WWU MÜNSTER

Aktuelle Fragen der Nanophysik

Montag, 07.03.2022 um 15:15 Uhr
Online Seminar

Semiconductors and Metals at the Atomic Limit


© Joshua A. Robinson

Prof. Dr. Joshua A. Robinson

The Pennsylvania State University, USA
Materials Science and Engineering
Center for 2D and Layered Materials
NSF 2D Crystal Consortium
NSF Center for Atomically Thin Multifunctional Coatings

The last decade has seen an exponential growth in the science and technology of two-dimensional materials. Beyond graphene, there is a huge variety of layered materials that range in properties from insulating to superconducting that can be grown over large scales for a variety of electronic devices and quantum technologies, such as topological quantum computing, quantum sensing, and neuromorphic computing. In this talk, I will discuss recent breakthroughs in two-dimensional atomic layer synthesis and properties, including understanding how substrate and layer thickness impacts doping of 2D materials to tune them from n- to p-type. Subsequently, I will discuss recent breakthroughs in the realization of unique 2D forms of traditional 3D metals. I will introduce a novel synthesis method, dubbed confinement heteroepitaxy (CHet), that utilizes graphene to enable the creation of atomically thin metals, enabling a new platform for creating artificial quantum lattices with atomically sharp interfaces and designed properties. By shrinking these traditional metals to atomically thin structures, we find that their properties are completely different than their bulk counterparts, lending themselves to unique quantum and optical applications not possible before.

Biosketch

Dr. Robinson obtained his B.S. degree in Physics with minors in Chemistry and Mathematics from Towson University in 2001. He received his doctorate degree from The Pennsylvania State University in Materials Science and Engineering in 2005, and was a National Research Council Post-doctoral Fellow at the Naval Research Lab 2005-2007. In 2012, he joined the Penn State Materials Science and Engineering Department as an Assistant Professor. In 2013, he co-founded the Center for Two-Dimensional and Layered Materials, and currently serves as Associate Director of the Center. In July 2015, he became Co-Director of the NSF I/UCRC Center for Atomically Thin Multifunctional Coatings (ATOMIC), and in 2016, he became the Director of User Programs for the NSF-funded 2D Crystal Consortium. He has authored or co-authored over 200 peer reviewed journal publications, and is the recipient of more than a dozen awards and honors, including the NSF CAREER (2015) and most recently the Penn State Faculty Scholar Medal for Engineering (2021).