MAR13-2012-020130

Abstract for an Invited Paper
for the MAR13 Meeting of
the American Physical Society

Probing Chirality in Superfluid ^{3}He-A: Free surface as an ideal boundary condition[1]

KIMITOSHI KONO, Low Temperature Physics Laboratory, RIKEN

Superfluid ^{3}He is known as a typical topological superfluid. A recent theoretical investigation suggests Majorana surface states at the free surface of superfluid ^{3}He-B phase [1]. On the other hand, superfluid ^{3}He-A is known as a chiral superfluid. The scattering of quasiparticle from small object is predicted to be skew with respect to an anisotropy axis [2]. We have developed an experimental technique to study transport properties of ions under the free surface of superfluid ^{3}He [3]. By using this technique, we can investigate interaction between elementary excitations in superfluid ^{3}He and small objects under well-controlled conditions. For example, in ^{3}He-B interaction with Majorana surface states, although no interaction is expected, will be investigated, whereas in ^{3}He-A skew scattering of quasiparticle from electron bubbles will be probed. In this paper, we present the recent results of transport properties of electron bubbles trapped below the free surface of superfluid ^{3}He. In particular, experimental evidences of the skew scattering and chirality of superfluid ^{3}He-A will be presented. The skew scattering of quasiparticle in ^{3}He-A from electron bubble results in a bubble transport analogous to the Hall effect, where the anisotropy vector of ^{3}He-A behaves as if it was a magnetic field in the Hall effect. Under experimental conditions, the effect is observed as an analogue of edge magnetoplasmon effect. After the analysis of data, we obtained a reasonable qualitative agreement with the theory [2].

[1] S. B. Chung and S.-C. Zhang: Phys. Rev. Lett. 103, 235301 (2009).
[2] R. H. Salmelin, M. M. Salomaa, and V. P. Mineev: Phys. Rev. Lett. 63, 868-871 (1989).
[3] T. Shiino, H. Mukuda, K. Kono, W. F. Vinen: J. Low Temp. Phys. 126, 493-498 (2002).

[1]This work is done in collaboration with Hiroki Ikegami.