

Physics 704, Spring 2006-05-10

Study guide for oral test, version 0.9

Correlation functions, truncation schemes, Ornstein-Zernike
Capillary-wave theory of interface fluctuations
Mean field (MF) treatment of phase transitions and critical exponents
Ginzburg-Landau extension of MF
Ising model using various schemes
Scaling transformations
Real-space renormalization: decimation
Finite-size scaling for divergent properties like specific heat, correlation length, susceptibility
Basic ideas of renormalization group flows and fixed points
Transfer matrices, esp. as applied to Ising model
Basics of molecular dynamics
Basics of Monte Carlo: Metropolis algorithm, detailed balance, Markov chains
Pseudorandom numbers
Fluctuation-dissipation ideas
Langevin and Fokker-Planck equations: examples, use, connection
Nucleation & growth vs. spinodal decomposition
Basics of Jarzynski relations and how they might apply to your research subject
Kosterlitz-Thouless transition, what is so unusual about it, where it shows up in physics

Homework problems (and their solutions)

LMB text equations:

3.33,3.35,3.75,3.76,3.79,3.83,3.85

4.14,4.17,4.25,4.30,4.38-46,4.78,4.96,4.111-112,4.114-116,4.139,4.142,
4.144($\omega \rightarrow y$),4.148,4.154

7.9-19,7.21-23,7.28

9.11-15,9.28,9.111-112,9.123-135,9.145-148