Tata Institute of Fundamental Research
Survey No. 36/P, Gopanpally Village, Serilingampally, Ranga Reddy Dist., Hyderabad - 500107

Seminar

Towards quantum-limited charge amplification using quantum point contacts

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An in-depth understanding of the electrical properties of mesoscopic systems requires direct insight into various quantum phenomena such as electron-electron correlations, dephasing and decoherence, quantum oscillations, single-electron charging, excitation and de-excitation process etc. Conventional electrical transport has limited reach in these studies as it probes only the average behavior of the system whereas, a complete understanding of these phenomena requires temporal and spatial information of individual electrons. Conventional transport also fails miserably when the current levels are in the range of a few fA or lower, a situation common in many mesoscopic devices such as quantum dots. One needs to resort to sensing the individual charges not the current to address these issues. Single charge sensing is also a necessary ingredient in technologies such as quantum electrical metrology and spinqubit readout. In this talk I will review the current art of transport by sensing the charges using quantum point contacts (QPC), an ultra-sensitive mesoscopic charge amplifier. Our recent experiment on coupling the QPC with a superconducting microwave cavity for pushing the sensitivity towards the quantum limit will also be discussed. The results show that we achieve a sensitivity of a few pico-Siemens/$Hz^{1/2}$ and the QPC amplifier offers shot-noise limited electrical amplification, an important step towards quantum limited charge detection.

Friday, Aug 16th 2019

4:00 PM (Tea/Coffee at 3:30 PM)

Auditorium, TIFR-H