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Exciton mediated triplet superconductivity in T_h system $PrOs_4Sb_{12}$

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In $PrOs_4Sb_{12}$, the lowest-lying singlet (Γ_1) and triplet states ($\Gamma_4^{(2)}$) of Pr $4f^2$ hybridize with conduction electrons with local a_u and t_u point group symmetries. To derive an attractive triplet pairing interaction, orbital degrees of freedom of the t_u orbitals are important. Ferromagnetic spin fluctuations can be induced for conduction electron system by orbital exchange in the scattering process with Pr $4f^2$.

In the T_h system, there are off-diagonal interaction terms in O_h basis functions. The triplet superconducting states are then classified in $\Gamma_1 \oplus \Gamma_2$, Γ_3 and $\Gamma_4 \oplus \Gamma_5$ types in the T_h point group symmetry. We show effective interactions for the three types in Fig. 1, where negative values are for attractive interactions. θ is a parameter expresses the T_h symmetry within $|\Gamma_4^{(2)}\rangle = \cos\theta|\Gamma_5\rangle - \sin\theta|\Gamma_4\rangle$. We can see that the effective attractive interaction is enhanced by the off-diagonal interaction terms. It indicates that the T_h point group symmetry plays an important role to stabilize the triplet superconductivity. The gap function has point nodes along the all basal x, y and z axes. However, it has two-fold symmetry (no four-fold symmetry), reflecting the T_h symmetry. Details will be reported at our presentation.

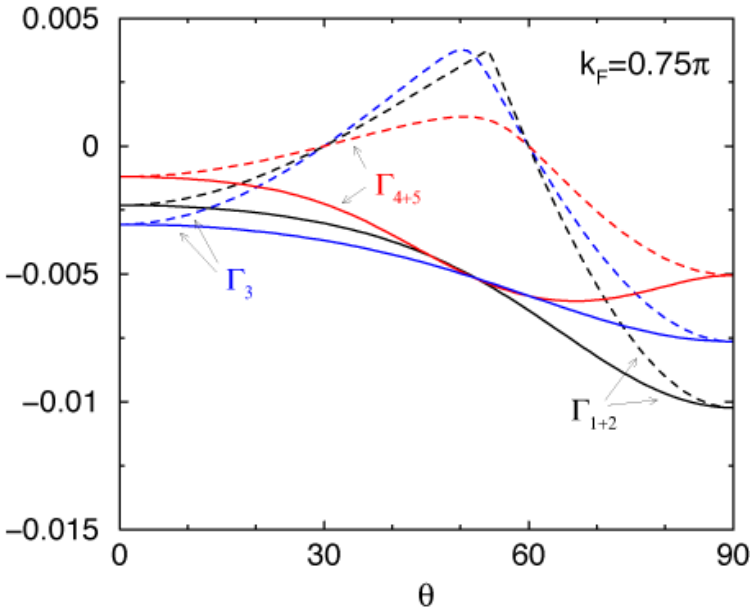

Figure 1: Effective interaction for three types pairing states. Dashed lines are effective interactions without off-diagonal interaction terms.