FLEET
ARC CENTRE OF EXCELLENCE IN FUTURE LOW-ENERGY ELECTRONICS TECHNOLOGIES

FLEET RESEARCH SEMINAR

Quantum Transport in Nanowire-Superconductor Hybrid Systems

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Abstract: Semiconductor nanowire-superconductor hybrid systems provide a promising platform for hosting unpaired Majorana fermions and thus realizing fault-tolerant topological qubits. In this talk, starting from the basic tenets of quantum transport theory, we demonstrate how to adapt the Non-Equilibrium Green's Function (NEGF) formalism to model quantum transport in normal (N)-superconductor (S) junctions.

We analyze Josephson junctions based on semiconductor nanowires and derive the Andreev bound state spectrum and current-phase relations. Literature has recently reported oscillations in the critical supercurrent with an axial magnetic field. Our simulations indicate that this phenomenon arises from the interference of orbital angular momentum modes of the cylindrical nanowire. We also add disorder and study its effect on the critical current oscillations, with an aim to gain a thorough going understanding of the experiments.

About the Speaker: ***Dr Bhaskaran Muralidharan obtained his B.Tech in Engineering Physics from the Indian Institute of technology (IIT) Bombay in 2001, his M. S. and Ph. D in Electrical Engineering from Purdue University, West Lafayette, USA in 2003 and 2008 respectively.***

Between 2008-2012, he was a post-doctoral associate at the Massachusetts Institute of Technology (MIT) and at the Institute for theoretical Physics at the University of Regensburg, Germany.

Since 2012, he has been a faculty in the Department of Electrical Engineering at IIT Bombay, where he is currently an associate professor. He was also the recipient of the APS-IUSSTF professorship award in 2014.

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