Theory of superconducting fluctuations in magnesium diboride

ANDREI VARLAMOV, Coherentia-INFM-CNR, via del Politecnico, 1, 00133 Rome, Italy, ALEXEI KOSHELEV, VALERII VINOKUR, Argonne National Laboratory — A theory of fluctuations in two-band superconductor MgB_2 is developed. Since the standard Ginzburg-Landau (GL) approach fails in description of its properties, we generalize it basing on the microscopic theory of a two-band superconductor. Calculating the microscopic fluctuation propagator, we build up the nonlocal two-band GL functional and the corresponding time-dependent GL equations. This allows us to calculate the main fluctuation observables. Temperature dependencies of the fluctuation specific heat, magnetic susceptibility, and in-plane conductivity are determined by the same function which interpolates between two regimes: the standard GL regime very close to T_c, where superconductivity is described by the unique order parameter for both bands, and the regime of dominating σ-band which is settled at temperatures slightly further away from T_c. This work was supported by the U.S. DOE, Office of Science, under contract # W-31-109-ENG-38. A.A.V. acknowledges the support of the FIRB project of the Italian Ministry of Science and Education.

Alexei Koshelev
Argonne National Laboratory