COHERENCE LENGTH IN NON-CONVENTIONAL SUPERCONDUCTORS

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In the standard BCS superconductors the Cooper-pair size $\xi_{pair}$ and the coherence length for the gap fluctuations $\xi_0$ are of the same order, being both settled by the ratio between the Fermi velocity $v_F$ and the gap amplitude $\Delta_0$.

In the superconducting cuprates the coherence length $\xi_0$ calculated from upper critical field measurements turns out to be sensibly shorter than in conventional materials and even smaller values $(10 - 15\mathring{A})$ are deducted from a very recent experiment of STS and STM [1]. A detailed study of the various length scales in these non conventional superconductors is then requested: in particular the effects of the $d-wave$ symmetry of the gap and of the not small strength of the pairing interaction have to be taken into account.

Within a (generalized) attractive Hubbard model, we show [2] that at weak coupling the presence of the nodal points in the $d-wave$ gap, while producing the divergence of the Cooper-pair size, corrects only by a numerical factor the BCS estimate for $\xi_0$.

The strong coupling regime has to be treated more carefully since it is not possible to study the gap fluctuations separately from the density fluctuations. We show explicitly [2](in the $s-wave$ case, but we do not expect significant differences for $d-wave$ superconductors) that the coherence length $\xi_0$ is effectively reduced to the order of a lattice spacing at finite density, while in the extreme diluted limit we recover the expected divergence for the coherence length of a weakly-interacting bosonic system.

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