Anisotropic Josephson-Vortex Dynamics in Layered Organic Superconductors

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When an external magnetic field is applied along the plane of Josephson junction in the superconducting state, the field penetrates into the junctions as quantized Josephson vortices. Since two dimensional organic superconductor κ-$ET_2Cu(NCS)_2$, which is also known as an unconventional superconductor with *d*-wave symmetry [1], consists of atomic scale Josephson junctions based on the layered structures, the magnetic field penetrating along the superconducting planes forms a Josephson-vortex system. The Josephson-vortex system has attracted much attention because of various interesting phenomena by the dynamics of Josephson-vortices.

We measured the Josephson-vortex flow resistance (JVFR) for κ-$ET_2Cu(NCS)_2$ in magnetic field of 13 T rotating within the two dimensional conducting plane. We found the clear fourfold symmetry with a dip structure in the angular variation at T = 5 K as shown by Fig. 1. The origin of the fourfold symmetry is discussed in terms of the *d*-wave symmetry. This result is very important because this observation opens an easy route to the experimental determination of the gap structure, which is crucial for understanding the pairing mechanism. In-plane angular dependence of JVFR for β-$(BDA\text{-}TTP)_2SbF_6$, which is another organic superconductor with *d*-wave symmetry [2], will be presented.

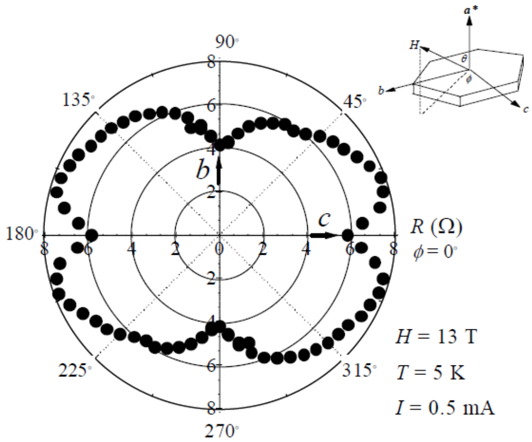

FIG. 1: Polar plots of Josephson-vortex flow resistance in κ-$ET_2Cu(NCS)_2$.

[1] K. Izawa *et al.*, Phys. Rev. Lett. 88 (2002) 027002.
[2] K. Nomura *et al.*, Physica B 404 (2009) 562.