INSTRUCTOR: J. Sirker (Allen 515), Email: sirker@physics.umanitoba.ca

FORMAT: Online lecture at agreed upon times

TEXTBOOKS: There is no required textbook for this course. Course notes will be published online. However, you might want to consult some of the textbooks listed below:

1) LD Landau and EM Lifshitz, *Statistical Physics, Part 1* (Elsevier Butterworth-Heinemann, 1980). Excellent discussion of many of the core concepts.
2) RK Pathria, *Statistical Mechanics* (Butterworth-Heinemann).
Another good introduction into the classical topics of Stat. Mech.
3) Roger Bowley and Mariana Sánchez, *Introductory Statistical Mechanics* (Oxford Univ. Press, 1999).
This is an undergraduate textbook. It contains helpful explanations of the main ideas and is easy to read.

1. INTRODUCTION:
    • Objectives of Statistical Mechanics
    • Hamiltonian mechanics, phase space
    • Liouville theorem, Poincare theorem
    • Density operators classical and quantum
    • Dirac notation

2. BASICS OF EQUILIBRIUM STATISTICAL MECHANICS
    • Ensembles
    • Entropy
    • Partition functions, thermodynamic relations, fluctuations

3. THE IDEAL GASES
    • The classical ideal gas
    • Identical particles: Fermions and Bosons
    • The ideal Bose gas (Photon gas, vibrations of solids, Bose-Einstein condensation)
    • The ideal Fermi gas

4. BOSE-EINSTEIN CONDENSATION IN WEAKLY INTERACTING GASES
    • Cold atomic gases, traps, optical lattices

5. MAGNETIC SYSTEMS
    • The Ising model (Solution in one dimension)
    • The Hubbard and the Heisenberg model

6. PHASE TRANSITIONS
    • Mean Field Theory
    • Classification of Phase Transitions: Landau theory
    • Critical exponents