

Statistical Mechanics 2/2022

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Lectures: Tuesday and Friday (3as e 6as feiras): 10:00-12:00 a.m

Contents

1. Nonequilibrium Thermodynamics I: Basic concepts: Macroscopic and “microscopic” descriptions, markovian systems, master equation, entropy production, first and second law of Thermodynamics.
2. Canonical Ensemble.
3. Grand-canonical ensemble and ideal Fermi gas.
4. (Optional) Bose-Einstein condensation and black body radiation.
5. General aspects of phase transitions and classical theories: van-der-Waals gas
6. Ising model I: Model, mean-field theory and remarkable points.
7. Ising model II: Beyond the mean-field theory. Transfer matrix, some techniques (Monte Carlo method) and general description for critical and discontinuous phase transitions.
8. Nonequilibrium Thermodynamics of phase transitions:
9. Nonequilibrium Thermodynamics II: Fluctuation relations, steady and periodically driven systems, linear stochastic thermodynamics for steady and periodically driven systems. Considerations about efficiency
10. Nonequilibrium Thermodynamics of chemical reactions.

Evaluation: Three examinations to be sent on the approximate dates (it will considered the arithmetic average between the two better grades).

P1: 28/09/20201

P2: 26/11/2021

P3: 03/12/2020

Bibliography

0. Lecture Notes, Carlos E. Fiore
1. Herbert B. Callen: Thermodynamics and Introduction to Thermostatistics
2. Silvio Salinas: Introduction to statistical Mechanics
3. R. K. Pathria-Statistical Mechanics
4. Leonard Sander: Equilibrium statistical Mechanics
5. J. M. Yeomans, Statistical mechanics of phase transitions.
6. Several references/nice papers to be sent to you.