2019 Boston College Summer School of Theoretical Condensed Matter Physics

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In this paper I list a group of topics I am interested in and summarize related materials worth reading (still under construction). It plays a role of summer study plan to prevent myself from deviation of the main thread. Hopefully I can cover most of them after three months's study.

山无数，乱红如雨，不记来时路。

—— 秦观「点绛唇 · 桃源」

- **2D CFT**
  - ⋆ OPE to Renormalization Group (Wilson-Fisher and XY Model) [1, 2]
  - ⋆ Anomaly and Central Charge [3–5]
  - ⋆ Kac-Moody Algebra and Edge Modes of FQHE [6]
- **Quantum Transport Theory**
  - ⋆ ~~Bloch Theorem [4, 7, 8]~~
  - ⋆ Luttinger's Gravitational Formulation on Thermal Transports [9, 10]
  - ⋆ Low-energy Newton Cartan theory of Quantum Transports [11–14]
  - ⋆ ~~Lattice Theory of Quantum Transport [15]~~
  - ⋆ Topological Origin of Thermal Hall Effects [14–16]
  - ⋆ Discussion on Energy Magnetization [10, 17, 18]
  - ⋆ ~~Semi-classical Treatment of Nonlinear Hall Response [19]~~
  - ⋆ Magnon Thermal Hall Effect [20, 21]
- **Lieb-Schulz-Mattis Theorem**
  - ⋆ ~~LSM theorem in (1+1)D [22]~~
  - ⋆ LSM theorem in higher dimensions [23–25]
- **Realization of Kitaev Model**
  - ⋆ ~~Kitaev's Honeycomb Model [26]~~
  - ⋆ ~~Honeycomb Iridates [27, 28]~~
  - ⋆ ~~Anyons and Unitary Modular Tensor Categories [26, 29]~~
- **Advanced FQHE**
  - ⋆ Dirac Theory of Composite Fermions [30]
  - ⋆ Hall Viscosity [31]
  - ⋆ Low-energy Newton Cartan theory of FQHE [13, 32]
- **Duality**
  - ⋆ Kramers-Wannier Duality and XY Duality [33–37]
  - ⋆ Bosonic Particle-Vortex Duality [38, 39]
  - ⋆ Fermionic Particle-Vortex Duality [30, 40–43]

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- **Topological Insulators and Topological Superconductors**
  - ⋆ Haldane Model [44–46]
  - ⋆ Chern Insulators in Higher Dimensions [45]
  - ⋆ $\mathbb{Z}_2$ Invariant and Kane-Mele Model [44–46]
  - ⋆ Vortex and Majorana Fermions [47, 48]
  - ⋆ Topological Periodic Table [49, 50]
- **Quantum Evalution**
  - ⋆ ~~Lieb-Robinson Bounds [51, 52]~~
  - ⋆ Equal-time Correlation [53]
  - ⋆ ~~Insensitivity to Twisted Boundary Conditions [54]~~
- **Quantum Phase Transition**
  - ⋆ Deconfined Quantum Critical Point [39, 55]
- **TQFT**
  - ⋆ Chern-Simons Gauge Fields and K-matrix Theory of FQHE [56, 57]
  - ⋆ Non-linear Sigma Model and WZW Model [58, 59]
  - ⋆ Braiding Statistics [56, 60]
- **Others Topics Discussed in Journal Club**
  - ⋆ ~~Paradox in Defining Bulk Quadrupole Moment [61]~~

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