Physics Colloquium

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"Search for Non-Abelian Majorana particles as a route to topological quantum computation"

Majorana zero modes are fermion-like excitations that were originally proposed in particle physics by Ettore Majorana and are characterized as being their own anti-particle. In condensed matter systems Majorana zero modes occur as fractionalized excitations with topologically protected degeneracy associated with such excitations. For over a decade the only candidate systems for observing Majorana zero modes were the non-Abelian fractional quantum Hall state and chiral p-wave superconductors. In this tutorial, I will state by explaining the basic ideas of topological quantum computation using Majorana zero modes. This will be followed by a status update on transport experiments on potential Majorana systems. I will then provide a more detailed explanation of braiding, Majorana operators and the associated topological degeneracy. I will end with my outlook on the challenges and future directions.

Jay Sau received a BTech in Electrical engineering from Indian Institute of technology, Kanpur in 2002. Following this Jay moved to Berkeley to pursue a PhD in physics. At UC Berkeley, Jay worked primarily on first principles electronic properties of nanostructures under the supervision of Prof. Marvin Cohen. Jay graduated in 2008 and started a postdoctoral position at University of Maryland in 2009 with Prof. Sankar Das Sarma. At Maryland, Jay focused on predicting superconductor semiconductor structures that could be used to realize Majorana zero modes. Following this, Jay moved to Harvard for a Harvard quantum optics postdoc fellowship in 2011. Jay started his faculty position at University of Maryland in 2013, where he has continued to focus on systems for topological quantum computing together with other aspects of topological systems in Weyl materials, twisted bilayer graphene and ultra-cold atoms.

Thursday, March 31, in LL 316 at 4:25 PM
For Zoom participation, please see information below:
Meeting ID: 972 1274 7894
Passcode: 631869