Transport and magnetic properties of edge states in the multi-band superconductor Sr_2RuO_4

Yoshiki Imai[1], Katsunori Wakabayashi[2], and Manfred Sigrist[3]

[1] *Department of Physics, Saitama University, Saitama, 338-8570, Japan*

[2] *International Center for Materials Nanoarchitectonics (WPI-MANA), National Institute for Materials Science (NIMS), Tsukuba 305-0044, Japan*

[3] *Theoretische Physik, ETH-Hönggerberg, CH-8093 Zürich, Switzerland*

Motivated by the spin-triplet chiral p-wave superconductor Sr_2RuO_4, the edge state of a multi-band superconductor is investigated by using a two band tight-binding model which includes inter-orbital hybridization and spin-orbit interaction. The obtained two-dimensional bulk bands reproduce α-β bands of Sr_2RuO_4, which have hole- and electron-like characters, respectively. In particular we focus on the electronic and magnetic properties in the superconducting phase with the chiral spin-triplet state. Despite the full quasiparticle excitation gap in the bulk system, gapless edge states appear and affect both spontaneous spin and charge currents which result from the spin-orbital interaction and the topology of the superconducting condensate, respectively. Onsite Coulomb repulsion gives rise to spin-polarization near the edges due to a Stoner-like mechanism. While the orientations of current- and correlation-induced magnetic fields are fixed by the spin-orbit coupling, the net magnetic field is strongly suppressed due to the compensation, which may give the explanation of negative results of the SQUID experiments which had been devised to observe the chiral edge currents [1].

[1] Y. Imai, K. Wakabayashi, and M. Sigrist, Phys. Rev. B **85**, 174532 (2012).