Carlo Beenakker
Leiden University

Deconfinement of Majorana vortex modes produces a superconducting Landau level

A spatially oscillating pair potential drives a deconfinement transition of the Majorana bound states in the vortex cores of a Fu-Kane heterostructure (a 3D topological insulator on a superconducting substrate, in a perpendicular magnetic field). In the deconfined phase at zero chemical potential the Majorana fermions form a dispersionless Landau level, protected by chiral symmetry against broadening due to vortex scattering. Unlike a conventional electronic Landau level, the Majorana Landau level has a non-uniform density profile: quantum interference of the electron and hole components creates spatial oscillations with a wave vector set by the Cooper pair momentum that drives the deconfinement transition. The striped pattern also provides a means to measure the chirality of the Majorana fermions.