ICFP M2 - Statistical physics: Advanced and New Applications
Some selected references

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These references may be updated during the semester.

For the first four lectures and three problems classes, which focus on stochastic dynamics, see:

- G. Biroli, *Slow Relaxations and Non-Equilibrium Dynamics in Classical and Quantum Systems* Lecture Notes of the Les Houches Summer School 2012: Volume 99 (2016), until pg 23. (https://arxiv.org/abs/1507.05858).
- A comprehensive discussion on Langevin equation and associated field theory can be found in A. Kamenev book "Field Theory of Non-equilibrium Systems", Chapter 4.
- To know more on discretization and Ito vs Stratonovich, you can look in particular Leticia F. Cugliandolo, Vivien Lecomte "Rules of calculus in the path integral representation of white noise Langevin equations: the Onsager-Machlup approach", Sec. 2.2.1, 2.2.2 and appendix.
- To know more on path integrals and quantum mechanics, see the book "Path Integrals in Quantum Mechanics" by Zinn-Justin. The book by Feynman (the inventor of path integrals!) and Hibbs provides also a very nice introduction ("Quantum Mechanics and Path Integrals").
- To know more on stochastic thermodynamics, see U. Seifert, "Stochastic thermodynamics, fluctuation theorems, and molecular machines" Rep. Prog. Phys. **75**, 126001 (2012), https://arxiv.org/abs/1205.4

For the lectures on phase transitions, see:

- The corresponding chapters in the book "Principles of condensed matter physics" by P. Chaikin, T. Lubensky.
- A nice, pedagogical and general discussion on renormalization group theory is provided in "A hint of renormalization" by B. Delamotte, Am.J.Phys. **72** (2004) 170-184, https://arxiv.org/abs/hep-th/0212049. If you want to know more, especially on non-perturbative renormalization group, see https://arxiv.org/pdf/cond-mat/0702365.pdf by the same author.
- For topological defects, see the corresponding chapter of Chaikin and Lubensky's book (in particular, you will find there a nice discussion of homotopy classes and more general examples of topological defects). For detailed analysis of the XY model, see Vol. 1, chapter 4 of "From Brownian motion to renormalization and lattice gauge theory" by Itzkynson and Drouffe.
- For critical dynamics see J. Cardy's book on Scaling and Renormalization in Statistical Physics.
- For slow dynamics due to quench across phase transitions, see chap. 4 of G. Biroli, *Slow Relaxations and Non-Equilibrium Dynamics in Classical and Quantum Systems* Lecture Notes of the Les Houches Summer School 2012: Volume 99 (2016). (https://arxiv.org/abs/1507.05858).

On information theory and related interdisciplinary applications of statistical physics, see:

- B. Bialek, Biophysics: searching for principles, Princeton University Press (2012), Secs 6.1, 6.2.

- The original Shannon paper: C. E. Shannon, A mathematical theory of communication, Bell Syst. Tech. J. 27, 623 (1948), available at http://affect-reason-utility.com/1301/4/shannon1948.pdf.
- The book by D. McKay, Information Theory, Inference, and Learning Algorithms, available at http://www.inference.org.uk/itprnn/book.pdf.
- The book by Marc Mézard and Andrea Montanari: Information, Physics, and Computation.

For the lectures on thermalization, see:

- Chap. 3 of G. Biroli, *Slow Relaxations and Non-Equilibrium Dynamics in Classical and Quantum Systems* Lecture Notes of the Les Houches Summer School 2012: Volume 99 (2016).