Seminar Statistical Physics

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Summer term 2021

Preliminaries

This the preliminary plan of the seminar. Each talk shall be hold by one or two students. The total time of a talk is 90 minutes, but we need time for questions, discussions, etc.. Therefore, please prepare the talk for 60 minutes or less.

For each talk, a tutor will be available, see below.

You may use the black board, slides, etc., whatever means of presentation may be suitable. Please prepare a summary of your talk, three to five pages, for the other participants, where you mention as well the literature you used.

Please provide, if possible, the mathematical background of your talk. Often in statistical physics proofs for certain statements are known. You should present the theorem and its preconditions. You may sketch the proof if this is important and understandable for the participants.

The topics are in most cases too large for a 60 minutes talk, therefore feel free to specialise to a certain subtopic you are interested in. Its your talk, therefore you are setting the focus. The literature given below is always too much for a 60 minutes talk. It is intended to give you a broad background. Please make your choice. You may as well take different literature.

Talks, topics, dates (still preliminary)

16.4.2021 Preliminary discussion and introduction

23.4.2021 Ising model and renormalisation. (3) Tutor: Giacomo Bighin

- John Cardy, Scaling and Renormalization in Statistical Physics. Cambridge Lecture Notes in Physics, Vol 5.

30.4.2021 Quantum Spin Models, Heisenberg etc. (2) Tutor: Markus Schröfl

- John Parkinson, Damian J J Farnell: An Introduction to Quantum Spin Systems. Springer Berlin Heidelberg 2010

7.5.2021 Hubbard model. (3) Tutor Giacomo Bighin

- Many-Body Physics: From Kondo to Hubbard, http://www.cond-mat.de/events/correl15/manuscripts/correl15.pdf, esp the article The Hubbard Model and its Properties by Andreas Mielke.

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14.5.2021 Mermin-Wagner-Theoren, (3) Tutor: Markus Schröfl

- N.D. Mermin and H. Wagner, Phys. Rev. Lett. **17**, 1133 (1966)
- D. K. Ghosh, Phys. Rev. Lett. **27**, 1584 (1971)
- T. Koma and H. Tasaki, Phys. Rev. Lett. **68**, 3248 (1992)

21.5.2021 Bose-Einstein condensation. (3) Tutor Giacomo Bighin

- E. A. Cornell and C. E. Wieman, Rev. Mod. Phys. **74**, 875 (2002)
- http://www.nobelprize.org/nobel_prizes/physics/laureates/2001/index.html

28.5.2021 Kosterlitz Thouless Transition, (1) Tutor: Markus Schröfl

- tba

4.6.2021 Monte-Carlo simulation. (3) Tutor: Giacomo Bighin

- Kurt Binder (ed.): Monte Carlo methods in statistical physics. Springer, Berlin [u.a.] 1979

11.6.2021 Boltzmann equation, H-Theorem (3) Tutor: Markus Schröfl

- Stewart Harris, An Introduction to the Theory of the Boltzmann Equation. Dover 2004
- Cédric Villani, Théorème vivant, Bernard Grasset, Paris 2012 (also available in German or English translations)

18.6.2021 Arrow of time (2) Tutor Giacomo Bighin

- Heinz-Dieter Zeh, The physical basis of the direction of time. Springer, Berlin, Heidelberg 2007
- Lazarovici and Reichert (2020)
- Goldstein et al (2016).

25.6.2021 Stochastic systems (2) Tutor: Markus Schröfl

- Hannes Risken, The Fokker-Planck Equation. Springer, Berlin, Heidelberg, New York 1989.
- Zeev Schuss, Theory and Applications of Stochastic Processes. Springer, Berlin, Heidelberg, New York 2009.

2.7.2021 Stochastic systems, esp. in environmental Physics (3) Tutor Giacomo Bighin

- tba

9.7.2021 Self organisation, pattern formation. (3) Tutor: Markus Schröfl

- D. Walgraef, Spatio-Temporal Pattern Formation, Springer-Verlag Berlin, Heidelberg, New York 1996.
- H. Haken, Synergetics. Springer-Verlag Berlin, Heidelberg, New York 1978 (good introduction, but not deep enough)

16.7.2021 Final discussion

Tutors:

- Giacomo Bighin <bighin@thphys.uni-heidelberg.de>
- Markus Schröfl <schroefl@thphys.uni-heidelberg.de>