Spring 2019 Colloquium
LANGE LECTURE
Materials Department

Professor Sergey Frolov
Department of Physics and Astronomy
University of Pittsburgh

Friday, April 5th, 2019
11:00 am, ESB 1001

Status of the Search for Majorana Fermions in Semiconductor Nanowires

Majorana fermions are non-trivial quantum excitations that have remarkable topological properties and can be used to protect quantum information against decoherence. Tunneling spectroscopy measurements on one-dimensional superconducting hybrid materials have revealed signatures of Majorana fermions which are the edge states of a bulk topological superconducting phase. We couple strong spin-orbit semiconductor InSb nanowires to conventional superconductors (NbTiN, Al) to obtain additional signatures of Majorana fermions and to explore the topological phase transition. A potent alternative explanation for many of the recent experimental Majorana reports is that a non-topological Andreev state localizes near the end of a nanowire. We compare Andreev and Majorana modes and investigate ways to clearly distinguish the two phenomena. We explore new materials combinations in the broad superconductor-semiconductor family to find a perfect pair for the realization of topological quantum bits.

Bio

Frolov is an Assistant Professor of Physics at the University of Pittsburgh specializing in the experimental investigation of quantum electronic devices based on novel materials. He received hid PhD from the University of Illinois at Urbana-Champaign and did postdoctoral work at the University of British Columbia and Delft University of Technology. Frolov's work has impacted the fields of semiconductor spintronics and quantum computing. Frolov is a recipient of the AAAS Newcomb-Cleveland Prize, NSF CAREER Award, ONR Young Investigator Program, a Sloan Fellowship, a Cottrell Scholarship, and other prizes.

http://frolovlab.org/

Hosted by Chris Palmstrom.