



Canadian Association
of Physicists

Association canadienne
des physiciens et physiciennes

Contribution ID: 206 Type: **Oral not-in-competition (Graduate Student) / Orale non-compétitive (Étudiant(e) du 2e ou 3e cycle)**

Identifying and Isolating Flat Bands in 2D Systems

Wednesday, June 9, 2021 1:10 PM (3 minutes)

Flat band systems are becoming popular due to special properties. For instance, the strong correlation of electrons leads to realization of unconventional superconductivity [1]. Typically, such bands are only approximately flat and are engineered by fine tuning Vanderwaal's structures. Here we consider Kagome and Lieb lattices with perfectly flat bands. However, at some points in the Brillouin zone the bands superimpose leading to degeneracies. It has been shown that the degeneracy can be lifted when time-reversal symmetry (TRS) is broken [2]. In this presentation, we explore further means to lift the degeneracy while preserving the flat band. We show that the flatness is robust under certain changes to the lattice and that breaking TRS is not sufficient to isolate the flat band. Instead, we show that modulating the flux based on Chern-Simons field as outlined in [3] successfully gaps out the band.

[1] Cao, Y. et al. (2018). Unconventional superconductivity in magic-angle graphene superlattices. *Nature*, 556(7699), 43-50

[2] Green, D., Santos, L., & Chamon, C. (2010). Isolated flat bands and spin-1 conical bands in two-dimensional lattices. *Physical Review B*, 82(7).

[3] Maiti, S., & Sedrakyan, T. (2019). Fermionization of bosons in a flat band. *Physical Review B*, 99(17).

Authors: BAE, Jun Hyung (Concordia University); MAITI, Saurabh (Concordia University); Dr SEDRAKYAN, Tigran (University of Massachusetts Amherst)

Presenter: BAE, Jun Hyung (Concordia University)

Session Classification: W2-9 Contributed Talks II (DCMMP) / Conférences soumises II (DPMCM)

Track Classification: Condensed Matter and Materials Physics / Physique de la matière condensée et matériaux (DCMMP-DPMCM)