Gentile et al., Phys. Rev. Lett. 111, 097003 (2013).
- [8] L. Klam, A. Epp, W. Chen, M. Sigrist, and D. Manske, Phys. Rev. B 89, 174505 (2013).