CSU PHYSICS COLLOQUIUM

"New twists in two-dimensional systems due to (quasi) periodicities in space and time"

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Monday, Oct. 19th at 4:00pm

Virtual via Zoom (see announcement for link)

Abstract

Thanks to the discrete translation symmetry in crystalline solids, we are able to understand their macroscopic properties from basic principles of quantum mechanics through the Bloch theorem. When such a symmetry is absent in a materials system, it quickly becomes intractable to explain or predict its physical behavior based on first principles, but interesting new phenomena may also arise. A prominent example is the recent discovery of superconductivity in twisted bilayer graphene. In this talk I will introduce some controllable ways to approach non-periodic quantum mechanical systems, and then talk about their applications in some recent works done by people at CSU. By considering the effect of periodic magnetic fields in general two-dimensional electronic systems, we have found a robust way to realize topological flat bands with arbitrary rotation symmetry, which has several unique advantages over the moire structures formed by stacking 2D materials. By further extending the idea of emergent periodicity to the time domain, we have found a surprising presence of Landau levels without magnetic fields in two-dimensional electronic systems interacting with light.