

Two-Dimensional Polar Metals and Heterostructures

IRG 1 of the Center of Nanoscale Science at Penn State, a MRSEC of the National Science Foundation
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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.