Impurity-induced Local Density of States in a D-wave Superconductor Carrying a Supercurrent

DEGANG ZHANG, C.S. TING, Texas Center for Superconductivity, University of Houston, Houston, Texas 77204, C.-R. HU, Department of Physics, Texas A & M University, College Station, Texas 77843 — The local density of states (LDOS) and its Fourier component induced by a unitary impurity in a supercurrent-carrying d-wave superconductor are investigated. Both of these quantities possess a reflection symmetry about the line passing through the impurity site and along the supercurrent if it is applied along the antinodal or nodal direction. With increasing supercurrent, both the coherence and resonant peaks in the LDOS are suppressed and slightly broadened. Under a supercurrent along the antinodal direction, the coherence peaks split into double peaks. The modulation wavevectors associated with elastic scatterings of quasiparticles by the defect from one constant-energy piece of the Fermi surface to another are displayed as bright or dark spots in the Fourier space of the LDOS image, and they may be suppressed or enhanced, and shifted depending on the applied current and the bias voltage.