



Photons for many body physics: a platform and probe

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Refreshments : 10.00 am - 10.15 am

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Zoom Link: <https://purdue-edu.zoom.us/j/94212877783>

Abstract:

In this talk, I will discuss the applications of cavity electrodynamics for controlling many-body electron systems. The focus will be on achieving strong coupling between cavities and collective excitations of interacting electrons at Terahertz and IR frequencies. As a specific example I will consider a cavity platform based on a two-dimensional electronic material encapsulated by a planar cavity consisting of ultrathin polar van der Waals crystals. I will also discuss how metallic mirrors sandwiching a paraelectric material can modify the transition into the ferroelectric state. Finally, I will review a general question of theoretically describing ultrastrong coupling waveguide QED. I will present a novel approach to this problem based on a non-perturbative unitary transformation that entangles photons and matter excitations. In this new frame of reference, the factorization between light and matter becomes exact for infinite interaction strength and an accurate effective model can be derived for all interaction strengths.

Biography:

Eugene Demler received PhD in theoretical physics at Stanford University in 1998. He was a Junior Fellow in the Harvard Society of Fellows, became an assistant professor at Harvard in 2001 and a full professor there in 2005. In the Fall of 2021, he moved to ETH Zurich, Switzerland, as a full professor. Demler was a recipient of the 2006 Johannes Gutenberg lecture award from the University of Mainz. In 2015, he received a Humboldt Research Award and became a Distinguished Scholar at the Max Planck Institute for Quantum Optics in Munich, Germany. In 2021 he received Hamburg Prize in the Theoretical Physics. His research focuses on understanding strongly correlated quantum systems, from electrons in solids to dilute atomic gases to photons. His work has had a profound impact on diverse areas, such as magnetism and superconductivity, many-body physics with ultracold atoms in optical lattices, nonlinear quantum optics, understanding light induced states of matter, developing real world applications of NISQ devices.