

*February 13, 2023 – Speaker: Shenglong Xu*

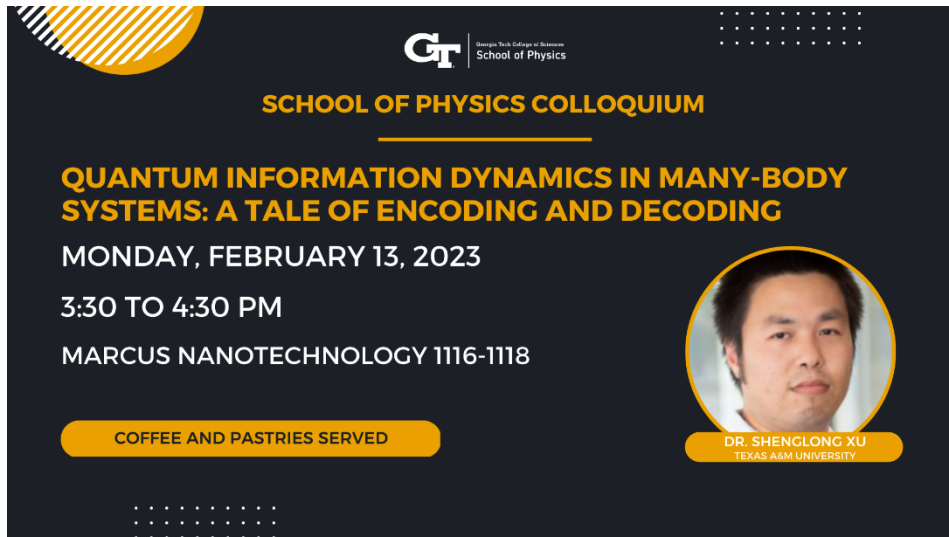
**Time: 3:30-4:30 PM**

**Location: Marcus Nanotechnology 1116-1118**

**Title:** Quantum information dynamics in many-body systems: a tale of encoding and decoding

**Abstract:** Recent advances in NISQ (Noisy Intermediate-Scale Quantum) technology and cross-disciplinary dialogues have significantly expanded the frontiers of out-of-equilibrium quantum many-body systems. In this talk, I will discuss quantum information dynamics, i.e., the fate of a quantum qubit thrown into a many-body system, as a general framework to study this new dynamical regime. I will show that local quantum information in a strongly interacting system spreads to non-local degrees of freedom in a universal manner, similar to the spread of an epidemic, and is encoded in the many-body Hilbert space in late time. This process, dubbed scrambling, has been observed in cold atoms, superconducting circuits, ion traps, and solid-state NMR experiments. The non-local nature of scrambled quantum information makes it more noise-resilient but challenging to decode. I will present our recent progress in decoding and teleporting quantum information in a prototypical many-body model, the 2D quantum XY model, using exact long-range entangled eigenstates and local measurements. Our protocol is ready to be carried out on current NISQ devices and may open new possibilities for quantum information processing.

**Bio:** Shenglong Xu is a research assistant professor at Texas A&M University. He obtained his Ph.D. in 2017 from the University of California, San Diego. Before joining TAMU in 2020, he worked as a postdoc in the condensed matter theory center at the University of Maryland. His current research interests include non-equilibrium phenomena in quantum many-body systems, quantum information and entanglement dynamics, and developing algorithms for classical and quantum



The poster is a dark blue rectangle with yellow and white text. At the top left is a yellow and white striped circular graphic. At the top center is the Georgia Tech logo (GT) with the text "Georgia Tech College of Sciences School of Physics" to its right. At the top right is a grid of white dots. Below the logo is the text "SCHOOL OF PHYSICS COLLOQUIUM" in yellow. Below that is the title "QUANTUM INFORMATION DYNAMICS IN MANY-BODY SYSTEMS: A TALE OF ENCODING AND DECODING" in yellow. Below the title is the date "MONDAY, FEBRUARY 13, 2023" in white, followed by the time "3:30 TO 4:30 PM" in white, and the location "MARCUS NANOTECHNOLOGY 1116-1118" in white. At the bottom left is a yellow button with the text "COFFEE AND PASTRIES SERVED" in white. At the bottom right is a circular portrait of Dr. Shenglong Xu with a yellow border, and below it is a yellow button with the text "DR. SHENGLONG XU" and "TEXAS A&M UNIVERSITY" in white. At the bottom center is a grid of white dots.