PCP1-5

Transition temperature in a dirty mesoscopic superconductor: Transition from localized superconductivity to extended superconductivity

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Transition temperature (Tc) of a mesoscopic superconductor is enhanced [1]. This is because superconducting electrons are confined in a small space, an effective density of states is enhanced. This phenomenon is clearly appeared as gigantic enhancement of Tc in a dirty nano-size superconductor. (Fig.1) In this case, superconducting electrons are localized in a small region, and effective density of states is enhanced [2]. (Fig.2)

However, just below this transition temperature, superconductivity remains localized. If we defined true Tc as the temperature when zero resistivity occurs, true Tc is lower than the enhanced Tc. In order to find this true Tc, we must solve the full Bogoliubov-de Gennes (BdG) equations, instead of the linearized BdG equations [2].

In this study, we investigate how localized superconductivity in a dirty mesoscopic superconductor extend to whole superconductor, with decreasing the temperature. Also, we investigate how Tc depends on the size and structure of the superconductor.

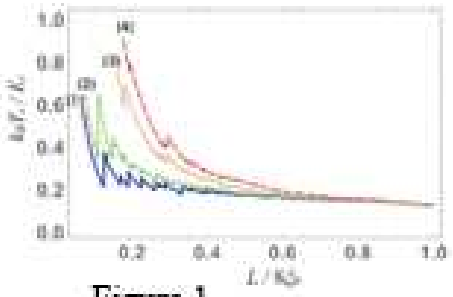

Figure 1

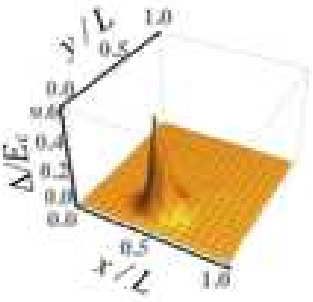

Figure 2

[1] M. Umeda and M. Kato, Physica C, 560 (2019) 45.
[2] M. Umeda and M. Kato, J. Appl. Phys., to be appeared.

Keywords: Transition temperature, Dirty mesoscopic superconductor, Bogoliubov-de Gennes equations, Localization