

Speaker: Sai Vinjanampathy, Associate Professor, Department of Physics, Indian Institute of Technology Bombay, India

Time and venue: March 27, 2025; 2:30 PM; Physics Seminar Hall HSB-209

Title: Designing Quantum Sensors via Randomness

Abstract:

Sensors, from voltmeters to magnetometers and gyroscopes, play a crucial role in science and technologies. A metric of performance for sensors is the so-called Signal to Noise Ratio (SNR). A sensor is deemed “quantum” if this SNR is larger than $\sqrt{N}$, where N are the number of participating quantum subsystems. This limit of $\text{SNR}=\sqrt{N}$ is called the shot noise limit. Design of such quantum sensors usually requires very complicated unitary operations to prepare good initial states and also involve complicated measurements. It would be much more preferable to design quantum sensors wherein one picks unitary operators more or less “randomly” and beat this aforementioned shot noise limit. We show that there are choices that produce such quantum sensors that are (a) chosen without fine tuning, (b) “easy” to prepare and (c) easy to measure. We furthermore comment on multi-parameter metrology in this context.