

## SYLLABUS

### **Physics 715 Statistical mechanics Spring, 2000**

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|--------------|------------------------------------|
| Instructor:  | Associate Prof. Andrey V. Chubukov |
| Address:     | B307 Sterling                      |
| Office hours | Tu,Th 5-6pm.                       |
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*Text:* L.D. Landau, E.M. Lifshitz Statistical Physics, Pergamon Press, 1980; Kerson Huang Statistical Mechanics, John Wiley & Sons, Second Edition; Both textbooks are available for purchase in the University Bookstore and are on reserve at the Physics Library.

#### Tentative Schedule of Topics

|             |   |
|-------------|---|
| 1/24 - 1/31 | Introduction. Fundamental Principles of Statistical Physics. HUANG \$\$ 1.1, 1.4, 6.1, 6.2; LANDAU \$\$ 1-3, 7, 8 |
| 2/2 - 2/11  | Thermodynamic variables. The laws of Thermodynamics. HUANG \$\$ 1.2, 1.3, 1.5-1.7; LANDAU \$\$ 9-16, 19-21, 23-24 |
| 2/14 - 2/21 | Gibbs and Maxwell distributions. HUANG \$\$ 4.1-4.2; LANDAU \$\$ 28, 29, 31, 35, 36                               |
| 2/23 - 3/1  | Equilibrium state of a dilute gas. Magnetism of gases. HUANG \$\$4.1-4.5; LANDAU \$\$ 38-44, 52                   |

|             |  |
|-------------|--|
| 2/21 - 2/28 | Mid-term exam  |
| 3/3 - 3/31  | Quantum gases. Fermi and Bose gases. Magnetism of electronic gas. Imperfect Fermi gas. Superfluidity. Liquid He. HUANG §§ 11.1-11.7, 12.1-12.5, 13.1-13.8; LANDAU §§ 53-60, 62, 63 |
| 4/3 - 4/10  | Nonideal gases. Van-der-Vaals formula. Liquid-gas transition. HUANG §§ 2.2, 2.3; LANDAU §§ 74, 76, 81, 83, 84  |
| 4/10 - 4/17 | Mid-term exam  |
| 4/12 - 4/21 | Magnetism. Mean-field theory. HUANG §§ 14.1, 14.3, 16.1, 16.3  |
| 4/24 - 5/10 | Phase transitions and Critical Phenomena. Landau theory. Scaling approach. Critical exponents. HUANG §§ 16.4, 16.5, 17.1-17.4, 17.8, 17.9, 18.1-18.7; LANDAU §§ 142-150            |
| 5/10 - 5/17 | FINAL EXAM   |

### Three credit students

1. Exams. Each three-credit student will take a total of three exams (including the final exam). Each mid-term exam will have 3 questions, final exam will have 5 questions. Exam dates are listed on the Schedule of Topics. The dates are tentative and are subject to change. Exams will cover the assigned lectures. Approximately 2/3 of the questions will be drawn from Huang and Landau textbooks, others will be drawn from lectures.

2. Problem Sets. There will be 4 problem sets, each set will have 6-10 problems and will be due in three weeks.

3. Grades Each solution will be graded on the conventional (A-F) grading system. Valid grades are **A** - 5 points, **AB** - 4 points, **B** - 3 points, **BC** - 2 points, **C** - 1 points **D** - 0.5 points, and **F** - 0 points. The total grades for mid-term exams will be based on the following scheme: **A** - 15-13 points, **AB** - 12-11 points, **B** - 10-9 points, **BC** - 8-7 points, **C** - below 7 points. For the final exam, the total grades will be as follows **A** - 25-22 points, **AB** - 21-19 points, **B** - 18-16 points, **BC** - 15-13 points, **C** - below 13 points. The final grade for the course will be based on the mid-term exams (30% each), and on the final exam (40%).

Besides, to get **A** or **AB**, one should present solutions for **all** four homesets and collect more than 66% of the maximum total number of points graded on the same system. To get **B**, one should collect more than 50% of the maximum total number of points.

4. Class attendance is required.