Surface Andreev Bound States in Topological Superfluid ^{3}He-B

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Here, we theoretically investigate surface Andreev bound states (SABS) in superfluid ^{3}He-B confined to a slab geometry. It is known that the self-charge-conjugate Majorana property of the SABS gives rise to the Ising anisotropy of spin susceptibility on the surface, which is contrast to isotropic susceptibility in the bulk B-phase. This reflects the assumption that the order parameter manifold of ^{3}He-B is restricted to the subspace. In this talk, we first demonstrate that the SO(3) manifold of the ^{3}He-B order parameter, which describes the relative rotation of spin and orbital, plays a critical role on the various properties associated with the SABS, such as Majorana fermions, the gapless dispersion, topological invariant, and spin susceptibility. In particular, we emphasize that the SABS in the presence of a magnetic field behaves as a massless or massive Majorana fermion. Then, based on the quasiclassical Eilenberger theory which takes account of the dipole interaction and Fermi liquid corrections, we quantitatively discuss thermodynamics and the Majorana property of the SABS in superfluid ^{3}He-B under a magnetic field, where the Majorana property and spin susceptibility is determined by the interplay of the magnetic field and dipole interaction.