Syllabus

Physics 551: Statistical Physics

Department of Physics & Astronomy, University of Tennessee
Fall 2004

Hours: Tuesdays and Thursdays, 3:40-4:55 pm
Classroom: Physics 512
Instructor: Dr. Zhenyu Zhang
Office: 505 Nielsen Physics Bldg.
Phone: 974-4553 or 576-5346 or 300-6330
Email: zhangz@ornl.gov
Co-Instructor: Dr. Kalman Varga
Office: 505 Nielsen Physics Bldg.
Phone: 974-4553, or 574-5785
Email: vargak@ornl.gov
Office hours: Tuesday and Thursday, 2:30-3:30pm, or by appointment.
Second edition paperback ISBN 0 7506 2469 8
Prerequisites: A reasonable mastery of basic thermodynamics and quantum mechanics is assumed.

Brief course description:
This course introduces the statistical foundation of thermodynamics. Statistical mechanics is relevant whenever the number of particles in a system is large, and therefore plays an important role from the beginning of the history of the universe to the most recent developments in condensed matter physics and beyond. This is a core course intended for all physics graduate students at The University of Tennessee. The material covered is at a more advanced level than the typical undergraduate course on the same subject.

Specific topics and tentative lecture schedule:

1. Basic concepts and statistical basis of thermodynamics (Pathria Ch. 1 and other reference books) (8/19, 8/24, 8/26)
2. Elements of ensemble theory (Ch. 2) (8/31)
3. The canonical ensemble (Ch. 3) (9/2, 9/7, 9/9, 9/14)
4. Grand canonical ensemble (Pathria Ch. 4) (9/16)
5. Formulation of Quantum statistics (Ch. 5) (9/21, 9/23)
   Midterm Exam (2 hours) (9/28)
6. Simple gases (Ch. 6) (9/30, 10/5, 10/7)
7. Ideal Bose systems (Ch. 7) (10/12, 10/19, 10/21)
   Special Lecture: Current Research on Bose-Einstein condensation (10/26)
8. Ideal Fermi systems (Ch. 8) (10/28, 11/2, 11/4)
   Special Lecture: “Electronic growth” of metallic nanostructures (11/9)
9. Interacting systems (Ch. 9) (11/11, 11/16, 11/18)
   Special Lecture: Monte Carlo methods in film growth (11/23)
   Reviews (11/30, 12/2)
   Final Exam (2 hours) (12/7)

**Grading Scheme:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Points</th>
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<tbody>
<tr>
<td>Homework</td>
<td>30</td>
</tr>
<tr>
<td>Midterm Exam</td>
<td>30</td>
</tr>
<tr>
<td>Final Exam</td>
<td>40</td>
</tr>
<tr>
<td>Maximum score</td>
<td>100</td>
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Homework is an extremely important part of the course. Statistical mechanics is abstract, mathematical, fun, and challenging. Only by solving problems and thinking about the concepts of the course will you arrive at a solid understanding. Homework assignments will be handed out every Thursday and must be turned in one week later. The homework will be graded, each assignment on a 2-5 scale (0 if you fail to turn in an assignment).

The midterm exam will be open book, for two hours, on materials up to Chapter 5.

The comprehensive final exam will be closed book, for two hours, covering materials from Chapters 6-9.

You are strongly encouraged to see either of the instructors regularly to discuss your progress. You are also welcome to send your questions and comments by email, which will be responded within 24 hours.