Chiral Superconductivity in the Layered Pnictide $BaPtAs_{1-x}Sb_x$ with a Honeycomb Network

*Tadashi Adachi

Department of Engineering and Applied Sciences, Sophia University, 7-1 Kioi-cho, Chiyoda-ku, Tokyo, 102-8554, Japan

Abstract

Chiral superconductivity is a new class of superconducting (SC) state that has attracted much attention over the past decade. In a chiral SC state, the orbital motion of SC electron pairs creates a spontaneous magnetic field, which is a manifestation of broken time-reversal symmetry. For the chiral *d*-wave superconductivity with spin-singlet pairing, muon-spin-relaxation (μSR) measurements in the layered pnictide SrPtAs with a honeycomb network revealed the development of a weak internal magnetic field below the SC transition temperature T_c, suggesting the occurrence of a spontaneous magnetic field caused by the breaking of the time-reversal symmetry [1].

To investigate the possible chiral *d*-wave state, we performed μSR measurements on another layered pnictide, $BaPtAs_{1-x}Sb_x$ (x = 0.2, 0.9, 1.0), which also has a honeycomb network [2,3]. Possible chiral SC states were theoretically proposed for x = 1.0 [4]. Zero-field μSR revealed that, while the relaxation rate of muon spins, λ, is almost temperature-independent for x = 0.2 and 0.9, λ gradually increases with decreasing temperature below T_c = 1.6 K for x = 1.0. These results suggest that an internal magnetic field corresponding to the spontaneous magnetic field develops at x = 1.0. It is also suggested that the disorder induced by As substitution destroys the chiral SC state, and that the observed chiral SC state at x = 1.0 is probably a *d*-wave one [5].

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