MAR10-2009-004903

Abstract for an Invited Paper
for the MAR10 Meeting of
the American Physical Society

Recent Developments in the Studies of Sr_2RuO_4: Suppression of the Upper Critical Field and the Interference between the Even-Parity Superconductivity and the Superconductivity of Sr_2RuO_4[1]

YOSHITERU MAENO, Kyoto University

Although there are a number of convincing experimental evidence for odd-parity, spin-triplet superconductivity of Sr_2RuO_4, there are still a few puzzling phenomena not yet clarified in this framework. To describe recent progress, we mainly present on the accurate and precise dependence of the upper critical field H_{c2} on the field direction and temperature. Compared with the extension of the initial slope of H_{c2} vs.T near T_c, the low-temperature H_{c2} is strongly suppressed only when the field direction is within a few degrees form the exact in-plane direction. Interestingly, if the anisotropic ratio in Sr_2RuO_4 is assumed to depend on temperature, the observed angular dependence of H_{c2} is reproduced better at lower temperature with an effective-mass model for an anisotropic three-dimensional superconductor. The magnitude of the suppression is rather comparable to that known for UPt_3, another strong candidate of the odd-parity superconductor. Concerning another development, we will present on the unusual temperature dependence of the critical current between the so-called 3-K phase (a eutectic crystal of Sr_2RuO_4 with Ru-metal inclusions) and lead deposited on the surface of the 3-K phase crystal. The critical current of such proximity junctions exhibits extraordinary dependence, dropping sharply below $T_c = 1.5$ K of Sr_2RuO_4, but abruptly starting to increase again below about 1.1 K. Such behavior is most naturally ascribable as an interference between the even-parity and odd-parity superconductivity..

[1]This work is done mainly in collaboration with Shunichiro Kittaka, Taketomo Nakamura, and Shingo Yonezawa.