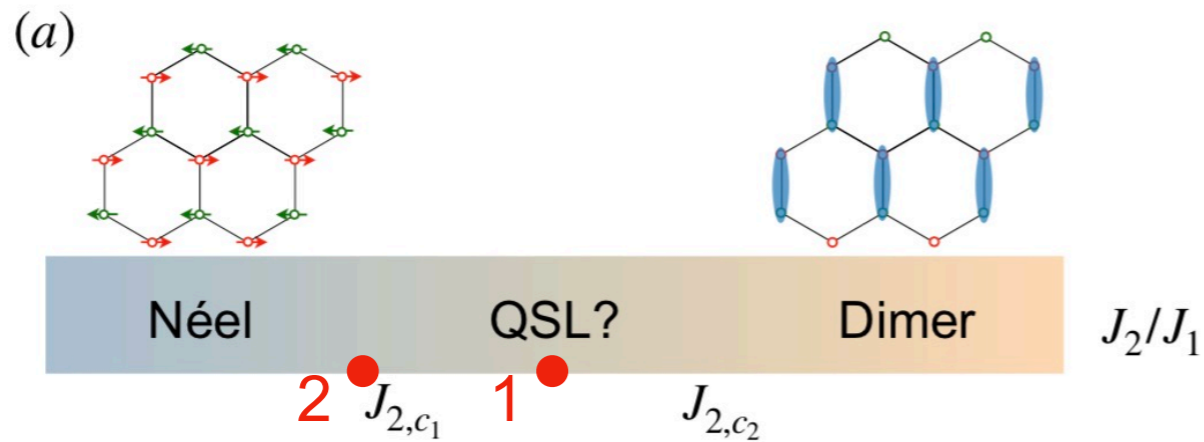


Topological phase transition and nontrivial thermal Hall signatures in honeycomb lattice magnets

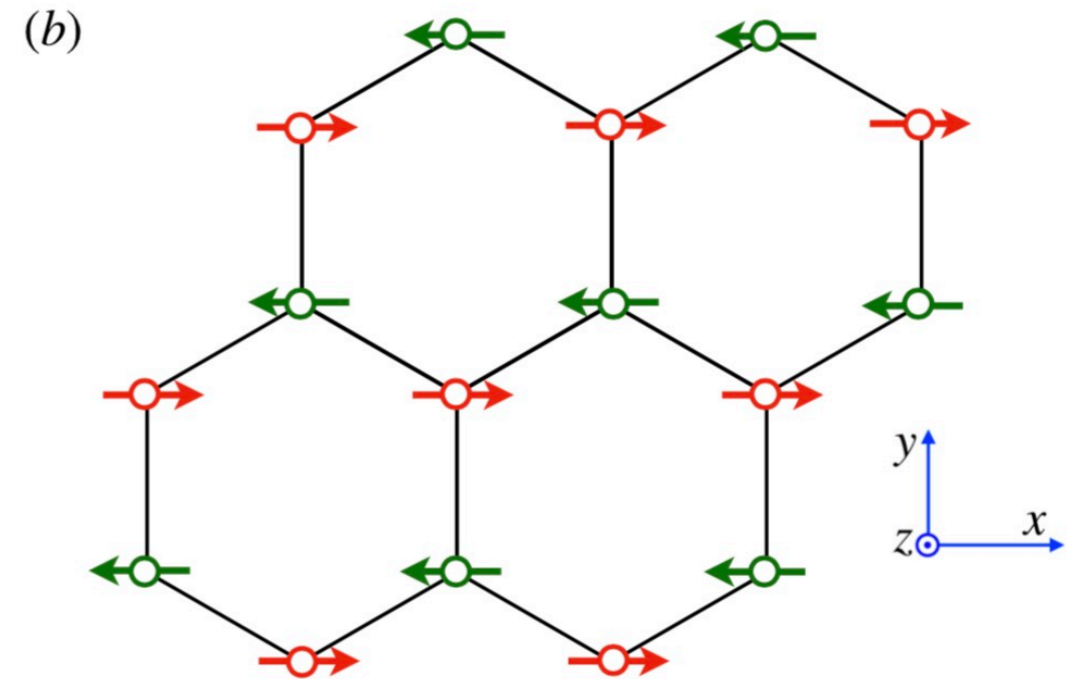
Yonghao Gao_(Fudan), Xu-Ping Yao_(HKU)

Gang Chen
Fudan/HKU

Intermediate phase of honeycomb lattice magnets



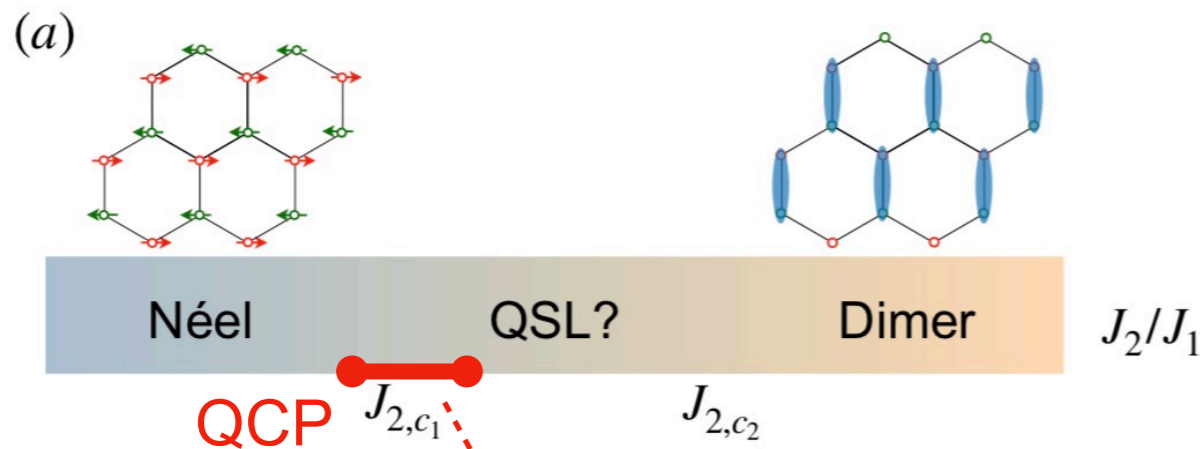
General PD for J_1 - J_2 model
from numerical studies



1. What kind of QSL?

2. What kind of quantum critical behavior?

Coexisting regime: When CSL meets Neel

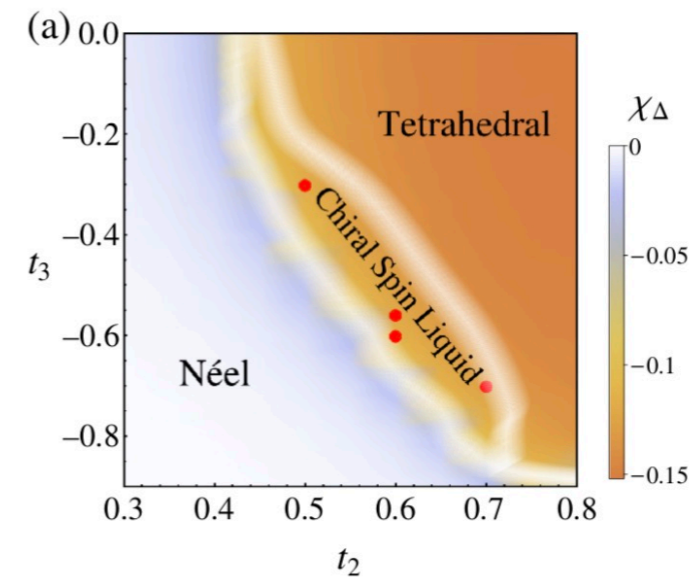
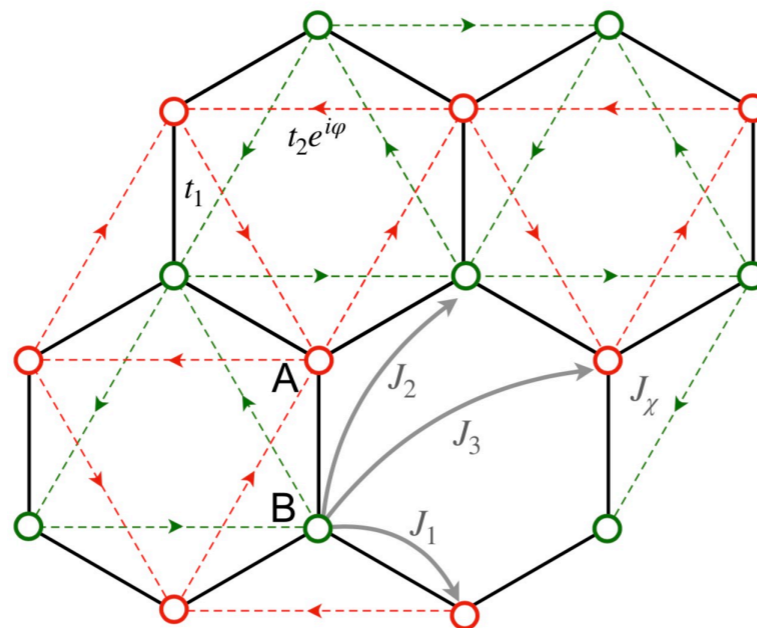


QSL \longrightarrow CSL?

$$\mathbf{S}_i \cdot \mathbf{S}_j \times \mathbf{S}_k$$

Coexisting phase: Neel+CSL

CSL ansatz:



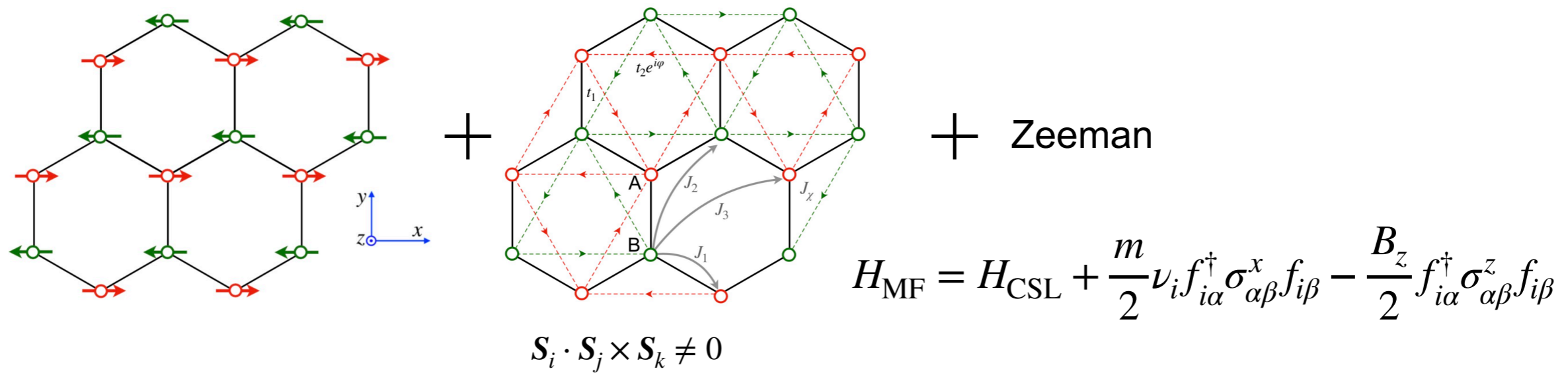
PD from numerical study (ED)
for J_1 - J_2 - J_3 - J_x model

C. Hickey *et al*, PRL (2016)

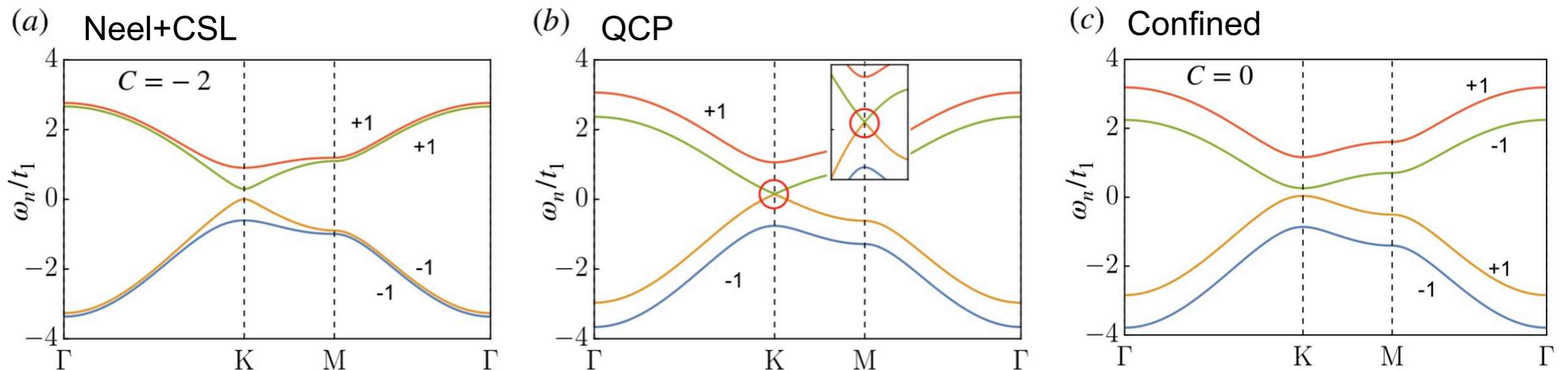
J. Liu *et al*, Physica E (2020)

Coexisting regime: When CSL meets Neel

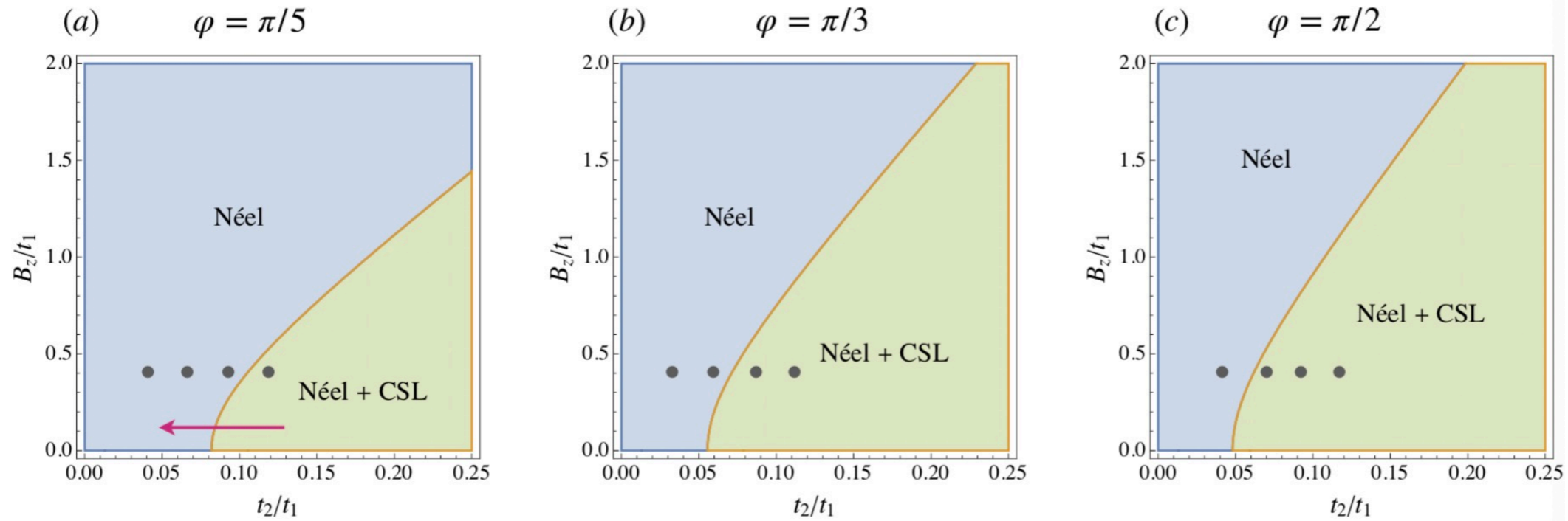
1. Mean-field analysis:



2. Spinon band evolution under fields:

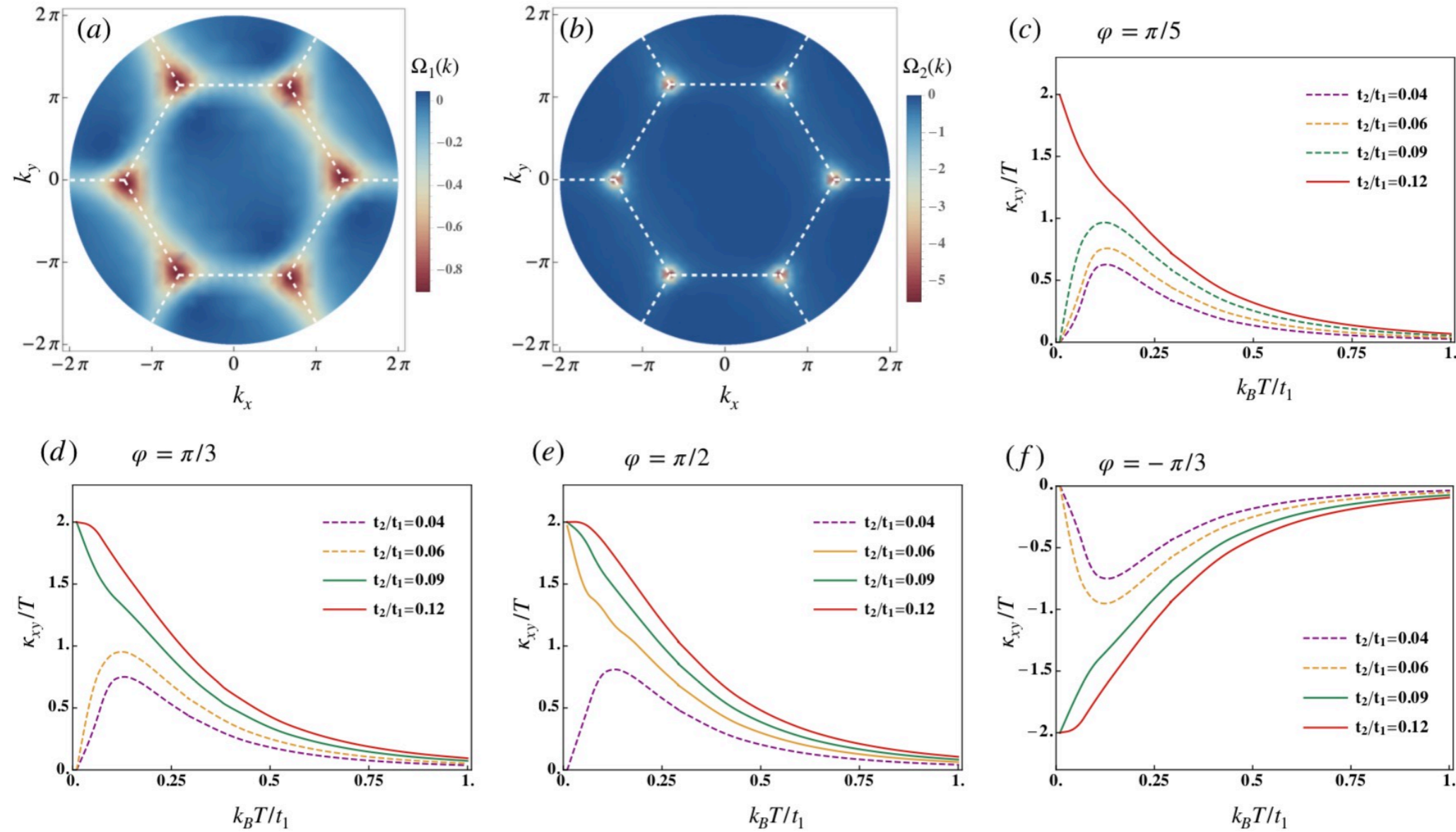


Phase diagrams



$$H_{\text{MF}} = H_{\text{CSL}} + \frac{m}{2} \nu_i f_{i\alpha}^\dagger \sigma_{\alpha\beta}^x f_{i\beta} - \frac{B_z}{2} f_{i\alpha}^\dagger \sigma_{\alpha\beta}^z f_{i\beta}$$

Exp. Probe & nontrivial thermal Hall signatures



Nontrivial thermal Hall signatures near QCP

Summary

1. Topo. phase transition from a coexisting phase of QSL and Neel order to the conventional magnetic order under external fields
2. Nontrivial thermal Hall response in the confining ordered phase near the QCP
3. How magnetic order and Zeeman field influence topology of Majorana fermion bands and related critical behavior?
4. When charge degree of freedom is involved?