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Disorder-induced quantum critical point in an anisotropic gap superconductor VICTOR GALITSKI, Physics Department and Joint Quantum Institute, University of Maryland — We consider an inhomogeneous anisotropic gap superconductor in the vicinity of the quantum critical point, where the transition temperature is suppressed to zero by disorder. Starting with the BCS Hamiltonian, we derive the Ginzburg-Landau action for the superconducting order parameter. It is shown that the critical theory corresponds to the marginal case in two dimensions and is formally equivalent to the theory of an antiferromagnetic quantum critical point, which is a quantum critical theory with the dynamic critical exponent, z=2. This allows us to use a parquet method to calculate the non-perturbative effect of quantum superconducting fluctuations on thermodynamic properties. We also discuss mesoscopic disorder fluctuations, which lead to the spatial variations of the local pairing temperature and the formation of superconducting islands above the mean-field transition. This disorder-induced Griffiths phase is described by a network of superconducting islands and metallic regions with a strongly suppressed density of states due to superconducting fluctuations. We argue that the phenomena associated with mesoscopic disorder fluctuations may also be relevant to high-temperature superconductors, in particular, to recent STM experiments, where gap inhomogeneities have been explicitly observed.

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