Two-Dimensional Polar Metals and Heterostructures

IRG 1 of the Center of Nanoscale Science at Penn State, a MRSEC of the National Science Foundation
Cui-Zu Chang, Vincent Crespi, Susan Fullerton-Shirey, Noel (Chris) Giebink, Danielle Hickey, Shengxi Huang, Ken Knappenberger, Chao-Xing Liu, Slava Rotkin, Nitin Samarth, Mauricio Terrones, Jun Zhu (jzhu@phys.psu.edu) and Joshua A. Robinson (jrobinson@psu.edu)
Departments of Physics, Chemistry, Materials Science and Engineering, Electrical Engineering, Chemical Engineering and Biomedical Engineering

Abstract:

The Interdisciplinary Research Group 1 of the Penn State MRSEC consists of 13 faculty and students and postdocs from 5 departments. We aim to discover new fundamental science and the potential applications of atomically thin polar metal films and their heterostructures combining a wide range of synthesis, characterization, property measurement and modeling tools. Our team explores novel quantum phenomena arising from broken inversion symmetry, extreme quantum confinement, strong light-matter coupling and the physics of surface and interface in atomically thin 2D metals, alloys, nanostructures and heterostructures. Current main thrusts include the synthesis and characterization of few-layer Ag, Pb, Bi, and their alloys, unconventional superconductivity in topological insulator/superconductor epitaxial heterostructures, metal-based spintronics, non-linear optics and the engineering and harnessing of strong light-matter interaction including higher harmonics generation and surface-enhanced Raman sensing.