Novel Electronic and Optical Phenomena in Atomically Thin Quasi-2D Materials

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Abstract
Experimental and theoretical studies of atomically thin quasi two-dimensional (2D) materials and their nanostructures have revealed that these systems can exhibit highly unusual behaviors. Owing to their reduced dimensionality, quasi-2D materials present opportunities for manifestation of concepts/phenomena that may not be so prominent or have not been seen in bulk materials. Symmetry, many-body interaction, and substrate screening effects often play a critical role in shaping qualitatively and quantitatively their electronic, transport and optical properties, and thus their potential for applications. In this talk, we present theoretical studies on quasi-2D systems such as monolayer and few-layer transition metal dichalcogenides and metal monochalcogenides, as well as other 2D crystals going beyond graphene. Several phenomena are discussed, including novel exciton behaviors, tunable electrical transport and magnetic properties, and the important influence of substrate screening. We investigate their physical origins and compare theoretical predictions with experimental data.

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