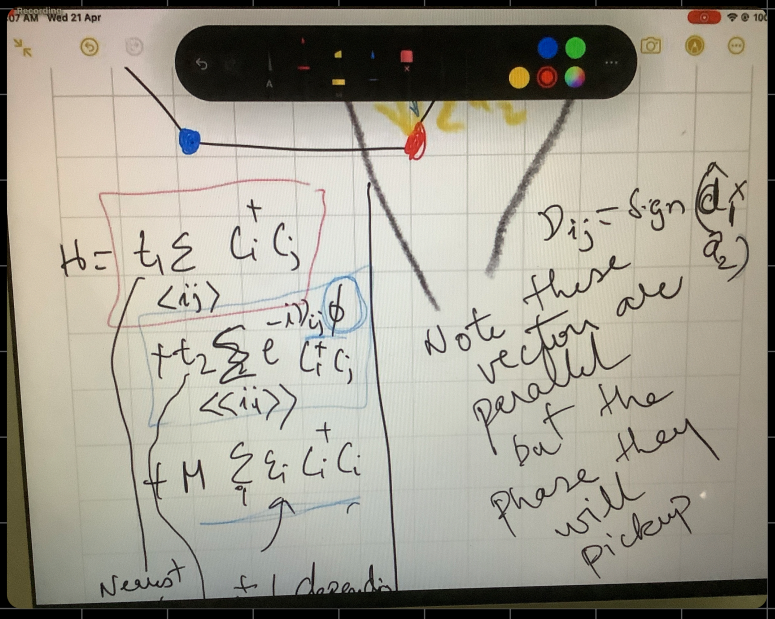
Recap:- Haldane model

↳ on a unit cell it doesn't break TRS

↳ but overall it does break TRS

② TRS ⇒ is broken by phase term

↳ sign of phase oscillates



$$t_2 \sum_{\langle\langle ij \rangle\rangle} c_i^\dagger c_j \, e^{-i D_{ij}(\phi)}$$

→ spin isn't taken into account

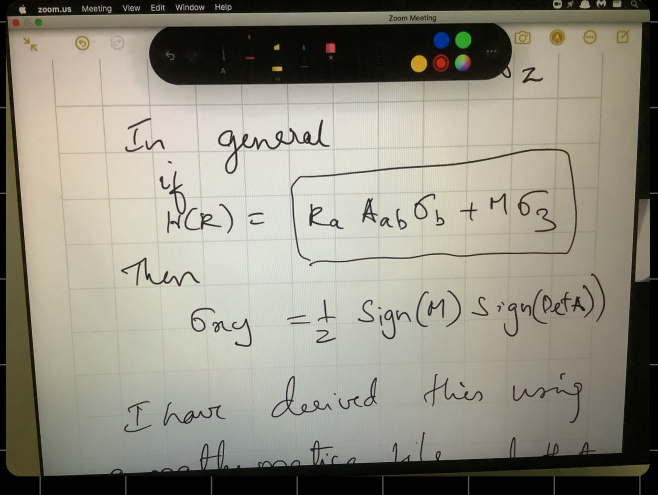
→ 2×2 Hamiltonian

effective low energy Hamiltonian

⇒ Gap opening & closing → as you vary phase term

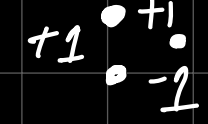
↓

≠ leads to boundary modes!



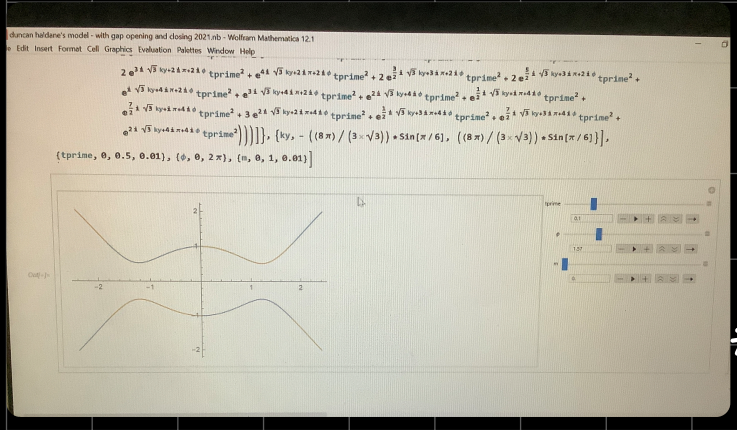
finite ribbon implementation [what is the reason for Bulk-boundary correspondence?]

↳ why isn't there a phase on m?
↳ net flux over



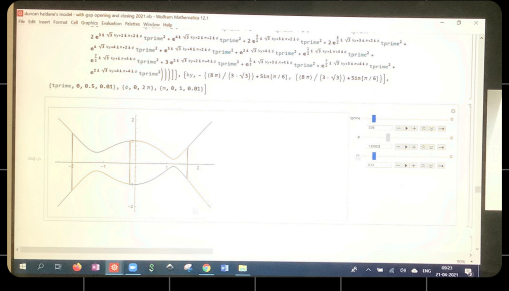
Haldane → Chern # of filled as a Chern insulator
↳ break TRS without adding $\vec{B}$ explicitly

Do HW problems



high symmetry points

phase term → lifts symmetry b/w two valleys



phase → closes gap
site A/site B twisting of the evecs

trivial → some sites weight
non-" → site weight changes

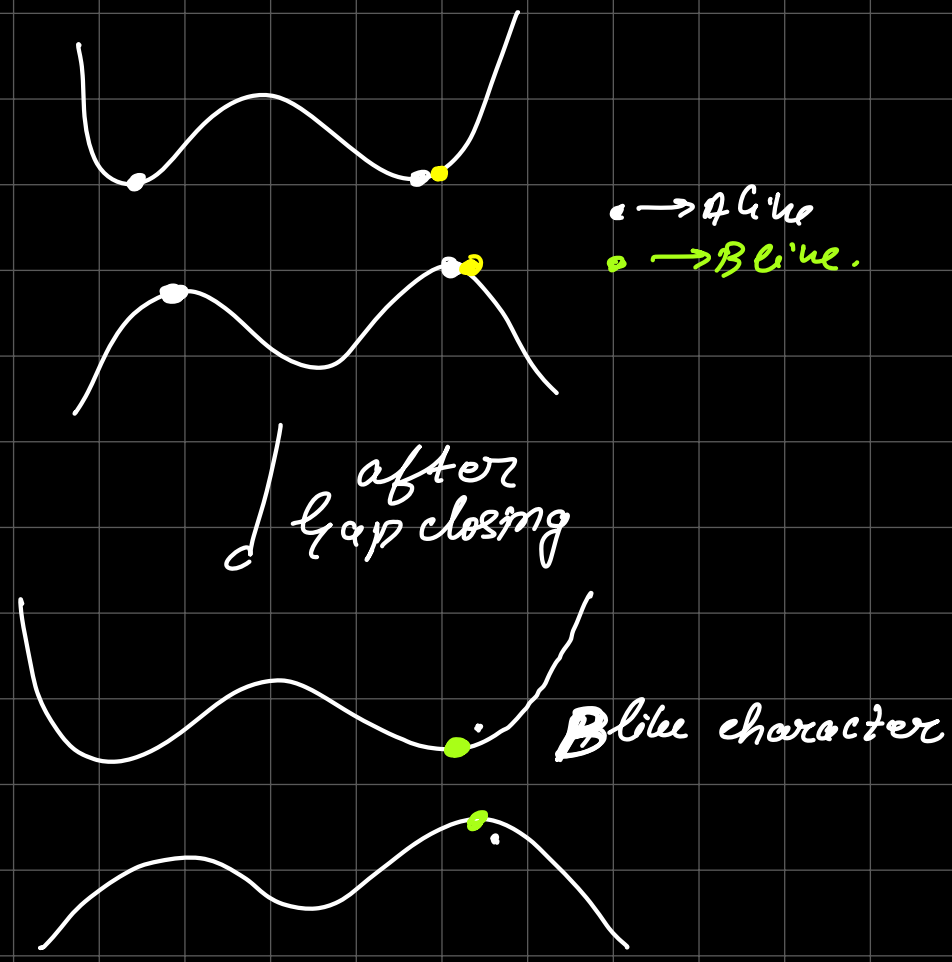
play with mathematica

↳ "twisting" of bonds
↳ gap closing in k-space

Gap closing in real space

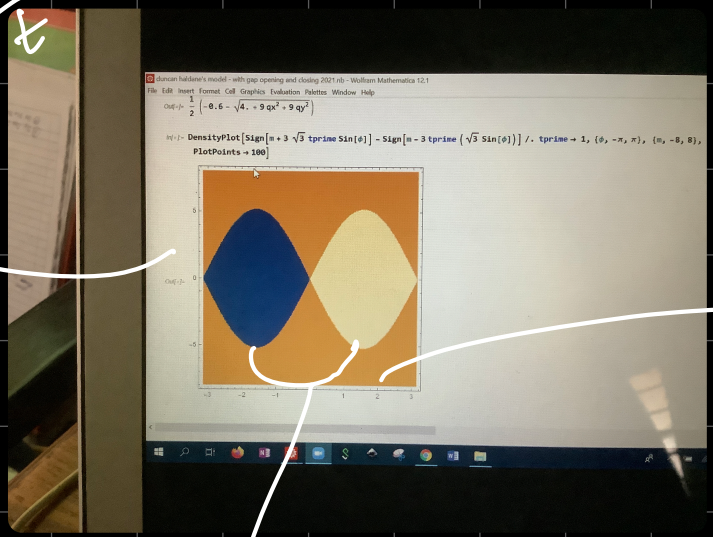
@ Vanderbilt's Book

Python package



* Chern # → sum over 2 valleys → non zero chern # which change sign

ratio of m & t

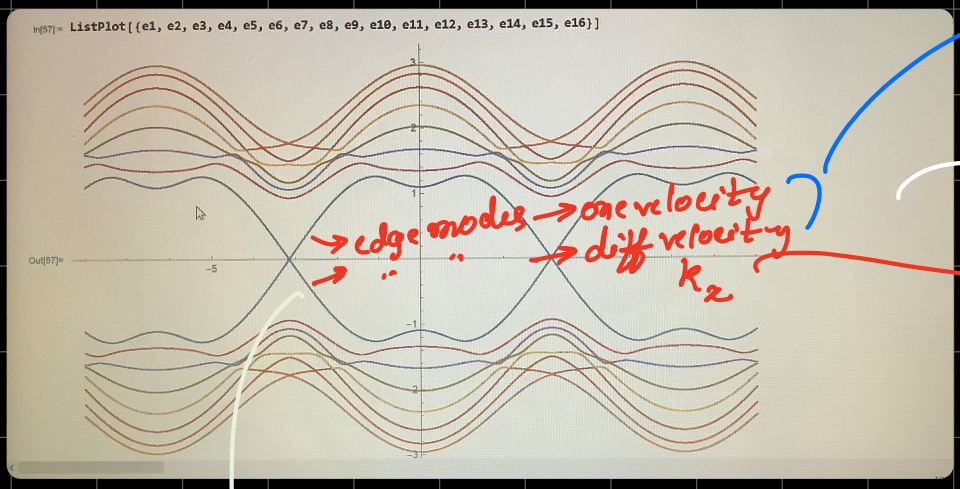


→ phase

$\phi = \frac{-\pi}{2}$ to $\frac{\pi}{2}$

Ribbon realisatn of same model

↳ painful book keeping but simple calculation

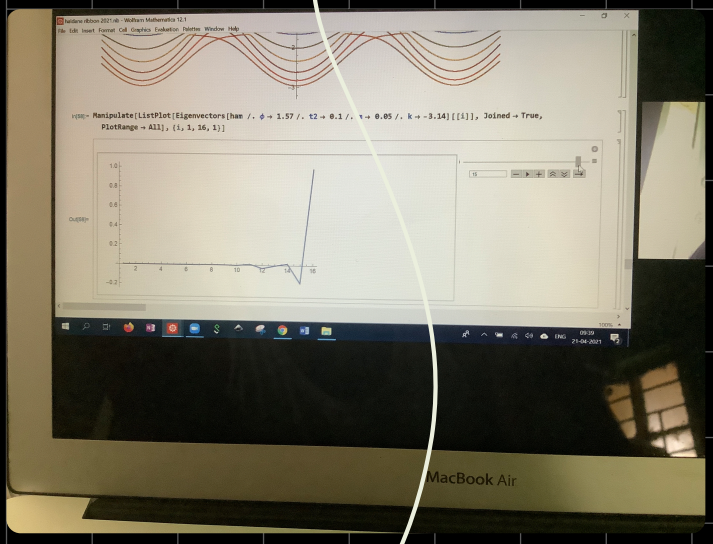


one circulates in 1 direction & other in other direction

→ Gaps in spectrum

→ along the length of ribbon

* we have a circulating current itself



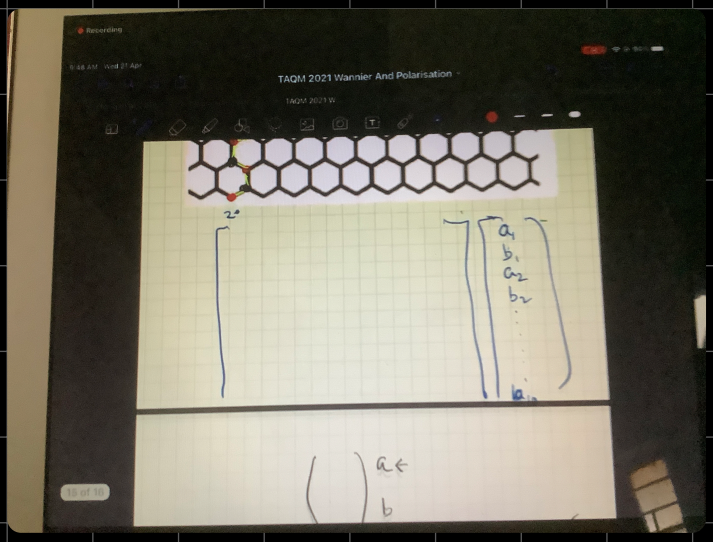
Chern # ⇝ magnetizatn of the system

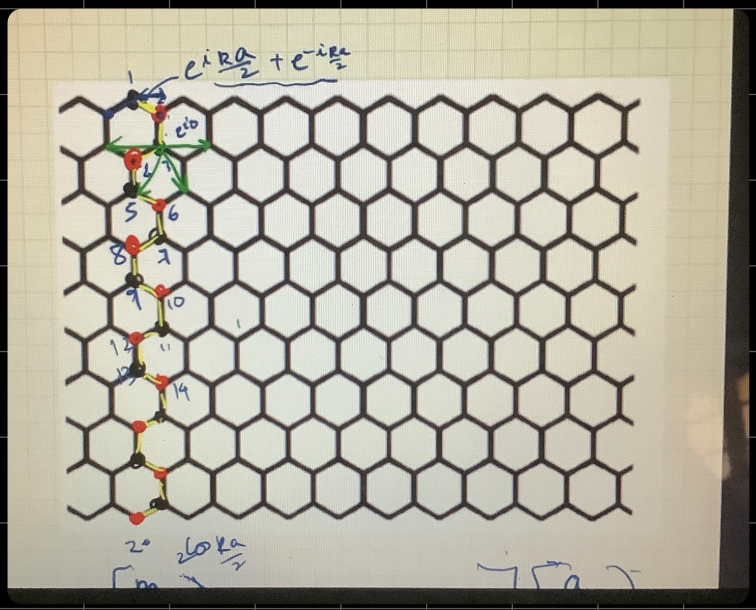
Q Hall → eqm no current?

↳ dumb law

↳ live on one side

↳ live on other side


Recording
TAQM 2021 Wannier And Polarisation
TAQM 2021 W
2a
a1
b1
a2
b2
a
b
13 of 16


$e^{i\frac{Ra}{2}} + e^{-i\frac{Ra}{2}}$
e^{i0}
1
2
3
4
5
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7
8
9
10
11
12
13
14
2a
$2\cos\frac{Ka}{2}$