

Chez Pierre

Presents ...

Monday, November 17, 2025

12:00 pm -1:00 pm

Duboc Room – 4-331



Chez Pierre Seminar

Victor Galitski, University of Maryland

"Interaction-Induced Flat Bands and Index Theorems"

This talk will review the appearance of flat bands through the mathematical lens of index theorems. It will be shown that the flatness of a band is equivalent to removing the time dimension, which in two spatial dimensions leads to a quantization condition related to the chiral anomaly [1]. In particular, the moire problem can be reformulated in terms of a Dirac electron in a fictitious magnetic field whose flux needs to be quantized for flat bands to exist. A non-Abelian version of this criterion will be discussed [2] with some simple examples [3]. Finally, I'll show that the flat band condition can appear spontaneously through the formation of periodic electronic moire textures in contrast to externally imposed moire potentials [1]. I'll argue that certain models of heavy fermions naturally lead to energetically favorable interaction induced localization, which provides a new mechanism of symmetry breaking.

References:

- [1] A. Parhizkar and V. Galitski, "Localizing Transitions via Interaction-Induced Flat Bands," *Phys. Rev. Lett.* 133, 166502 (2024)
- [2] V. Iugov and N. Nekrasov, "Yang-Mills flows for multilayered graphene," <https://arxiv.org/abs/2504.19097>
- [3] A. Parhizkar and V. Galitski, "Zero Flux Localization: Magic Revealed," <https://arxiv.org/abs/2409.05942>