NEW YORK CITY COLLEGE OF TECHNOLOGY
Physics Department
Center for Theoretical Physics

Probing Excitons and Exciton Complexes in Ultrathin Transition Metal Dichalcogenides

Presented by:

Dr. Mark S. Hybertsen

Brookhaven National Laboratory, NY

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Abstract

Due to the discovery of a direct band gap and strong absorption in ultrathin (one chemical unit) transition metal dichalcogenides (TMDCs) such as MoS2, these materials play a central role in the race to identify new phenomena and engineer the characteristics of two-dimensional (2D) materials derived from van der Waals materials, by themselves and in new combinations of heterostructures. One of the novel physical characteristics of the 2D-TMDCs is the substantial deviation in the screened Coulomb interaction from the conventional, long-wavelength form of 1/e0r. Furthermore, the interaction strength is tunable and it can be substantially stronger than found in traditional semiconductor heterostructures, e.g., GaAs-based quantum well structures. In this presentation, I will describe some of the consequences for the low energy electron-hole excitations in TMDCs and complexes formed from them. Topics will include the non-hydrogenic form of the exciton spectrum and the formation of charged exciton complexes (trions) and biexciton complexes [1-4].

[1] T. C. Berkelbach, M. S. Hybertsen, and D. R. Reichman, Phys. Rev. B 88, 045318 (2013).
[2] A. Chernikov, et al, Phys. Rev. Lett. 113, 076802 (2014).
[3] Y. You, et al., Nat. Phys. 11, 477 (2015).
[4] M. Z. Mayers, et al., ArXiv:1508.01224v2, 2015.

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