Max-Planck-Institut für Struktur und Dynamik der Materie

Max Planck Institute for the Structure and Dynamics of Matter

Friday, September 7th , 2018 – 11:00 a.m.
CFEL Seminar room IV (Bldg. 99, 1st Floor)

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Exciton-polarons and polaritons in two dimensional systems

Cavity-polaritons have emerged as an exciting platform for studying interacting bosons in a driven-dissipative setting. Typically, the experimental realization of exciton-polaritons is based on undoped GaAs quantum wells (QW) embedded in between two monolithic distributed Bragg reflector (DBR) layers. Introduction of a degenerate electron gas either to the QW hosting the excitons or a neighboring layer substantially enriches the physics due to polariton-electron coupling. It has been proposed that such an interacting Bose-Fermi mixture can be used to study polariton-mediated superconductivity in a two dimensional electron gas.

Transition metal dichalcogenide (TMD) monolayers, such as molybdenum diselenide (MoSe2), represent a new class of valley semiconductors exhibiting novel features such as strong Coulomb interactions, finite exciton Berry curvature with novel optical signatures and locking of spin and valley degrees of freedom due to large spin-orbit coupling. In contrast to quantum wells or two-dimensional electron systems in III-V semiconductors, TMD monolayers exhibit an ultra-large exciton binding energy of order 500 meV and strong trion peaks in photoluminescence that are red-shifted from the exciton line by 30 meV.

In this talk, I will present an overview of elementary optical excitations of TMD monolayers and the modification of the optical spectra under magnetic fields. I will then describe cavity spectroscopy of gate-tunable monolayer MoSe2 exhibiting strongly bound exciton-polaron

resonances, as well as non-perturbative coupling to a single microcavity. Our findings constitute a first step in investigation of a new class of degenerate Bose-Fermi mixtures consisting of polaritons and electrons.

Host: Angel Rubio and Andrea Cavalleri

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