Calculation of the pairing temperature $T_c$ and the gap function in electron-doped cuprates

DHANANJAY DHOKARH, ANDREY CHUBUKOV, UW-Madison, Physics — Using a spin-Fermion model, and applying an Eliashberg-type theory to electron-doped cuprates at quantum criticality, we calculate the pairing transition temperature $T_c$, and the gap function $\Delta(\vec{k}, \omega_n)$ for $T < T_c$. We carry out the calculation with a frequency dependent interaction, mediated by spin fluctuations exchange. We argue that for near-critical electron-doped cuprates, the geometry of the problem is such that the Fermi surface curvature plays an important role in the calculation of the polarization bubble $\Pi$, the fermionic self energy $\Sigma$, as well as the anomalous self energy $\Sigma_{02}$. For $T < T_c$ the polarization $\Pi$ also depends on $\Delta(\vec{k}, \omega_n)$. As an advantage over previous works, vertex corrections are also included in our calculations. We show that vertex corrections actually give rise to a larger $T_c$ and explain why. For $T < T_c$, we obtain a gap function $\Delta(\vec{k}, \omega_n)$ that is non-monotonic along the Fermi-surface, but monotonically decreases as a function of frequency $\omega_n$. We find that the ratio of the maximum of $\Delta$ to $T_c$ is around 1.8 without vertex corrections; with the corrections it is around 4.