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The purpose of this thesis is to show the superfluid ^{3}He-B is definitely a topological superfluid and its surface Andreev bound states (SABS) have Majorana properties by the measurement of the shear mode acoustic impedance ($Z = Z' + iZ''$). Z is found to probe the transverse momentum exchange between ^{3}He quasi-particles in the SABS and a wall spectroscopically by setting the frequency comparable to the gap energy. In the preceding measurements under zero magnetic field, the experimental results are well reproduced by the assumption of the existence of the SABS inside the superfluid energy gap. However, these preceding experimental results are not strong enough to make such an assertion.

When the magnetic field is applied perpendicular to a wall, the time-reversal symmetry is broken and the superfluid ^{3}He-B is turned out to be non-topological state. As a result, it is shown theoretically that a gap corresponds to the Zeeman energy Δ_{Zeeman} opens up in the surface density of states (SDOS) at the Fermi energy. Moreover, Δ_{Zeeman} does not appear under the magnetic field which is applied parallel to the wall, as long as it is below the dipolar field (～3 mT). This anisotropic behavior is regarded as the reflection of the Majorana properties of the SABS.

We got started the measurement of Z on the diffusive limit wall, since it is expected that the large density of state near the Fermi energy of the SABS will make the effect of the magnetic field large. We performed the measurement of Z under various magnetic fields which are applied perpendicular to the wall. The resonant frequency of our measurements was 13.63 and 41.06 MHz and the pressure was 1.01 MPa.

Some characteristic structures which did not appear under zero magnetic field were observed in both components of the impedance. The temperature at which the characteristic structures were observed shifted to lower temperature at higher magnetic field. We calculated the magnetic field dependence of Δ and Δ_H (bulk gap distortion due to the magnetic field) at those temperatures and were able to derive the magnetic field dependence of Δ_{Zeeman}.

Thus, we were able to clarify the existence of Δ_{Zeeman} under magnetic field which is applied perpendicular to the diffusive wall. Though the simple dispersion relation of the quasi-particles in the diffusive limit does not hold, the fact that Δ_{Zeeman} gap opens at the Fermi energy gives strong evidence that ^{3}He-B is unquestionably a topological superfluid.

In order to find out the anisotropy with respect to the direction of the magnetic field which comes from the Majorana properties, we measured Z under the magnetic fields below the dipolar field. Unfortunately, however, any structure in the impedance was observed under the magnetic field of 2 mT. We were not able to check the anisotropy of the SDOS under such a low magnetic field.