WWU MÜNSTER

FACHBEREICH PHYSIK

Allgemeines Physikalisches Kolloquium

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Creating and Exploring Novel Atomically-Thin Materials and Heterostructures

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. Furthermore, heterogeneous stacking of 2D materials also allows for additional “dimensionality” for band structure engineering. In this talk, I will discuss recent understandings on the importance of 2D layer-count on doping efficacy and activation, development of atomic layer deposited boron nitride, and creating 2D allotropes from traditionally 3D materials for photonic and quantum applications. Our recent works demonstrate that confinement heteroepitaxy (CHet), where elements can be intercalated between graphene and silicon carbide, is an effective way to realize 2D allotropes of traditional 3D materials (e.g. 2D Ag, Ga_2O_3, Pb, etc.). The quantum confinement effects include metal-to-semiconducting behavior (2D-Ag), enhancement in superconducting transition tempatures (2D-Ga), and symmetry breaking that leads to enormous non-linear susceptibility.