PH 554: Phase Transitions (3-0-0: 3)

Introduction

Review of Statistical Mechanics: the thermodynamic limit, condition of statistical equilibrium, postulates of statistical mechanics, thermodynamics in different ensembles, stability and positive response functions, positive response function and free energy, fluctuations and response functions.

Phase Transitions

First order and second order phase transitions, symmetry breaking, ergodicity breaking.

Critical Phenomena

The order parameter, the correlation function, critical exponents and universality, the importance of dimensionality.

The Landau Approach

The Landau Free Energy, mean-field theory, the Van der Waals equation.

Text Books and References:

1. S. R. A. Salinas, “Introduction to Statistical Physics”, Levant Books.
2. S. K. Ma, “Modern theory of critical phenomena”, Levant Books.
3. K. Huang, “Statistical Mechanics”, John Wiley & Sons.
4. R. K. Pathria and P. D. Beale, “Statistical Mechanics”, Butterworth-Heinemann.
5. L. D. Landau and E. M. Lifshitz, “Statistical Physics”, Springer.
6. N. Goldenfeld, “Lectures on Phase Transitions and the Renormalization Group”, Sarat Book House.