NEW YORK CITY COLLEGE OF TECHNOLOGY
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Excitons in atomically thin two-dimensional materials

Presented by:

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Thursday, March 26 at 12:00 PM
Namm, Room 823

Abstract

Since the discovery of graphene, a single sheet of carbon atoms, research focused on two-dimensional (2D) materials evolved rapidly due the availability of atomically thin, thermally stable, high-quality crystals with intriguing physical properties. The 2D materials naturally inherit major traits associated with systems of reduced dimensionality: strongly enhanced Coulomb interactions, efficient light-matter coupling, and sensitivity to the environment. In particular, the considerable strength of the Coulomb coupling between the charge carriers introduces a rich variety of many-body phenomena. In the class of 2D semiconductors, e.g., this leads to the emergence of strongly bound electron-hole quasi-particles, such as excitons, trions, and biexcitons, with unusually high binding energies and efficient light absorption.

In this talk, I will present a study of the excitonic properties of 2D semiconductors, as exemplified in recent works on atomically thin transition metal dichalcogenides. The observation of exciton binding energies on the order of 0.5 eV and the marked deviation of the exciton Rydberg series from the hydrogenic model will be discussed. The results reflect both strong carrier confinement and the distinctive nature of dielectric screening in atomically thin materials. I will further describe how non-equilibrium conditions such as strong photo-excitation can profoundly alter the many-body interactions in these systems.

Light refreshments will be served.