Physics Colloquium

Arghavan Safavi-Naini

“There and back again with trapped-ions”

One of the most important goals of modern quantum sciences is to learn how to control and entangle many-body systems and use them to make powerful and improved quantum devices, materials and technologies. The challenge lies in the complexity of quantum many-body systems and the emergence of entanglement and quantum correlations. In this talk I will introduce a quantum simulator, composed of a 2D crystal of ~100 trapped-ions in a Penning trap which can overcome this challenge by “simulating” the behavior of paradigmatic spin and spin-boson models. Moreover, this simulator gives us the power to travel backwards in time and measure a family of out-of-time-order correlators (OTOCs). These correlators provide a measure for the butterfly effect in quantum systems and allow us to directly probe the dynamics of correlations, coherences, and the scrambling of quantum information. These measurement not only impact quantum information processing and quantum enhanced metrology, but may open a path for future tests of the holographic duality between quantum and gravitational systems.

Arghavan Safavi-Naini *is a postdoctoral researcher at JILA, NIST, CU-Boulder in the group of Ana Maria Rey. Her research focuses on using a broad array of theoretical methods to develop new approaches for controlling and understanding the properties of quantum many-body systems. She received her undergraduate degree in Engineering Science and Physics from the University of Toronto and her PhD from Massachusetts Institute of Technology. During her PhD she developed an ab-initio models for the anomalous heating observed in ion traps, worked on proposals for quantum simulation with exotic few-body interactions, and devised algorithms based on Path Integral Quantum Monte Carlo (QMC) methods, suitable for simulating the equilibrium properties of lattice gases with long-range interactions. During her time at JILA she has continued developing analytical and numerical techniques using QMC, Matrix Product state (MPS) methods, and phase space techniques such as the Truncated Wigner Approximation (TWA). She has used these approaches to guide and benchmark renowned experiments at NIST and JILA featuring trapped-ions, cavity systems, and ultra-cold gases.*

Physics Faculty Position Candidate

Thursday February 15th in LL 316 at 4:10

Refreshments available at 3:45