Monte Carlo Methods

Dénes Sexty
Lecture at KFU Graz
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denes.sexty@uni-graz.at

Topics to be covered on the lecture:

- Introduction: Overview, examples where MC methods are needed
- Integration vs Sampling
- Pseudo random generators
- Generating random numbers with a given distribution
- Importance Sampling, Markov chains, Metropolis Algorithm
- Statistics, Autocorrelation, error estimates with Jackknife and Bootstrap
- Monte Carlo simulations in practice
- Phase transitions, finite size effects
- Worm Alg., Cluster Alg., Swendsen-Wang Alg.
- Importance sampling with neural networks
- Sign problem, reweighting
- Langevin equation, Complex Langevin eq.
- Quantum Monte Carlo