



Imaging Exciton Transport and Quantum Interactions with Ultrafast Microscopy

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Wednesday, Feb. 4th @ 2:00 pm in BRK 1001

Coffee and snacks served before seminar

also on [MS Teams](#)

Abstract: At the most fundamental level, transport of energy carriers (such as electrons and excitons) in the solid state is determined by their wavefunctions and the interactions with the lattices and the environment. Wave properties of these particles have profound consequences in their transport. The key difficulties in probing transport in the quantum regime in real materials lie in the fast (picosecond or shorter) dephasing processes and the nanoscale localization lengths. Thus, to image the motion of excitons in their natural (quantum) time and length scales, experimental approaches combining spatial and temporal resolutions are necessary.

To address this challenge, my research group has developed the combined use of optical microscopy and ultrafast spectroscopy tools to image transport of excitons from the nanoscale to the mesoscale and over a wide range of temperatures. In my talk, I will discuss our recent progress on imaging environment-assisted quantum exciton transport in perovskite quantum dot superlattices and quantum phase transition of moiré excitons. These results provide fundamental understandings of how excitons migrate in materials and how these processes can be manipulated quantum mechanically. The unique ability to measure and control coherent pathways are critical for both solar energy and quantum information applications.

Bio: Libai Huang is the Tarpo Professor of Chemistry at Purdue University and Director of the U.S. DOE Energy Frontier Research Center “Quantum Photonics Integrated Design Center (QuPIDC),” where her group develops ultrafast microscopy and spectroscopy to visualize quantum transport and many-body phenomena, spanning exciton dynamics, superradiance, and strong light–matter interactions—in 2D materials, perovskite nanocrystal assemblies, and molecular emitters. She serves as an Executive Editor of The Journal of Physical Chemistry. Before joining Purdue, Huang was a Postdoctoral Fellow at Argonne National Laboratory; she earned her Ph.D. in Chemistry from the University of Rochester and B.S. from Peking University.