COEXISTENCE OF FERROMAGNETISM WITH SPIN TRIPLET SUPERCONDUCTIVITY

G. Górski[a], J. Mizia and K. Kucab
[a]Institute of Physics, Rzeszów University, Poland

9.7 cm

The experimental results for $ZrZn_2$, URhGe, and partly also for UGe_2 have shown that the ferromagnetic superconductors are weak itinerant ferromagnets. We describe the phenomenon of coexistence between equal spin triplet pairing superconductivity and ferromagnetism using the extended Stoner model, which includes in Hamiltonian the on-site Coulomb interaction, U, and occupation dependent hopping integral, t_{ij}^{σ}. This occupation dependence of hopping integral 'produces' the additional terms in Hamiltonian, i.e. assisted hopping, Δt, and exchange-hopping, t_{ex}, interaction. We use Hartree-Fock (H-F) approximation and the Green functions technique. In the H-F approximation the on-site Coulomb interaction plays the role of the on-site exchange (Hund's) field. All inter-site interactions will have included the inter-site kinetic correlation, $\langle c_{i\sigma}^{+} c_{j\sigma} \rangle$, within the H-F approximation. We introduce the pressure-dependence to the hopping integral. We compare the numerical results with exparimental data for $ZrZn_2$. The kinetic correlation creates the superconductivity without the help of negative values of Coulomb interactions. The model can explain stimulation of triplet SC by the weak itinerant ferromagnetism. This effect was observed experimentally in $ZrZn_2$. The numerical analysis also confirms the experimental effect of decreasing of the critical temperatures (Curie and superconducting) with increasing external pressure.

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Corresponding author :
dr Krzysztof Kucab

Address for correspondence :
Institute of Physics
Al. Rejtana 16A
35-959 Rzeszów
Poland

Email address :
kkucab@univ.rzeszow.pl