

CHEM 950/PHSX 971

Advanced Statistical Mechanics

Fall 2017

Instructor: Brian B. Laird: 6008C Malott, blaird@ku.edu, 864-4632

Time and Place: MW 2:00-3:15PM (2007 Malott)

This course will focus primarily on methods in non-equilibrium statistical mechanics. Topics that we plan to cover include stochastic processes in chemistry and physics, linear response theory, time correlation functions, kinetic theory and molecular hydrodynamics. We will also discuss some important theorems governing the relationship of non-equilibrium work and entropy measurements to equilibrium free energies and the second-law of thermodynamics; namely, the Jarzynski theorem and the Fluctuation theorem. Additional topics in advanced equilibrium statistical mechanics may be discussed depending upon student interest.

Prerequisite: A basic knowledge of equilibrium statistical mechanics

Text: N.G. Van Kampen, *Stochastic Processes in Physics and Chemistry*, 3rd ed., (North-Holland Personal Library, 2007).

Grading: The grade will be based entirely on several (5-7) problem sets handed out in class. In addition to traditional problems, there will be some computational exercises that will involve some programming in your favorite language. Each problem set will be due two weeks after the date of assignment. There are no exams.

Office Hours: Office hours are by appointment or walk-in. They will be held in Prof. Laird's office in 6008C Malott.

Some Useful References:

- R.Kubo, M. Toda and N. Hashitsume, *Statistical Physics II (Non-equilibrium Statistical Mechanics)*, 2nd ed., (Springer Series on Solid-State Physics, 2003)
- D.A. McQuarrie, *Statistical Mechanics*, 2nd ed. (University Science Books, 2000).
- J.P Boon and S. Yip, *Molecular Hydrodynamics*, (Dover, 1992).