PHYS 614 – Statistical Physics II – Spring 2020

**Coordinates**

The class meets Tuesdays and Thursdays, 14:00 - 15:50 as a Zoom online meeting.

Course website (Canvas): [https://canvas.uoregon.edu/courses/158507](https://canvas.uoregon.edu/courses/158507). Lecture notes and problem sets will be posted on the Canvas site. Class-wide announcements will be made through Canvas Announcements. The Modules page will be periodically updated with the topics to be covered and the readings for the coming week.

**Instructor**

Jayson Paulose  
Office: 454 Willamette Zoom meeting room  
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Office hours: Wednesdays 12:30 – 13:30, or by appointment

**Teaching Assistants**

Wenqian Sun  
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Office hours: TBD

Nathan Villiger  
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**Description**

This is the second course in the graduate sequence on statistical physics. It builds on material introduced in PHYS 613, which is a prerequisite for this course.

**Course objectives**

We will study advanced topics in statistical mechanics and their applications to a variety of fields of physics.
Upon completion of this course, students will have knowledge of the following topics:

- Quantum statistical mechanics (8 lectures)
  - Motivations: Diatomic gas
  - Fundamentals
  - Ideal Bose gases: Bose-Einstein condensation, photons, phonons
  - Ideal Fermi gases: White dwarf stars, Pauli paramagnetism
- Interacting systems (3 lectures)
  - Imperfect gases
  - The Ising model
- Phase transitions (4 lectures)
  - Mean-field theory
  - Landau theory
- Nonequilibrium statistical mechanics (4 lectures)
  - Brownian motion and diffusion
  - Langevin and Fokker-Planck equations

Materials

Readings will be assigned from the following sources. See the Links to online course materials page on Canvas to find all electronic resources in one place.

- Statistical Physics of Particles, by Mehran Kardar (CUP, 2007). (Available as online lecture notes)
- David Tong's lecture notes
- Michael Cross's lecture notes

Coursework and evaluation

Lectures will be held as Zoom meetings, and will be made available as recordings on Canvas. Lectures will include activity sheets which are expected to be tackled during the lecture session (with online collaboration in small groups).

Each week, readings will be posted in advance on Canvas. They will provide relevant material for the week’s lectures, and doing the readings ahead of time will make the in-class activities more accessible and useful.

Grades will be assigned according to the following mix:

- Problem sets: 50%
- Midterm: 20%
- Final: 30%
Problem sets will be assigned roughly each week, typically on Thursdays, and will be due before the start of class the following Thursday as an online submission via Canvas. Your lowest problem set score will be dropped in calculating the final grade. There will likely be a problem set due during the last week of classes.

The midterm will be a take-home exam, to be completed over two hours during a 24-hour period during Week 5 (exact date TBD). If it helps your grade, your score on the midterm can be replaced by your score on the final (i.e. the final will count for 50% of the grade).

The final will be a take-home exam, and will be due during finals week.

Inclusivity

I take my responsibility to create inclusive learning environments seriously. Please notify me if there are aspects of this course that result in barriers to your participation. For more information or assistance, you are also encouraged to contact the Accessible Education Center, 164 Oregon Hall, 346-1155; website: http://aec.uoregon.edu/

Course policies

- You are strongly encouraged to participate in the online class meetings and in the activities.
- Collaborating on the homework is allowed and encouraged. However, you have to turn in your own work. It is up to you to make sure that you understand the material independently. You will not be able to collaborate on the exams.
- Much of the points on homework and exams will be assigned for the arguments leading up to the final answer. You will be expected to show your work and demonstrate that you understand the steps involved.
- The teaching assistants will be involved in grading your coursework. If you have any concerns about this, please discuss the matter with me.
- Make-up exams will not be given unless previously discussed.

Academic integrity

It has become quite easy to find solutions to homework problems online. Use of these solutions or similar materials is not allowed: it goes against the pedagogical purpose of graduate school, is unfair to your classmates, and violates the University Student Conduct Code (available at http://conduct.uoregon.edu).