mini-Projects

presentations

- summarize key physics points in reading.
- 15 min presentation
  - 5-10 slides: demonstrating an intro. for basic theory / method, and the key results
  - numerical demonstration: in the form of a problem set (of course you need to solve it!)
- numerical codes

topics

Choose a topic from below or form your own! Here are some suggestions (and guiding questions)

- Van der Waals parametrization of phase diagram
  - any Stat. Mech. Textbook, e.g. Kerson Huang and Pathria
  - molecules
  - Qs:
    - how attractive and repulsive forces affect the shape of phase diagram ?
    - how Maxwell construction works?
    - relate the Van der Waals parameters to those of a microscopic model, e.g. Walecka model.
- Ising model
  - Kogut
  - intro. notes
  - Qs:
    - concept of duality: low and high temperature expansions
    - order parameter and susceptibility
    - how the phase transition is modified by higher pairing forces
    - vortices and other special objects
    - hysterysis and how it evolves with temperature
    - beyond nearest-neighbor forces
- coherent states
  - susy qm (first 2 chapters)
  - notes from Nicholas Wheeler
  - Qs:

    - understand how the ladder operator works
    - what are the key features of a coherent state?

- constituent quark model
  - quark model
  - Qs: - how to understand the spectrum of charmonium states in the PDG: n, J, L, ? - attempt to fit the low lying states. - explore the effect of spin-orbit couplings.

- Understanding resonances.
  - resonances
  - kinematics
  - how (intermediate) resonances show up in a Dalitz plot.
  - how dynamics are affecting the distributions.
  - coupled-channel models.