THE CHINESE UNIVERSITY OF HONG KONG

Department of Physics

SEMINAR

Towards Exciton Optomechanics in Suspended 2D Semiconductors

by

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Time: 10:00 - 11:00 a.m
Join ZOOM Meeting: https://bit.ly/3wVtQN5

ALL INTERESTED ARE WELCOME
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Abstract

Excitons, made of electron-hole pairs bound by Coulomb interaction, provide compelling opportunities for applications in optoelectronics, information storage, non-volatile logic. However, the small binding energy of exciton in conventional semiconductors jeopardizes its integration and potentials in modern optoelectronics schemes. In the past decade, a new type of two-dimensional semiconductors, mainly transition metal dichalcogenides (TMDs), attract tremendous interests with much larger exciton binding energy. Thus, stable excitonic effects up to room temperature can give rise to extremely strong light-matter interaction. Together with their ultra-lightweight and other emerging properties, such strong excitonic interaction in 2D TMD opens up the possibility to optically control properties of monolayer semiconductors over the suspended structure. In this talk, I will first review this new type of 2D semiconductors and interesting device physics by employing the structure of nanoelectromechanical systems (NEMS). Then I'll present our study of exciton-induced nonlinearities in suspended TMD monolayers, where we achieved a robust optical bistability near the exciton resonance. Our results also demonstrate a helicity-dependent optical switching that enables control of light not only by light intensity but also by its polarization using monolayer materials [1]. Additionally, I will discuss our recent results on dynamically manipulating the mechanical motion of a suspended 2D semiconductor through its exciton resonance, without an optical cavity structure [2]. Finally, I will discuss future opportunities in emergent moiré physics and their possible detection and modulation using NEMS platform.

References
[1] H. Xie et al., Nano Letters 18,3213-3220 (2018).
[2] H. Xie et al., Nano Letters 21,2538-2543 (2021).

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