MAR17-2016-020210

Abstract for an Invited Paper
for the MAR17 Meeting of
the American Physical Society

Design of Majorana Edge States in Topological Superconductors[1]

DIRK MORR, University of Illinois at Chicago

The experimental observation of Majorana bound states in topological superconductors represents a major breakthrough in realizing their applications in quantum computation. Recent proposals focusing on the creation of Majorana states on the edges of 2D magnetic islands have raised the question of whether Majorana states can also emerge in more complex spatial structures of magnetic islands or layers and s-wave superconductors. In this talk, I discuss the design of Majorana edge states in magnetic-superconducting hybrid structures and their stability with regards to the spatial form of the magnetic order and spatial variations in the superconducting order parameter. I show that by investigating the relation between local transport properties as reflected in the spatial flow of charge and global transport properties of topological states [1], one can identify transport characteristics of Majorana states, such as a quantized conductance, that distinguish them from conventional Shiba states [2]. We demonstrate the existence and unconventional spatial structure of superconducting triplet correlations which can be both time reversal (TR) breaking and TR preserving within the same system [2]. While these correlations exists both in the topologically trivial as well as non-trivial phases, low-energy edge modes that carry a supercurrent exist only in the topologically non-trivial phases. Implications for the existence or lack of chiral edge modes in triplet superconductors will be discussed. References: [1] J. Van Dyke and D. K. Morr , Controlling the Flow of Spin and Charge in Nanoscopic Topological Insulators,Phys. Rev. B 93, 081401(R) (2016), Rapid Communication. [2] S. Rachel and D.K.Morr, Design of Majorana Edge States in Topological Superconductors, unpublished.

[1]This project was supported by the U. S. Department of Energy, Office of Science, Basic Energy Sciences, under Award No. DE-FG02-05ER46225