Seminarankündigung

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"Van der Waals semiconductors: From unconventional heterostructures to twisted nanostructures"

Two-dimensional crystals have attracted broad interest due to novel properties that arise in atomically thin materials. As interesting scientifically and important technologically but much less explored are layered van der Waals crystals that, assembled from 2D building blocks, lie between a monolayer and the bulk. In this regime, phenomena such as spontaneous phase separation, transformations between different crystal polymorphs, hybrid dimensionality, and introduction of defects provide unprecedented opportunities for controlling morphology, interface formation, and novel degrees of freedom such as layer stacking and interlayer twist. But going beyond a single layer also poses significant challenges, both due to the diversity and complexity of the possible few-layer structures and the difficulty of probing functionality such as optoelectronics and photonics at the relevant (nanometer) length scales.

Here, we discuss recent research that addresses these challenges by combining in-situ microscopy of growth and processing with advanced materials characterization and spectroscopy of light-matter interactions at the ultimate resolution limit. We focus on group IVA chalcogenides, an emerging class of layered semiconductors with multiple stable polymorphs that show promise for energy conversion, optoelectronics, and information processing. Our results highlight the rich sets of materials architectures and functionalities that can be realized in van der Waals crystals, heterostructures, and nanostructures beyond the 2D limit.

Prof. Peter Sutter
Department of Electrical & Computer Engineering
Prof. Eli Sutter
Dapartment of Mechanical & Materials Engineering
University of Nebraska-Lincoln
USA