

Nonequilibrium Statistical Mechanics (0321-4111)

Formerly called “**Thermodynamics & Statistical Mechanics 2**”

Graduate Level Course, Semester B, 2019

School of Physics & Astronomy, Tel Aviv University

Lecturer: Prof. **Yacov Kantor**

Detailed syllabus

1. Stochastic processes, Markovian and Gaussian processes, harmonic analysis, correlation functions, Wiener-Khintchine theorem.
2. Brownian motion, random walk, diffusion equation.
3. Langevin equation, Einstein relations.
4. Fluctuation dissipation theorem.
5. Master equation, magnetic resonance, Overhauser effect, computational Monte Carlo method.
6. Fokker-Planck equation.
7. Boltzmann equation, collision integral, τ -approximation.
8. Boltzmann entropy and H-theorem.
9. Elementary transport theory and macroscopic continuum theory. Calculation of transport coefficients from Boltzmann equation.
10. Quasi-thermodynamics theory of fluctuations, Onsager reciprocal relations.
11. Green-Kubo formula.
12. Far-from-equilibrium systems: Jarzynski equality and its extensions.
13. Linear response theory, Kramers-Kronig relations, dielectric relaxation.
14. Collision-less plasma: Vlasov equation, waves, Landau damping.

Supplementary information

Textbooks (any edition of the books can be used)

Main texts that will be used throughout the course:

1. Ryogo Kubo, Morikazu Toda, and Natsuki Hashitsume. *Statistical Physics II, Nonequilibrium Statistical Mechanics*. Springer, Berlin.
2. Federick Reif. *Fundamentals of Statistical and Thermal Physics*. McGraw-Hill, London.
3. Linda E. Reichl. *A Modern Course in Statistical Physics*. Wiley, New York.
4. Evgeny M. Lifshitz and Lev P. Pitaevskii. *Physical Kinetics*. Vol. 10 in Series “Course of Theoretical Physics” by L. D. Landau and E. M. Lifshitz. Pergamon, New York [and Nauka, Moscow (in Russian)].

Texts that will be used only in some parts of the course:

1. Hannes Risken, *The Fokker-Planck equation*, Springer, Berlin.
2. Pavel L. Krapivsky, Sidney Redner, and Eli Ben-Naim. *A Kinetic View of Statistical Physics*. Cambridge University Press.
3. Ryogo Kubo. *Statistical Mechanics*. North-Holland, Amsterdam [and Mir, Moscow (in Russian)].
4. Dmitry N. Zubarev. *Nonequilibrium Statistical Thermodynamics*. Consultants Bureau, New York [and Nauka, Moscow (in Russian)].
5. Kerson Huang. *Statistical Mechanics*. Wiley, New York.

Texts on specific subjects:

1. Radu Balescu. *Equilibrium and Nonequilibrium Statistical Mechanics*. Wiley, New York [and Mir, Moscow (in Russian)].
2. Mehran Kardar. *Statistical Physics of Particles*, Cambridge U. Press.
3. Lev D. Landau and Evgeny M. Lifshitz. *Statistical Physics: Part 1*. Vol. 5 in Series “Course of Theoretical Physics.” Elsevier, Amsterdam [and Nauka, Moscow (in Russian)].