Spectral bulk-boundary correspondence and topological criticality in chiral-symmetric superconductors

Shintaro Hoshino
Department of Physics, Saitama University, Japan

Recently, the topological materials are recognized as one of the most important issues in condensed matter physics for their interesting concepts and potentials for application. As for the topological superconductors, the presence of surface Andreev bound state (SABS) in e.g. p/d-wave superconductor and Rashba nanowire-based systems proximately coupled to s-wave superconductor attracts considerable interests, some of which are promising candidates for a platform of the topological quantum computation due to the emergence of Majorana fermions. Recent studies have clarified that the SABS accumulated at the edges is closely related to the presence of the odd-frequency pairs which have odd-function pair amplitude in frequency/time as first proposed by Berezinskii in 1974. However, the roles of odd-frequency pairs in topological superconductors have not yet been studied, and little is known about it.

Taking typical topological superconductors having chiral symmetry which allow us to define the topological winding number, we have developed the two important concepts for odd-frequency pairing. (1) Spectral bulk-boundary correspondence (SBBC): A conventional bulk-boundary correspondence tells us that the topological number in bulk is related to the number of edge states. We extend this concept to the finite frequencies, which connects the generalized winding number in bulk to odd-frequency pair amplitude at the boundary. (2) Topological criticality: The coefficients of odd-frequency pair amplitudes show a power-law divergence at the topological phase transition, indicating a degree of proximity to the topological phase transition. These results have extended the preexisting concepts of topological material and odd-frequency pairs, and will be useful for the further exploration of this issue.

Contact : T. Mizoguchi 溝口知成 Tel:029-853-4535 Email: mizoguchi@rhodia.ph.tsukuba.ac.jp