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MAX PLANCK LECTURE ON NON-EQUILIBRIUM QUANTUM PHENOMENA

Strongly correlated excitonic insulator in Coulomb-coupled bilayers

Excitonic insulators (EIs) arise from the formation of bound electron-hole pairs (excitons) in semiconductors and provide a solid-state platform for quantum many-boson physics. Strong exciton-exciton repulsion is expected to stabilize condensed superfluid and crystalline phases by suppressing both density and phase fluctuations. Although spectroscopic signatures of EIs have been reported, conclusive evidence for strongly correlated EI states has remained elusive.

In this talk, I will discuss the realization of strongly correlated EIs in Coulomb-coupled bilayers of 2D semiconductors. In particular, I will present direct thermodynamic evidence of the EI ground state and discuss the exciton phase diagram that reveals both the Mott transition and interaction-enhanced quasi-condensation. If time permits, I will also discuss the realization of a strongly correlated EI in a moiré lattice, effectively realizing the Bose-Hubbard model in a solid-state platform.

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Hosts:
Andrea Cavalleri,
Angel Rubio

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3 pm
Zoom Lecture*

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https://www.mpsd.mpg.de/neqp-lecture#mak