CSU PHYSICS COLLOQUIUM

"Flatland quantum simulation and visualization with atomic resolution "

Yulia Maximenko

National Institute of Standards and Technology

Monday, February 13th at 4:00 PM

120 Engineering (Hammond Auditorium)

Abstract

Quantum computing and simulation promise to revolutionize fundamental physics, technology, and quantum chemistry. Simulating quantum systems using analog platforms was first proposed in the 1980s, but recent technological advances have brought this idea to new heights. Trapped atoms and ions, superconducting circuits, and advanced solid-state platforms have achieved an unprecedented level of quantum control and are able to model increasingly complex Hamiltonians. Quantum simulation in 2D solid platforms has proved to be incredibly versatile, while also being compatible with the existing semiconductor technology. In this colloquium, I will showcase the exciting recent developments in the field of 2D quantum simulators, highlighting twisted moiré systems and atomic manipulation. Scanning tunneling microscopy (STM) has proved crucial for the progress of this field. My focus will be on revealing the topological and strongly correlated physics in twisted layered graphene and on the surprising insights gained through the use of STM. Through high-resolution magnetic field scanning tunneling spectroscopy, we have demonstrated the importance of the fine details of quantum geometry in these novel 2D platforms. Specifically, I will report on the discovery of the emergent anomalously large orbital magnetic susceptibility in twisted double bilayer graphene.

Biography

Dr. Yulia Maximenko is a postdoctoral fellow at the National Institute of Standards and Technology and the University of Maryland. She studies topological and strongly correlated phases in novel twisted and layered quantum materials using state-of-the-art ultrahigh vacuum instruments, which include multiple measurement capabilities, such as ultralow-temperature scanning tunneling and atomic force microscopy, high magnetic field studies, and magnetotransport. In her PhD at the University of IL at Urbana-Champaign, she studied thin films of topological insulators and nanofabricated superconducting/topological heterostructures, using low-temperature scanning tunneling microscopy.