Massachusetts Institute of Technology
Physics Department

Physics 8.334 | Spring 03

Statistical Mechanics II

Last modified: February 3, 2003

Lectures: We, Fr, 2-3:30, in Rm. 12-142, by Prof Leonid Levitov;
Rec: Mo, 2-3:30, in Rm. 12-142, by Mr Vadim Roytershteyn
Prerequisite: Introductory level Statistical Mechanics course

Course outline

- Long-range order, symmetry and hydrodynamical modes;
- Phase transitions, mean field theory;
- Continuous and discontinuous phase transitions, the role of symmetry;
- Critical phenomena, scaling transformation, universality;
- Renormalization group, statistical field theory;
- Wilson-Fisher fix point near $d = 4$, calculation of critical exponents;
- Exactly solvable models: Ising, Potts, duality transformation;
- Topological transitions, vortices in the XY model, Kosterlitz-Thouless RG theory;
- XY and solid-on-solid duality, vortex melting of 2D crystals;
- Lower critical dimension, nonlinear sigma model;

and, if time permits,

- Critical dynamics, scaling theory;
- Field-theoretic description of localization;
- Conformal invariance and Conformal Field Theory in Statistical Mechanics.

Recommended texts:

S-K Ma, *Modern Theory of Critical Phenomena,* (1976, The Bejamin/Cummings Publishing Co.)
D J Amit, *Field Theory, Renormalization Group, and Critical Phenomena,* (1984, World Scientific)
C Itzykson, J-M Drouffe, *Statistical Field Theory,* vol.I,II, (1991, Cambridge University Press)