APS March Meeting 2019

View Abstract

CONTROL ID: 3086759

TITLE: Tunable Optical Absorption by Excitons in Xenes via an External Electric Field

Abstract Body: We study the binding energies and optical properties of direct and indirect excitons in monolayers and double-layer heterostructures of Xenes: silicene, germanene, and stanene. The exciton eigenenergies, optical transition energy, oscillator strength, and absorption coefficient are calculated [1]. An external electric field tunes the eigenenergies and optical properties of excitons by changing the effective mass of charge carriers. The Schrödinger equation with field-dependent exciton reduced mass is solved by using the Rytova-Keldysh (RK) potential for direct excitons, while both the RK and Coulomb potentials are used for indirect excitons. For indirect excitons, we show that the choice of interaction potential can cause significant changes in the eigenenergies. Finally, our results show that the choice of material parameters has a significant effect on the binding energies and optical properties of direct and indirect excitons. These calculations contribute to the rapidly growing body of research regarding the excitonic and optical properties of this new class of two-dimensional semiconductors.

[1] M. N. Brunetti, O. L. Berman, and R. Ya. Kezerashvili, *Phys. Rev. B* **98**, 125406 (2018).

Funding Acknowledgement: This work is supported by U.S. Department of Defense under Grant No. W911NF1810433

PRESENTATION TYPE: Oral

UNIT: 12.0 COMPLEX STRUCTURED MATERIALS, INCLUDING GRAPHENE (DCMP)

SORTING CATEGORY: 12.09.00 2D materials: Transport and Optical Phenomena

Category Type: Theoretical

AUTHORS (FIRST NAME, LAST NAME): Matthew Brunetti[1], Oleg Berman[2], Roman Kezerashvili[2]

INSTITUTIONS (ALL): 1. CUNY Graduate Center, ,
2. Physics, CUNY - City Tech, null,

Teams: (none)