Spring 2019 Joint Colloquium
Materials Department & Materials Research Laboratory

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University of Illinois at Urbana-Champaign

Friday, May 17th, 2019
11:00 am, ESB 1001

Van der Waals Dislocations in 2D Materials

Moiré patterns are commonly observed in layered systems of 2D materials such as graphene, h-BN, MoS_2, etc, or when 2D materials are grown on crystalline metal substrates. To understand moiré patterns, we introduce the concept of interlayer or van der Waals (vdW) dislocations, and show that arrays of these defects constitute the moiré patterns associated with regions of commensurability and incommensurability between the layers. We note that moiré patterns and the defects appearing therein are electronic structure objects formed by weak interactions between the layers, locked into place by strong in-plane interactions in the constituent layers. We explain the variety of experimentally observed moiré phenomena, including the distinct moiré patterns formed by various combinations of 2D materials on the same metal support layers, as well as point and line defects in moiré patterns. We then discuss the connection between vdW dislocations and several microstructural observations in 2D materials synthesis, including the distribution of angles and the formation of grain boundaries in polycrystalline 2D material layers.

Bio

Harley T. Johnson is a Professor in the Department of Mechanical Science and Engineering and a Faculty Fellow in the Office of the Vice Chancellor for Research at the University of Illinois at Urbana-Champaign. He has research interests in the mechanics and physics of electronic and optical materials. He holds graduate degrees from Brown University, and an undergraduate degree from Georgia Tech. He is a fellow of ASME, a past recipient of an NSF CAREER Award, and he has received the ASME Thomas J. R. Hughes Young Investigator Award for Special Achievement in Applied Mechanics. In 2014-2015 he was a Fulbright U.S. Scholar in France and an Invited Professor at Université Joseph Fourier in Grenoble.

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Hosted by Matt Begley and Tresa Pollock.