

Hofstadter butterfly in transition metal dichalcogenide monolayers

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Overview

Group VI-B Transition Metal Dichalcogenides (TMD) are compound semiconductors of the type MX_2

The diagram shows a simplified periodic table with the following elements highlighted:

- Transition metals (green):** Ti, V, Zr, Nb, Mo, Pd, Hf, Ta, W, Re, Pt.
- Chalcogenides (yellow):** S, Se, Te.

Labels in the diagram:

- Transition metal** (green box at the bottom left).
- Chalcogenides** (yellow box at the bottom right).

Chemical formula and definitions:

MX_2
M: Transition metal
X: Chalcogenide

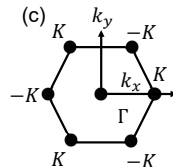
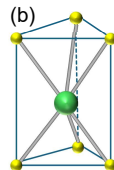
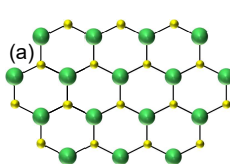


Figure: Transition metal dichalcogenides compound. Top view of monolayer MX_2 . The large sphere is M atom and the small sphere is X .

Transition Metal Dichalcogenides Monolayers

- One M layer sandwiched by two X layers as show in top view (a) and side view (b)
- They have the inverse



Three-band tight-binding model under a magnetic field

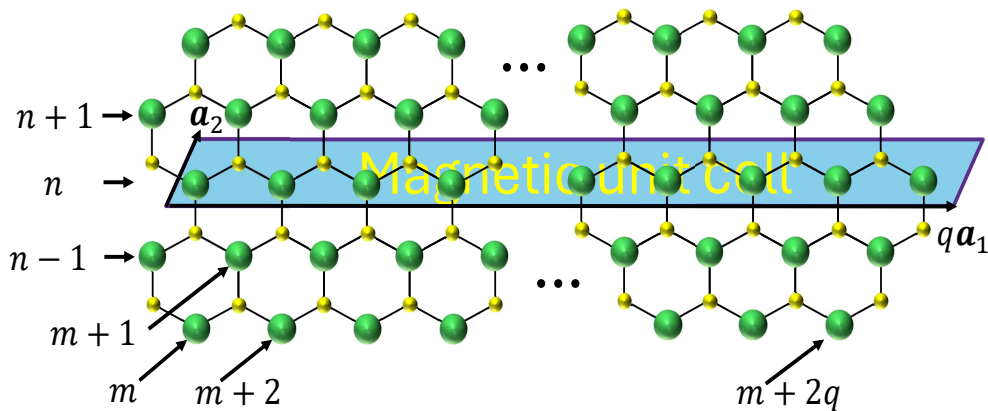


Figure: Magnetic unit cell for TMD monolayers.

Landau levels

Classical Hall effect

Summary:

- We confirm the Hofstadter butterfly in this model corrected compared to previous study.
- From three-band TB + magnetic field \rightarrow QHE.

Further research:

- High Harmonic Generation
- High-order Side-band Generation
- Photovoltaic effect

Thank you for your listening.