

"Quantum decorating: Imaging novel electronic states in defect-engineered 2D materials" by Christopher Gutierrez (UCLA)

Primary tabs

Date: Thursday, November 21, 2019 - 4:00pm to 5:00pm

Series: Physics and Astronomy Colloquium

Thursdays, 4:00-5:00 pm

1-434 Physics and Astronomy (map)

Reception from 3:45-4:00 p.m.

(unless otherwise posted)

Guest Speaker: Christopher Gutierrez (University of California, Los Angeles)

Talk Title: "Quantum decorating: Imaging novel electronic states in defect-engineered 2D materials"

Abstract: Two-dimensional (2D) quantum materials have attracted much excitement due to the many interesting physical properties that emerge when they are thinned down to single atomic layers. Graphene, for instance, is a single layer of the ordinary graphite found in your pencil lead, yet its electrons behave like relativistic massless Dirac fermions. This has allowed graphene to act as a tabletop testbed for exploring novel forms of symmetry breaking and for verifying longstanding theoretical predictions in relativistic quantum mechanics.

Importantly, owing to its exposed surface, graphene's electronic properties can be precisely tailored by the presence of atomic defects. In this talk I will present atomic scanning probe and photoemission spectroscopy experiments that highlight how the spatial arrangement of such defects can be harnessed to create novel electronic states in graphene. In the first part, I will show how different types of atomic scatterers peppered above (or below) graphene can self-assemble and drive the formation of new and topologically distinct collective density wave phases in graphene. In the second part, I will show that when substrate defects instead form large, amorphous clusters, they can create local potentials that can trap graphene's quasi-relativistic electrons into quantized atomic-like orbitals, opening the door to studying 2D analogs of large, relativistic "Dirac atoms."

For more information, contact Yaroslav Tserkovnyak

We thank the following people for their contributions to the wine fund for the post-colloquium reception:

Professors Katsushi Arisaka, Andrea Ghez, Karoly Holczer, Huan Huang, HongWen Jiang, Per Kraus, Alexander Kusenko, Matthew Malkan, Mayank Mehta, Warren Mori, Ni Ni, Seth Putterman, Yaroslav Tserkovnyak, Vladimir Vassiliev, Shenshen Wang, and Nathan Whitehorn.

Location:

1-434 PAB