Statistical Physics

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Objective

The main topic in this course will be Critical Phenomena in Statistical Mechanics. Phase transitions and critical exponents will be discussed, as well as their explanation through Mean Field Theory and the Renormalization Group.

Course Outline

i) Preliminaries

- Review of Thermodynamics
- Basics of Statistical Physics
- Thermodynamic Approach to Phase Transitions

ii) Microscopic Theory of Phase Transitions

- Ising Model, Order Parameter
- Mean Field Theory, Critical Exponents
- From Ising to Field Theory
- First Look at Wilsonian Renormalization
- Heisenberg Model: A System with Continuous Symmetry
- Vortices

iii) Monte Carlo Methods

iv) Black Hole Thermodynamics

Additional reading

- PSI study text: *Statistical Physics*

Thermodynamics

- C.J. Adkins, *Equilibrium Thermodynamics*

Statistical Mechanics

- L.D. Landau and E.M. Lifshitz: *Statistical Physics, Part I*
- R.K. Pathria, *Statistical Mechanics*

Critical Phenomena

- N. Goldenfeld, *Lectures on Phase Transitions and the Renormalization Group*
- J. Cardy, *Scaling and Renormalization in Statistical Physics*
- Mehran Kardar, *Statistical Physics of Fields*
- M.E.J. Newman and G. T. Barkema, *Monte Carlo Methods in Statistical Physics*
- Subir Sachdev, *Quantum Phase Transitions*