

The Hubbard Model and the Mott Transition: From Basic Properties to Solution Strategies

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Lecture I: Introduction of the Hubbard model

- Introduction of the Hubbard model: its derivation from standard electronic structure models
- Why do we need strongly correlated models?
- Behavior of strongly correlated models in limiting cases: band theory limit, atomic limit
- Symmetries of the Hubbard model
- The large U limit/correlated insulators

Lecture II: Solution strategies: mean-field theory, Gutzwiller variational theory

- Spin density wave mean-field theory
- Gutzwiller variational theory
- The Brinkman-Rice transition

Lecture III: Exact solution in 1D: the basics of the Bethe-ansatz

- Bethe ansatz solution for a Bose gas
- Introduction to the Bethe ansatz for the Hubbard model: solution of the two-particle system with an on-site Coulomb potential