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

Black phosphorus and phosphorene: from 3D to 2D and back

Presented by:

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Abstract

Phosphorene, a two-dimensional (2D) form of elemental phosphorus, has attracted considerable interest in recent years. This interest is due, in large part, to predictions and observations of high mobility (several thousand cm^2/Vs), a highly tunable band gap, anisotropic optoelectronic properties, and strong light-matter interactions. This talk provides an introduction to phosphorene and our experiments to explore these and related properties. To this end, we have developed a synthetic approach for production of phosphorene at a 10-gram scale. With significant quantities of phosphorene now available, we have measured the band gap as a function of flake thickness, finding that the band gap ranges from 0.33 eV in bulk to 2.1 eV in monolayers, a range that is larger than any other 2D material. We also describe our efforts to employ phosphorene in a variety of solar-energy harvesting systems, including in solar-to-chemical and solar-to-electric energy conversion. Perhaps most interesting, we show how phosphorene can be re-assembled into 3D structures that are electrically conductive but still remain quantum confined, therefore providing access to 3D materials with widely tunable optoelectronic properties.

Light refreshments will be served.