Study of Strongly correlated Kane-Mele-Hubbard Model by Schwinger Boson Formalism

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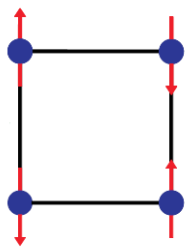
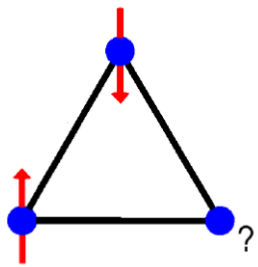
Background and Theory

- Model known to support the quantum spin liquid phase
- Interesting from a theoretical point of view and for applications
- Ground state exhibits gapped excitations and topological order
- Topological phases $\longrightarrow$ within quantum computing and quantum information
- Methods: Bosonization of a spin Hamiltonian and Scwhinger boson mean field theory



Square Lattice
Unfrustrated



Triangular Lattice
Frustrated

$$\hat{H} \sim \sum_{ij} \mathbf{S}_i \cdot \mathbf{S}_j$$

$$\rightarrow \sum_{ij} \sum_{\alpha\beta\gamma\kappa} \hat{b}^{\dagger}_{i\alpha} \hat{b}_{i\beta} (\sigma_{\alpha\beta} \cdot \sigma_{\gamma\kappa}) \hat{b}^{\dagger}_{j\gamma} \hat{b}_{j\kappa}$$

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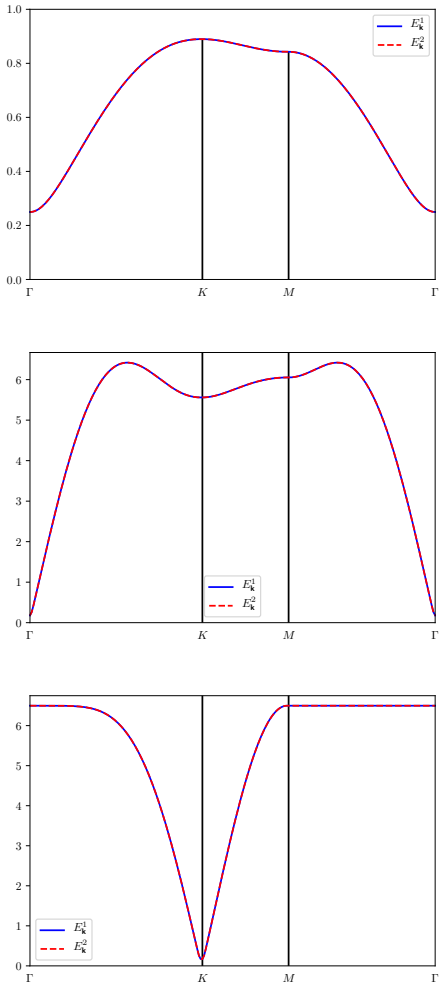
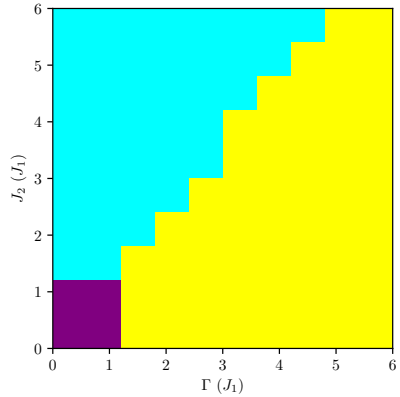
My project - preliminary results

- Extension of work done by Fosstveit
- Focus on learning mathematical methods $\rightarrow$ results will hopefully follow in the masters thesis





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Summary and Outlook

- The model I considered proved it self too difficult for the time constraints
- For the master thesis - Try to solve this problem
- End goal: Predict measurable transport properties in the QSL phase
- Due to the topological nature, transport such as spin-Hall and thermal Hall are non-trivial in a QSL
- Use these to distinguish between QSL and magnetic phases

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