第12回トポロジカル物質科学セミナー
Topological Materials Science Seminar (12)

Spin triplet superconductors: interface to ferromagnets and magnetic edge states

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Abstract: The past decades have been marked by a growing interest in the study of the interplay between superconductivity and magnetism in heterostructures both for the potential applicative impact and because of the underlying fundamental phenomena. The physical properties of heterostructures are strongly dependent on the interface and on the nature of its electronic states at the cross-talk region. A special position in the variety of the electronic states is taken by the gapless modes at the boundary of materials whose bulk is gapped and owe their existence on the global symmetries of the bulk state without depending on the details of the surface scattering and other sample-dependent parameters. Simple band insulators or conventional superconductors do not support robust low-energy states at the boundary. The topological non-trivial nature of the bulk state and the bulk-boundary correspondence theorem are the fundamental aspects that dictate the existence of surface states. Within the superconducting systems, a notable case of superconductor with non-trivial topological number is the two dimensional (p+ip)-wave superconductor with time reversal symmetry breaking, which has in the single layer SrRuO its leading candidate.

In this talk I will focus on various remarkable effects occurring at the interface of chiral and helical spin-triplet superconductors: i) the spin-orbital coupling emerging at the interface with an itinerant ferromagnet (FM) [1,2], ii) the occurrence of magnetic Andreev states at their edge if the system allows for mixed parity and singlet pairing [3,4], and iii) the control of spin- and charge currents at the interface between helical spin-triplet and ferromagnets [5].

1. P. Gentile, M. Cuoco, A. Romano, C. Noce, D. Manske, P. M. R. Brydon, Phys. Rev. Lett. 111, 097003 (2013).
2. D. Terrade, P. Gentile, M. Cuoco, and D. Manske, Phys. Rev. B 88, 054516 (2013).
3. A. Romano, P. Gentile, C. Noce, I. Vekhter, M. Cuoco, Phys. Rev. Lett. 110, 267002 (2013).
4. A. Romano, P. Gentile, C. Noce, I. Vekhter, and M. Cuoco, Phys. Rev. B 93, 014510 (2016)
5. D. Terrade, D. Manske, and M. Cuoco, Phys. Rev. B 93, 104523 (2016)

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