QuanTalks

IISc Quantum Technology Initiative (IQTI) Seminar Series

Dr. Ruchi Saxena

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Title: Single-photon source: Photon emission by hot electron injection across a lateral PN junction

Abstract: On-demand single photon source requires controlled emission of photons which is a challenging task to achieve. A tunable barrier quantum dot-based single-electron source can be used to control the emission of photons by recombining the exact number of electrons to the hole across the pn junction. To separate a single electron source from the Fermi sea we need to have a hot electron injection into the pn junction. However, the hot electrons lose energy and relax to the Fermi sea by emitting optical phonons before entering the pn junction. In this work, we demonstrate hot-electron transport from a mesoscopic barrier to the pn junction with electrical and optical spectral study. A depletion gate is shown to modulate the confining potential along the quantum Hall edge channel which reduces the optical phonon emission and helps hot electrons to travel up to a few micron distance. We achieve an asymmetric photon emission spectrum caused by hot electrons recombining with a hole into the p-type region.

Wednesday, 6th September 2023 at 4.00 PM (IST)

Biography: **Dr. Ruchi Saxena** joined the Quantum Electrical Metrology group at the National Physical Laboratory, England as a Higher Scientist in February 2022. Her research work primarily focuses on realizing a single and multi-photon source and their detection. In addition, she studies single-electron pump devices at cryogenic temperatures and high magnetic fields to improve their accuracy which can redefine the SI current unit to the quantum current standard. Modeling and experimenting with next-generation devices based on AlGaAs/GaAs heterostructures at low temperatures is also one of my main research work at NPL.

She received her PhD in Theoretical Quantum Condensed Matter Physics in 2018 under the supervision of Professor Sumathi Rao from Harish-Chandra Research Institute, India. During her PhD, she worked on quantum transport in low-dimensional Dirac systems with spin-orbit coupling. She also studied Floquet topological insulators and disorder-driven topological transitions in Dirac systems. Afterward, she joined the Advance Technology Institute, University of Surrey as a Postdoc in August 2018 where she worked with Eran Ginossar on a European project 'High-frequency Topological Insulator Devices for Metrology' (HiTIMe). She, along with her collaborators proposed a quantum dot model based on a topological insulator nanowire and analyzed its potential to realize a topological quantized charge pump for metrological applications.

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