

# Quantum Transport models for nanowire hybrid systems

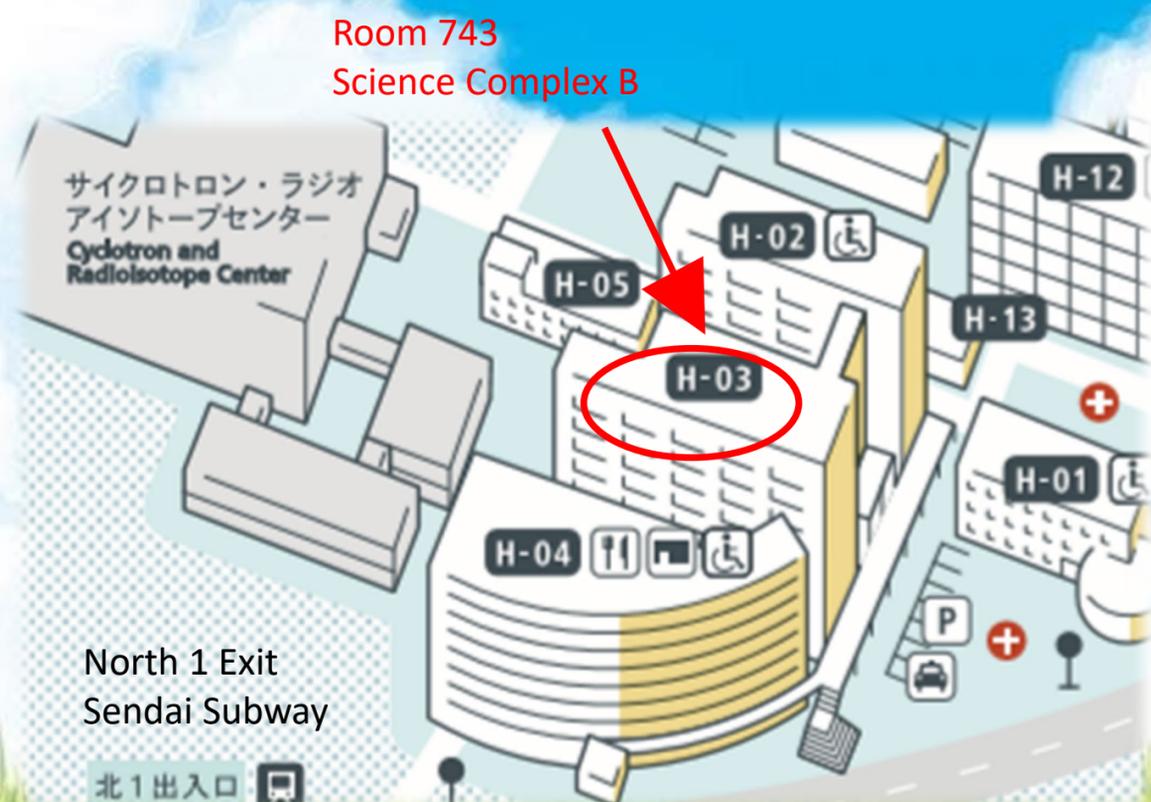
Date: Tuesday, **May 14**, 2019

Time: **4:30** pm - **5:30** pm

Venue: Room **743**, 7<sup>th</sup> Floor, Science Complex B,  
School of Science, Aobayama Campus,  
Tohoku University



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## Quantum Transport models for nanowire 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 study, we employ 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. Recently, [1], and [2] have 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 [3,4] of the cylindrical nanowire. We also add disorder and study its effect on the critical current oscillations, with an aim to gain a thoroughgoing understanding of the experiments.

[1] K. Gharavi et.al., [ArXiv:1405.7455v2](#), (2014).

[2] Zuo, et. al. *Phys. Rev. Lett.* 119, 187704 (2017)

[3] P. Sriram et. al., [ArXiv:1902.10947](#) (2019).

[4] A. Lahiri et.al., *Phys Rev B*, 98, 125417, (2018).

**BIO OF 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.