Joint
Condensed Matter
Theory Center/JQI
Seminar

Wednesday, March 21, 11:00-12:30pm
2205 Physics Building

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Microsoft Q

"The search for elusive Majorana particles in semiconductor-superconductor structures"

Abstract:
The exploration of topological phases of matter is one of the main challenges in condensed matter physics. Among the exciting recent developments in this direction are the discoveries of the new phases of matter with many intriguing properties such as topological insulators and superconductors. In my talk, I will focus on topological superconductors and discuss how to realize spinless p-wave superconductivity in semiconductor/superconductor heterostructures. I will show that such a non-trivial topological state emerging at the interface supports zero-energy modes that can be occupied by Majorana fermions. These quasi-particles, which are exotic in the sense that they are at the same time their own antiparticles, are effectively fractionalized objects (anyons) obeying non-Abelian statistics. Despite being first predicted by E. Majorana in 1930s, there is still no conclusive evidence of their existence. If found, Majorana fermions would constitute a key building block for the implementation of fault-tolerant topological quantum computation schemes that are inherently decoherence-free. I will conclude by proposing several experiments for detecting Majorana fermions in semiconductor nanowires.

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