S. Shlosman

Statistical Physics

Course Description

This is a course on rigorous results in statistical physics and random fields. Most of it will be dedicated to the theory of phase transitions, uniqueness or non uniqueness of the lattice Gibbs fields.

The topics will include:

- grand canonical, canonical and microcanonical ensembles,
- DLR equation,
- Thermodynamic limit,
- Gibbs distributions and phase transitions,
- one-dimensional models,
- correlation inequalities (GKS, GHS, FKG),
- spontaneous symmetry breaking at low temperatures,
- uniqueness at high temperatures and in non-zero magnetic field,
- non-translation-invariant Gibbs states and interfaces,
- Dobrushin Uniqueness Theorem
- Pirogov–Sinai Theory
- O(N)-symmetric models
- the Mermin–Wagner Theorem
- Reflection Positivity and the chessboard estimate
- infrared bounds

Course Prerequisites

It is desirable that the students are somewhat familiar with the probability theory, measure theory and functional analysis. Of course, the calculus knowledge is assumed.