

Thursday, September 14, 2023

Refreshments at 3:15pm outside PSF 101
Colloquium from 3:30pm - 4:30pm in PSF 101

Taming Quantum Fluctuations in Nanoscale Systems: Some Ado About Nothing

Professor Kanu Sinha

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Abstract:

Fluctuation-induced phenomena are a fascinating and fundamental feature of quantum electrodynamics (QED), with implications spanning spontaneous emission of atoms, stability of colloidal suspensions such as milk, adhesive properties of gecko feet, stiction in nano- and micro-mechanical machines, and, potentially, density perturbations in the early universe. Quantum fluctuation phenomena also play a significant role in the state-of-the-art nanoscale quantum systems that enhance the efficacy of light-matter interactions by confining light in small regions. Such systems are integral to a myriad of emerging quantum technological applications: from building single-photon devices and storing and transmitting quantum information over long distances, to facilitating precision tests of fundamental physics. Fluctuation phenomena critically limit the ability to trap and control quantum systems at nanoscales from surfaces.

In this talk, I will review quantum fluctuation effects – such as fluctuation-induced forces, decoherence and Brownian motion – and our work on various ways to tailor these phenomena in nanoscale quantum systems.

Biography:

Kanu Sinha is an Assistant Professor at the School of Electrical, Computer and Energy Engineering at Arizona State University. Prior to her appointment at ASU, she was an Associate Research Scholar at the Department of Electrical and Computer Engineering at Princeton University. She earned her Bachelor of Technology degree in Engineering Physics at the Indian Institute of Technology (IIT), New Delhi, followed by her Ph.D. in Physics at University of Maryland (UMD), College Park. She was then a postdoctoral fellow at the Institute of Quantum Optics and Quantum Information (IQOQI) in Innsbruck, Austria and at the US Army Research Laboratory (ARL) in Maryland. Her research is at the intersection of quantum optics, quantum information and open quantum systems – with a focus on fluctuation phenomena, collective atom-field interactions and non-Markovian open quantum systems. While primarily a theorist, she collaborates closely with ongoing experiments with cold atoms coupled to optical nanofibers, solid-state quantum optics, and levitated nanoparticles.

Host: Prof. Cindy Keeler

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