PHYS 758 **STATISTICAL PHYSICS** **Spring 2003**

Instructor: Dr. Alan R. Denton
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South Engineering 214B, 231-7036

Meetings: TTh 10:00-11:15 a.m.
South Engineering 212C

References: See the list of books on reserve in the library for three-day loan.

Goals: Develop understanding of theoretical and computational methods of statistical physics and their applications to soft matter systems.

Topics: The following list may be modified to match students' interests.

I. Introduction: Review of Statistical Mechanics

- Boltzmann distribution and partition function
- Entropy and free energy
- Ensembles, ensemble averages, and statistical fluctuations
- Probability distributions, random numbers

II. Computer Simulation Concepts and Methods

- History and foundations of computer simulation
- Molecular dynamics simulation
- Monte Carlo simulation, importance sampling
- Statistical errors, finite-size effects

III. Theoretical Concepts and Methods

- Distribution functions and correlation functions
- Density-functional and integral-equation theories
- Variational theory for free energies
- Linear response theory and effective interactions

IV. Applications

- Phase transitions and phase behavior
- Simple liquids: hard-sphere and Lennard-Jones systems
- Polymers: single chains, polymer solutions
- Colloids: charged colloids, colloid-polymer mixtures
- Liquid crystals: nematics, smectics

Grading: Problem Sets/Projects 60%, Final Exam 40%

Any students with disabilities who need accomodation in this course are encouraged to speak with the instructor as soon as possible to make appropriate arrangements.