

第264回

物質科学セミナー

題名 : Coherent tunneling of Josephson vortices

講師 : Prof. Dr. Alexey Ustinov

(Karlsruhe Institute of Technology, Germany)

日時 : 2023年3月30日(木) 14:30 – 15:30

場所 : 総合科学部 K112

講演要旨 :

The existence of vortices in superconductors has a quantum nature. Quantized vortices of supercurrent are accompanied by magnetic flux penetrating the material, and play a key role in determining the properties of superconducting materials and devices. The dynamics of such vortices are essentially classical, while some earlier studies have hypothesised a collective quantum dynamics. However, the proposition that a vortex as a macroscopic entity can exist in a coherent superposition of two or more spatially distinct states has received no experimental evidence till now. We experimentally study the quantum dynamics of vortices in long Josephson junctions made of a high kinetic inductance material, in which the effective mass of the vortex is reduced by orders of magnitude. By probing the vortex states with a weak microwave signal, we observe direct evidence for a quantum coherent superposition of spatially distinct vortex configurations. The spectrum of the system has a two-level character, with a coherence time of Rabi oscillations between the states on the order of few microseconds. The observed phenomenon of quantum superposition between spatially separated vortex states complements to the well established temporal quantum coherence utilized in superconducting qubits.

5 研究科共同セミナーの認定科目です。

世話人 : 片山 春菜 (先進理工系科学研究科・理工学融合 P)

メール : halna496@hiroshima-u.ac.jp