

Astronomy 115 – Statistical Mechanics & Astrophysics

Instructor: Prof. T. Do
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Lecture Times: MWF 2:00 - 2:50 PM **Lecture Room:** 2748 PAB
Section Times: F 3:00 - 3:50 PM **Section Room:** 167 DODD
Required Textbook: “*Thermal Physics(2nd)*”, by Kittel and Kroemer

Introduction: Statistical Mechanics is the application of classical and quantum mechanics to large systems in order to derive the macroscopic behavior of matter. The term statistical mechanics comes from the fact that large systems cannot be solved exactly and we must instead deal with statistical behavior without concern about individual particles. Large systems also exhibit behavior not found for individual particles and we will deal with new macroscopic quantities such as temperature and entropy. Since astronomy deals with very large systems, only through statistical mechanics and its offshoot thermodynamics can we understand stellar interiors, planetary atmospheres, interstellar gas, and a slew of other astrophysical environments. At the same time, astrophysical observations of objects such as white dwarfs and neutron stars feed back into our understanding of fundamental physics.

Grades: Grades will be based on one midterm, a final exam and 8 homework sets. Homework will be due Friday’s at the start of class. I will accept one late homework (no later than the following Monday) from each person.

Homework (8)	35%
Midterm (Feb 10, in class)	25%
Final (Mar 14, 11:30am -2:30pm)	40%

Total	100%
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Approximate Course Schedule

Week of	Topics	Comments	Chapters in Kittel
Jan. 4	Intro, State of a system & Statistics		1 and 2
Jan 11	Boltzmann Distribution, Ideal Gas		3
Jan 18	Applications and Blackbody Radiation	Holiday on Monday	4
Jan 25	Chemical Potential		5 and parts of 8
Feb 1	Macroscopic Thermo and Stellar Interiors		5 and parts of 8
Feb 8	Astrophysical Applications	Midterm on Feb 10	5
Feb 15	Quantum Statistics Degenerate Matter	Holiday on Monday	6
Feb 22	Equilibrium between species		7
Feb 29	Kinetic Theory and phases		9, 10 and 14
Mar 7	Reactions and the SAHA equation		9
Mar 14	No lectures	Final Mar 14 11:30am- 2:30pm	