Abstract

Da-Chuan Lu

We propose that the Fermi surface anomaly of symmetry group G in any dimension is universally classified by G-symmetric interacting fermionic symmetry-protected topological (SPT) phases in $(0+1)$-dimensional spacetime. The argument is based on the perspective that the gapless fermions on the Fermi surface can be viewed as the topological boundary modes of Chern insulators in the phase space (position-momentum space). Given the non-commutative nature of the phase space coordinates, we show that the momentum space dimensions should be counted as negative dimensions for SPT classification purposes. Therefore, the classification of phase-space Chern insulators (or, more generally fermionic SPT phases) always reduces to a $(0+1)$-dimensional problem, which can then be answered by the cobordism approach. We provide concrete examples to demonstrate the validity of our classification scheme, and make connections to the recent development of Fermi surface symmetric mass generation.