

Lectures:

- 1.2.2022 Recapitulation. Mean field theory.
3.2.2022 Renormalization Group: Kadanoff block spins. Quantum phase transition.
8.2.2022 Open discussion forum: questions and answers about the entire lecture.
10.2.2022 Written exam/Klausur.

Book: Schwabl Appendix F, Chapters 6.5.2, , 7.3

Excercises: No more exercises.

Verständnisfragen

- 95.) Give a mathematical formula for the scaling behavior of a function (e.g. the free energy). What is a scaling dimension in this context?
- 96.) What is Curie's law? Derive it for a spin-1/2 magnetic moment.
- 97.) Explain cooling by adiabatic demagnetization.
- 98.) Explain the third law of thermodynamics? (Nernst theorem).
- 99.) Consider domain walls in the Ising model. Argue that they appear at any temperature in a 1D system.
- 100.) How is the critical temperature in the 2D Ising model related to the appearance of domain walls? Make a quantitative estimate of T_c .
- 101.) Derive the exact partition function for the 1D Ising model in a magnetic field. What is a transfer matrix?
- 102.) Describe the basic idea and steps of a mean field theory for a *general* interacting model.
- 103.) Apply the mean field theory for the Ising model to derive an equation for the magnetization as a function of field.
- 104.) Derive an expression for the mean field susceptibility.
- 105.) What is chain mean field theory? What is the Bethe lattice approximation for mean field theory?
- 106.) Explain the concept of the renormalization group.
- 107.) Discuss the Kadanoff block spin transformation for the Ising model.
- 108.) What is a quantum phase transition?