Topological Matter Conference

Online
June 28-July 1, 2021

Visualization of Topological Boundary Modes Manifesting Topological Nodal-Point Superconductivity d

Nurit Avraham[1]

Abhay Kumar Nayak[1*], Aviram Steinbook[1*], Yotam Roet[1*], Jahyun Koo[1],Gilad Margalit[1], Irena Feldman[2], Avior Almoalem[2], Amit kanigel[2],Gregory A. Fiete[3,4], Binghai Yan[1], Yuval Oreg[1], Nurit Avraham[1†],Haim Beidenkopf[1†]

[1]*Department of Condensed Matter Physics, Weizmann Institute of Science, Rehovot, Israel.*
[2]*Department of Physics, Technion-Israel Institute of Technology, Haifa 32000, Israel.*
[3]*Department of Physics, Northeastern University, Boston, Massachusetts 02115, USA.*
[4]*Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139, USA.*
∗*These authors contributed to this work equally.*
Email:nurit.avraham@weizmann.ac.il

Much work has been carried out in the last few years towards the study of topological superconductors with the aim to induce and manipulate Majorana zero modes. While numerous realizations of 1D topological superconductors have been discovered and studied, a far smaller number of 2D topological superconductors have been proven to exist, with almost no examples for topological superconductivity in naturally occurring layered materials. In my talk I will present scanning tunneling microscopy and spectroscopy measurements showing that the surface 1H termination of the transition metal dichalcogenide compound 4Hb-TaS2, in which 1T-TaS2 and 1H-TaS2 layers are interleaved, has the phenomenology of a topological nodal point superconductor. We find a residual density of states within the superconducting gap. We visualize exponentially decaying bound mode within the superconducting gap along boundaries of the exposed 1H layer, characteristic of a gapless Majorana edge mode. The anisotropic nature of the localization length of the edge mode aims towards topological nodal superconductivity. A zero-bias conductance peak is further imaged within fairly isotropic vortex cores. We show that all these observations are accommodated by a theoretical model of a two-dimensional nodal Weyl-like superconducting state, which ensues from inter-orbital Cooper pairing. I will describe the model and show its correspondence with the experimental data.

.

SKYTOP Skyrmion-Topological insulator and Weyl semimetal technology
THE FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION HORIZON 2020
TOCHA New Generation of Devices to Harness Topology