Enhanced Superconductivity in Bilayered Systems

SAURABH BASU, Dept. of Physics, IIT Guwahati — We investigate superconducting correlations in bilayered systems. The planes are described by a two-dimensional $t_\parallel - J_\parallel - U$ with $t_\perp$ and $J_\perp$ denoting the interplanar parameters. These interplanar couplings when coupled with hopping anisotropies in the planes may account for a host of unusual superconducting properties. Our main focus is to calculate superconducting correlations (using BCS theory) for various regions of the parameter space formed by the interplanar variables. For $t_\perp = 0$ (confining the carriers in planes) and $J_\perp < J_\parallel$, the pairing correlations are found to be purely planar. Further we generalize to $t_\perp \neq 0$ and $J_\perp/J_\parallel = (t_\perp/t_\parallel)^2$ and find that pairing correlations are enhanced at lower densities with increasing $t_\perp$. The most dramatic effect sets in when, additionally the planar hopping frequencies are made highly anisotropic ($t_y \ll t_x$) and $J_\perp \sim J_\parallel$. A small $t_\perp$ increases $T_c$ as much as four times when compared with the calculations performed for a single layer (PRB, 66, 144507 (2002)). Straightforward generalizations to more number of layers is discussed with a goal to study crossover to the bulk 3D limit.