Massachusetts Institute of Technology
Department of Physics

Condensed Matter Theory Seminar

"Evolution of Density of States and Spin Textures of Majorana Bound States"

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Abstract: We examine quasiparticle excitations inside vortex cores in the heterostructure of a three-dimensional (3D) topological insulator (TI) and a s-wave superconductor, a platform for realizing MBSs. Solving the Bogoliubov-de Gennes equation, we reveal that the spatial-energy distribution of local density of states (LDOS) evolves from a V shape to a Y shape corresponding to the absence and presence of MBS inside a vortex when the thickness of TI film increases, in good agreement with a recent STM/STS measurement in the $Bi_2Te_3/NbSe_2$ hetero-structure. We further demonstrate that there is a checkerboard-type pattern in the relative LDOS between the spin-up and -down channels associated with the MBS due to the relation among the orbital and spin angular momenta and the phase winding of superconducting vortex. This, if measured by the spin-resolved STM/STS, identifies the MBS as a single quantum state. I will also discuss briefly on possible helical spin textures of a 1D MBS.

References:
[1] T. Kawakami and X. Hu, Phys. Rev. Lett. vol. 115, 177001 (2015).
[2] T. Kawakami and X. Hu, arXiv:1511.02653.

12:00pm
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