

Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Resonant alteration of supercurrent in guiding structures with complex de Gennes distance and its magnetic-field-induced restoration
OLEG OLENSKI, King Abdullah Institute for Nanotechnology — Properties of the superconducting 2D disk and 3D wire are calculated within the framework of linearized Ginzburg-Landau theory with the complex de Gennes distance Λ in the boundary condition. As a result, the self-adjointness of the Hamiltonian is lost, its eigenvalues E become complex too and the discrete bound states of the disk turn into the quasibound states with their lifetime defined by the eigenenergies imaginary parts E_i . Accordingly, the longitudinal supercurrent undergoes alteration with its attenuation/amplification being E_i -dependent too. It is shown that E_i as a function of the de Gennes imaginary part Λ_i exhibits a pronounced sharp extremum with its magnitude being the largest for the zero real part Λ_r of the de Gennes distance. Increasing magnitude of Λ_r quenches the $E_i - \Lambda_i$ resonance and at large Λ_r the eigenenergies E approach the asymptotic real values independent of the de Gennes length imaginary component. The extremum is also wiped out by the applied longitudinal uniform magnetic field. The finite lifetime of the disk quasibound states stems from the Λ_i -induced currents flowing through the superconductor boundary. The effect can be observed in the superconductors by applying to them the external electric field.

Oleg Olenski
King Abdullah Institute for Nanotechnology

Date submitted: 23 Nov 2010

Electronic form version 1.4