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Bogoliubov angle and visualization of particle-hole mixture in[1]
ILYA GRIGORENKO, Los Alamos National Laboratory, KAZU FUJITA, JINHO LEE, ALFRED WANG, Cornell University, JIAN XIN ZHU, Los Alamos Natinonal Laboratory, J.C. DAVIS, Cornell University, HIROSHI EISAKI, Nanoelectronics Research Institute, AIST, Japan, S. UCHIDA, University of Tokyo, ALEXANDER BALATSKY, Los Alamos National Laboratory — Superconducting excitations — Bogoliubov quasiparticles — are the quantum mechanical mixture of negatively charged electron (-e) and positively charged hole (+e). Depending on the applied voltage bias in STM one can sample the particle and hole content of such a superconducting excitation. Recent Scanning Tunneling Microscope (STM) experiments offer a unique insight into the inner workings of the superconducting state of superconductors. We propose a new observable quantity for STM studies that is the manifestation of the particle-hole dualism of the quasiparticles. We call it a*Bogoliubov angle*. This angle measures the relative weight of particle and hole amplitude in the superconducting (Bogoliubov) quasiparticle. We argue that this quantity can be measured locally by comparing the ratio of tunneling currents at positive and negative biases. Bogoliubov angle allows one to visualize robustness of superconducting state locally. It may also allow one to measure the particle-hole admixture of excitations in normal state above critical temperature and thus to measure superconducting correlations in pseudogap state.

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