

BACHELOR Arbeitsthemen

Description of project nr. 1

The Monte Carlo Method

Statistical Physics Fundamentals

- 1) Fundamentals
- 2) Thermodynamic Observables
 - Internal energy
 - Free energy
 - Magnetization
 - Specific heat and susceptibility
- 3) **Monte Carlo Simulation**
 - Fundamentals
 - Expectation value, sampling, Markov-chain, ergodicity, detailed balance, etc.
 - Metropolis algorithm
- 4) Examples of a standard simulation.
 - Two-dimensional **Ising model**, comparison with analytic solution
- 5) Simulation for a **nanomagnet** described by a classical **Heisenberg model**
 - Description of the nanomagnet
 - Introduction of the Heisenberg model
 - Thermodynamic Observables
 - Results of the simulation and comparison with experiment

Literature

D.P. Landau, K. Binder, *Monte Carlo Simulations in Statistical Physics*. Cambridge University Press (2000)

M.E.J. Nevman and G.T. Barkewa, *Monte Carlo Methods in Statistical Physics*, Oxford University Press (1999)

Original Articles (Metropolis algorithm)

Mn. Rosenbluth, Ah. Teller, N. Metropolis, *Journal of Chemical Physics*, **21**, 1087 (1953).