

Magnetic Field Effect on the Pairing State Competition in Quasi-One-Dimensional Organic Superconductors (TMTSF)₂X

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The possibility of unconventional superconductivity has been suggested in quasi-one-dimensional organic conductors (TMTSF)₂X (X=PF₆, ClO₄, etc.). Recent experiments have shown the possibility of spin triplet pairing and/or Fulde-Ferrell-Larkin-Ovchinnikov (FFLO) state in the high magnetic field regime. [1, 2, 3]

As for a theoretical study on the pairing competition in the magnetic field, we have microscopically suggested that (i) consecutive pairing state transition from singlet to FFLO and further to $S_z=1$ triplet pairing takes place upon increasing the magnetic field, and (ii) the strong parity mixing between the singlet and $S_z=0$ triplet takes place in the FFLO state when the superconductivity mediated by charge fluctuations coexisting with spin fluctuations. [4] We have also shown that $S_z=1$ triplet pairing mediated by $2k_F$ spin and $2k_F$ charge fluctuations is strongly enhanced upon increasing the field. [5]

We have further obtained the T vs. H phase diagram of the model for (TMTSF)₂X (Fig. 1), which shows that the consecutive singlet-FFLO-triplet transition may indeed take place when $2k_F$ charge fluctuations are slightly smaller than $2k_F$ spin fluctuations.

[1] I. J. Lee *et al.*, Phys. Rev. Lett. 78 (1997) 3555.

[2] J. Shinagawa *et al.*, Phys. Rev. Lett. 98 (2007) 147002.

[3] S. Yonezawa *et al.*, Phys. Rev. Lett. 100 (2008) 117002; J. Phys. Soc. Jpn. 77 (2008) 054712.

[4] H. Aizawa *et al.*, Phys. Rev. Lett. 102 (2009) 016403.

[5] H. Aizawa *et al.*, Phys. Rev. B 77 (2008) 144513.

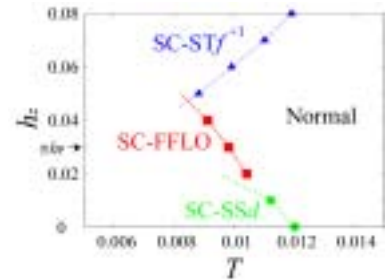


Fig.1. Calculated phase diagram in the temperature-magnetic field plane, where SC-SS d is spin singlet d -wave, SC-FFLO is FFLO state, and SC-ST f^1 is $S_z=1$ triplet f -wave pairing.