Condensed Matter Theory Center Seminar
Tuesday, April 22 at 1:00 pm
2205 Physics Building

Speaker: Amir Yacoby (Harvard)

Title: Induced Superconductivity in the Quantum Spin Hall Edge

Abstract:

Topological insulators are a newly discovered phase of matter characterized by a gapped bulk surrounded by novel conducting boundary states. Since their theoretical discovery, these materials have encouraged intense efforts to study their properties and capabilities. Among the most striking results of this activity are proposals to engineer a new variety of superconductor at the surfaces of topological insulators. These topological superconductors would be capable of supporting localized Majorana fermions, particles whose braiding properties have been proposed as the basis of a fault-tolerant quantum computer. Despite the clear theoretical motivation, a conclusive realization of topological superconductivity remains an outstanding experimental goal. Here we present measurements of superconductivity induced in two-dimensional HgTe/HgCdTe quantum wells, a material which becomes a quantum spin Hall insulator when the well width exceeds dC = 6:3 nm. In wells that are 7.5 nm wide, we find that supercurrents are confined to the one-dimensional sample edges as the bulk density is depleted. However, when the well width is decreased to 4.5 nm the edge supercurrents cannot be distinguished from those in the bulk. These results provide evidence for superconductivity induced in the helical edges of the quantum spin Hall effect, a

promising step toward the demonstration of one-dimensional topological superconductivity. Our results also provide a direct measurement of the widths of these edge channels, which range from 180 nm to 408 nm.

Host: Kostyantyn Kechedzhi

http://www.physics.umd.edu/cmtc/seminars.html
