

PREREQUISITES

I will assume that you are familiar with

(I) Undergraduate Thermodynamics at the level of **Physics 351** or Rutgers placement tes program, which includes

- **Basic:** Laws of thermodynamics-definitions, temperature scales, heat transfer by conduction, properties of ideal gas, relation between temperature and kinetic energy, Maxwell distribution, work and PV diagrams, Carnot cycle.
- **Intermediate:** Boltzmann distribution, phase transformations in binary mixtures, statistics of ideal quantum systems, black body radiation, Bose-Einstein condensation.
- **Advanced:** Boltzmann distribution, phase transformations in binary mixtures, statistics of ideal quantum systems, black body radiation, Bose-Einstein condensation.

(II) Graduate Classical Mechanics at the level of **Physics 507** or Rutgers challenge exam program:

- **Basic:** Lagrangian mechanics, invariance under point transformations, generalized coordinates and momenta, curved configuration space, phase space, dynamical systems, orbits in phase space, phase space flows, fixed points, stable and unstable, canonical transformations, Poisson brackets, differential forms, Liouville's theorem, the natural symplectic 2-form and generating functions, Hamilton-Jacobi theory, integrable systems, adiabatic invariants.

(III) Graduate Quantum Mechanics at the level of **Physics 501** or Rutgers challenge exam program:

- **Basic:** Vector spaces, eigenvalues and eigenvectors, position and momentum operators, Schroedinger equation, one dimensional potentials, harmonic oscillator, symmetries in quantum mechanics, identical particles, translations and rotations in two dimensions, hydrogen atom, energy levels, degeneracy, spin, Pauli matrices.