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Fluctuation Phenomena in Two-band Superconductors

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A theory of fluctuations in two-band superconductor is discussed. Since the standard Ginzburg-Landau approach fails in description of properties the latter, it is generalized basing on the microscopic theory of a two-band superconductor[1]. Calculating the microscopic fluctuation propagator, one can construct the nonlocal time-dependent GL equations. In the case of MgB_2, where the pairing in **σ** and **π** bands differs strongly, the parametrically narrow range of temperatures exists, where the standard GL theory of fluctuations is still applicable. Beyond it fluctuations become non-local and corresponding generalization of the GL approach requires account for the short-wavelength fluctuations. This approach allows us to calculate the main fluctuation observables such as fluctuation specific heat and conductivity, find the critical exponents in different regimes and explain the specifics of the experimental findings.

The account for short-wavelength fluctuations allows to explain the striking contrast in the shape of superconducting transitions in heat capacity and conductivity measurements on P-doped pnictides. The heat capacity transition turns much more narrow in comparison to that one in conductivity[2]. Theoretical examination of the fluctuation corrections to both of these characteristics in magnetic field close to the line $H_{c2}(T)$ allows to attribute the difference observed to the specific dependence of the effective coherence length of the two-band superconductor on magnetic field.

References

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