Ji Ung Lee
CNSE, SUNY Poly

Abstract:

Topologically protected Majorana zero-modes (fermions) are expected to lead to error-free quantum computers. Topology is a branch of mathematics that at one point had nothing to do with condensed matter physics. Topology deals with invariant properties of objects to deformations. When applied to condensed matter systems, it implies robustness of certain measurement properties to disorder. Its importance was solidified by the awarding of the Nobel Prize in physics in 2016 to three pioneers for providing the topological origin of certain quantum properties. Majorana fermions are quasiparticles in 2D p-wave superconductors that are topologically protected and can lead to qubits with long coherence times.

Here, I will provide an overview of topological quantum computation. I will also describe how semiconductor planar processing can be used to make devices to both prove the existence of Majorana fermions and fabricate scalable topological quantum computers.