Fourth Sound Resonance of Superfluid ^{3}He in Slab Geometry

C. Kato, S. Sasamoto, Y. Kimura, K. Obara, H. Yano, O. Ishikawa, and T. Hata

Graduate School of Science, Osaka City University

Superfluid ^{3}He is one of the spin triplet p-wave condensates and gives us an ideal system to study the property of p-wave condensates. We have studied the sound propagation mechanism in superfluid ^{3}He by using the fourth sound resonance technique, which is a peculiar sound propagating in a narrow space where normal-fluid component is clamped to walls by viscosity.
To study the anisotropic feature of the fourth sound propagation in superfluid ^{3}He, we made three kinds of stack of parallel plates as a narrow space; thickness of slab is 12, 25, and 50 μm. Such slab geometry has an advantage of controlling the texture in superfluid ^{3}He.
The sound experiments were performed at 29 bar in the magnetic field perpendicular to parallel plates of about 30 mT. We clearly observed the jump of the resonance frequency at the AB transition temperature with only 50 μm slab but didnot observe with 12 and 25 μm slabs. Similar result has been found by Kojima[1]; they found the kink of superfluid density at AB transition temperature with 50 μm slab. It is thought that ℓ-texture in 50 μm slab is different from that in 12 and 25 μm slabs. We also observed the jump of the quality factor of resonance, the energy loss, at AB transition temperature with all slabs. It seems that the energy loss mechanism in hydrodynamic region is different between the anisotropic A phase and the isotropic B phase.

[1]H. Kojima, D. N. Paulson and J. C. Wheatley, J. Low Temp. Phys. **21**, 283 (1975).