New Mexico Tech
Department of Physics

COLLOQUIUM

Thursday, Feb. 20, 2025
4pm Workman 101

Speaker: Nikolai Kalugin
Affiliation: New Mexico Tech

Quantum materials, topology, and new electronic phases: the example of light-induced Floquet effects in graphene

The rise of quantum materials is one of the most observable current trends in physics and materials science. During last several years, discoveries of topological phases of matter gave rise to understanding of possibilities to create entirely new phases of quantum matter when it is driven away from equilibrium.

In our current studies, we explore the possibilities of generation of Floquet-Bloch states by driving topologically trivial two-dimensional materials away from equilibrium with steady-state illumination, thereby modifying electron band structure and inducing topological states "on demand". Recently, we reported on the experimental observation of Floquet signatures in photoinduced longitudinal and transverse response in graphene Hall bars irradiated with high-power linearly and circularly-polarized mid- infrared radiation at cryogenic temperatures. Our results provide the way to lift substantial experimental restrictions, helping to unlock potential applications for light-induced manipulation of material properties.

We acknowledge support from NSF (projects DMR CMP #2104755, DMR CMP #2104770, OSI #2329006). The National High Magnetic Field Laboratory, where we conducted some of our experiments, is supported by the National Science Foundation through NSF/ DMR-2128556 and the State of Florida.