THE PSEUDOGAP PHENOMENON IN HIGH TEMPERATURE SUPERCONDUCTORS

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Contrary to conventional superconductors, high temperature superconductors exhibit a gap in the density of states which does not close at the critical temperature T_c and persists as a pseudogap up to temperatures T^* which, in the underdoped regime, can be well above T_c. It is presently believed that this phenomenon contains the key to our understanding of the underlying mechanism leading to high temperature superconductivity as it forshadows the onset of pair formation at T^* without any long range phase coherence. We discuss to what extent this phenomenon could possibly be linked to superconducting fluctuations arising from the low dimensionality of these systems. We show that a more likely explanation of this phenomenon is however the formation of two-particle resonance states having nothing to do with superconducting fluctuations. In that case we expect the system to show a tendency of approaching an insulating state before it collapses into its superconducting state as the temperature decreases. We illustrate these pseudogap features on hand of the single-particle spectral properties (seen by angle resolved photoemission experiments) and discuss how these anomalous single particle properties reflect themselves in the various transport coefficients.

9.7 cm

13.4 cm

Subject category :

1. Correlated Electrons and High Temperature Superconductors

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