

PHYS 8601

Spring, 2022

Instructor:

Prof. D. P. Landau

E-mail: dlandau@uga.edu

Course objective:

A student will be expected to develop an understanding of the fundamental aspects of Monte Carlo sampling techniques and as well as substantial, practical problem-solving ability.

Class meetings: 7th period, MWF via Zoom

Text:

A Guide to Monte Carlo Methods in Statistical Physics, 5th Edition, D. P. Landau and K. Binder (Cambridge U. Press, 2021)

Topical outline for the course:

1. Introduction (including the philosophy underlying simulations)
2. Some background (statistical mechanics, thermodynamics, random number generation)
3. Comments on programming
4. Simple sampling Monte Carlo methods
5. Importance sampling Monte Carlo methods
6. Advanced Monte Carlo methods and techniques of analysis
7. Reweighting and extended ensemble methods
8. Quantum Monte Carlo methods
9. Monte Carlo renormalization group methods
10. Simulations of non-equilibrium and irreversible processes
11. Introduction to other simulation methods

Projects

Students will be required to complete seven different projects based upon material presented in lectures and in the text. For each project students will have to implement an algorithm in a computer language of their choice (preferably Fortran, C, or C++), debug and run the code, analyze the results, and submit a report which includes the answers to questions posed in the assignment.

Grading Policy

Semester grades will be determined by the cumulative grade for the projects.