

Effects of Rashba and Dresselhaus Spin-Orbit Interactions on the Gap Anisotropy in Layered Superconductors

B. Tanatar¹

B. Suleymanli²

¹Department of Physics, Bilkent University, 06800
Ankara, Turkey

²Physics Department, Yıldız Technical University,
34220 Esenler, Istanbul, Turkey

tanatar@fen.bilkent.edu.tr

Figures

Abstract

THE theory of layered superconductors is extended in the presence of Rashba and Dresselhaus spin-orbit interactions (SOIs). Using the intralayer BCS-like pairing interaction and employing the Gor'kov formalism, we obtain analytical expressions for the temperature Green's functions and determine the gap function Δ which becomes complex in the presence of SOIs. In the absence of SOIs, Δ is isotropic at both zero and finite temperatures, but it becomes anisotropic even in the presence of a single SOI. This anisotropy is related to the extra $\cos(k_z)$ factors in which the k_z momentum along the z-direction contributes to the magnitude of the gap function. It is also found that SOIs suppress Δ at both zero and finite temperatures, and for certain critical values of SOIs and beyond Δ vanishes. Analytical expressions for the critical values of SOIs at zero temperature are obtained. Additionally, how the BCS equation for layered superconductors changes in the presence of SOIs is determined.

Figure 1: Variation of the magnitude of the gap function with respect to k_z momentum along the z-direction
