

APS March Meeting 2019

View Abstract

CONTROL ID: 3096655**TITLE:** Are freestanding Xene monolayers excitonic insulators in their ground state?

Abstract Body: We present evidence that monolayers of Xenes (silicene, germanene and stanene) suspended in vacuum behave as excitonic insulators in their ground state, by drawing upon well-established *ab initio* and theoretical models of the electronic structure of these materials. By solving the Schrödinger equation for electrons and holes interacting via the Rytova-Keldysh potential, it is shown that the direct exciton binding energy exceeds the band gap when the external electric field is small or zero [1]. We propose a phase transition in freestanding monolayer Xenes from the semiconducting phase to the excitonic insulating (EI) phase can be induced by reducing an external electric field below some critical value which is unique to each material. Our calculations show the coexistence of the semiconducting phase of *A* excitons with the EI phase of *B* excitons for a particular range of electric field. Enhanced dielectric screening in supported or encapsulated monolayer Xenes precludes the existence of the EI phase in those scenarios.

[1] M. N. Brunetti, O. L. Berman, and R. Ya. Kezerashvili, *arxiv:1809.04155* (2018).

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PRESENTATION TYPE: Poster**UNIT:** 12.0 COMPLEX STRUCTURED MATERIALS, INCLUDING GRAPHENE (DCMP)**SORTING CATEGORY:** 12.08.00 2D Materials: Electronic Structure and Interactions**Category Type:** Theoretical**AUTHORS (FIRST NAME, LAST NAME):** Matthew Brunetti¹, Oleg Berman², Roman Kezerashvili²

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