

# Seminar Statistical Physics

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Summer term 2018

## Preliminaries

This is the preliminary plan of the seminar. Each talk shall be held 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. In 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

**17.4.2018** Preliminary discussion and introduction

**24.4.2018** Ising model and renormalisation. Tutor: Javier Rubio

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

**8.5.2018** Potts model, Percolation, Polymers on lattices. Tutor: Stefan Flörschinger

- F. Y. Wu, Rev. Mod. Phys. **54**, 235 (1982)
- B. Bollobas, O. Riordan, Percolation. Cambridge University Press 2006
- D. Stauffer, A. Aharony, Introduction to Percolation Theory. Taylor & Francis 1991 (2nd. Edition)
- J. B. Kogut Rev. Mod. Phys. **51**, 659

**15.5.2018** Quantum Spin Models, Heisenberg etc. Tutor: Javier Rubio

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**22.5.2018** Hubbard model. Tutor A. Mielke

- 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.

**29.5.2018** No Seminar

**5.6.2018** Mermin-Wagner-Theorem, Kosterlitz Thouless Transition, Tutor: Stefan Flörchinger

- 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)

**12.6.2018** Bose-Einstein condensation. Tutor Nicolo Defenu

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

**19.6.2018** Strongly correlated Bosons. Tutor: Stefan Flörchinger

- tba

**26.6.2015** Anderson localisation. Tutor: Javier Rubio

- P. A. Lee and T. V. Ramakrishnan, Rev. Mod. Phys. **57**, 287 (1985)
- F. Evers and A. D. Mirlin Rev. Mod. Phys. **80**, 1355 (2008)
- [http://www.nobelprize.org/nobel\\_prizes/physics/laureates/1977/](http://www.nobelprize.org/nobel_prizes/physics/laureates/1977/)

**3.7.2018** Monte-Carlo method. Tutor Nicolo Defenu

- D. P. Landau, K. Binder, A Guide to Monte Carlo Simulations in Statistical Physics 2013 (3rd Edition)

**10.7.2018** Self organisation, pattern formation. Tutor: Stefan Flörchinger

- 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)

**17.7.2018** Physics of Self-Propelled Particles. Tutor Nicolo Defenu

- H. Levine, W.-J. Rappel, and I. Cohen, Phys. Rev. E **63**, 017101 (2000)
- E. Bertin, M. Droz, and G. Grégoire, Phys. Rev. E **74**, 022101 (2006)
- A. Czirók and T. Vicsek, Physica A **281**, 17 (2000)

**24.7.2018** Final discussion

**Tutors:**

- Nicolo Defenu, [defenu@thphys.uni-heidelberg.de](mailto:defenu@thphys.uni-heidelberg.de)
- Stefan Flörchinger, [floerchinger@thphys.uni-heidelberg.de](mailto:floerchinger@thphys.uni-heidelberg.de)
- Javier Rubio, [j.rubio@thphys.uni-heidelberg.de](mailto:j.rubio@thphys.uni-heidelberg.de)