

Astronomy 4303

Introduction to Astrophysics

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Office Hours: drop in or make appointment

Class Meets: MWF 9:30 - 10:30, 103 NH

Text: *An Introduction to Stellar Astrophysics*, by Francis LeBlanc

On Library Reserve:

Undergraduate Texts:

Stellar Interiors, by C. J. Hansen and S. D. Kawaler

Astrophysics I: Stars, by R. Bowers and T. Deeming

Introduction to Stellar Atmospheres and Interiors, by E. Novotny

Structure and Evolution of the Stars, by M. Schwarzschild

Fundamentals of Statistical and Thermal Physics, by F. Reif

Graduate Texts:

Stellar Atmospheres, by D. Mihalas

Principles of Stellar Evolution and Nucleosynthesis, by D. Clayton

Stellar Structure and Evolution, by R. Kippenhahn and A. Weigert

Stellar Structure, by S. Chandrasekhar

Radiative Transfer, by S. Chandrasekhar

Web Resources:

Radiative Transfer in Stellar Atmospheres R. Rutten available on the Web, (you can print it from [the original version on Rob Rutten's web page](#)).

Stellar Atmospheres, D. Mihalas, (New York: Freeman) 1977.

This book is out of print, but is in the library and is available [here \(part 1\)](#) and [here \(part 2\)](#).

The course serves as an introduction to the physics of stars and stellar systems. The course will consist of lectures, inclass work, (10%), homework (25%), two mid-term examinations (40%), and the final exam (25%).

The goal of inclass work is to foster active learning. Inclass work will consist of a variety of assignments, such as reading quizzes, “clicker” type questions (quick multiple choice quizzes), presentation of homework problems, (short, ~ 5 minute) impromptu presentations, group work, etc. Exams will be based on homework and inclass work.

The book this course is at a significantly lower level than the books I have used in the past, so I will supplement it with some readings with the books that are on reserve. Also, it takes a different order to the classical interiors/atmospheres division, which I will follow. The exams will be at the higher level of the course, rather than the level of the book problems, but there will be a mixture. I expect that “A” work will be at the higher level than of the book.

Attached is a *very* tentative schedule. This is meant to be a rough guide to give you an idea as to where you should be reading, and roughly what material will be covered on each exam. The dates of the midterm exams are firm and not tentative. The final exam will be comprehensive. Graduate students will do an extra project. Undergraduates can do the project for extra credit.

Possible projects are: Henyey code, Stellar evolution with MESA, variable Eddington factor radiation transfer code, White dwarf or neutron star structure (including GR). Other suggestions as we go along, including non numerical projects.

Tentative Schedule

Dates	Topic	Reading
Aug 18	Preliminaries	Chap 1
Aug 20	HSE	Chap 1
Aug 22	Virial Theorem	Chap 1
Aug 25	Time Scales	Chap 2
Aug 27	Pressure and Mean Molecular Weight	Chap 2
Aug 29	Jeans Mass and Star Formation	Chap 2
Sep 1	Labor Day Holiday	
Sep 3	Boltzmann Factors and Intro to Saha	Chap 2
Sep 5-15	Intro to Radiative Transfer	Chap 3 and notes
Sep 17-19	Sources of Opacity	Chap 3 and notes
Sep 21-Oct 3	Stellar Atmospheres	Chap 4 and notes
Oct 6	Mid-term Exam #1	
Oct 8	Convection, Constant Density Model	Chap 5
Oct 10	OU-Texas Holiday	
Oct 13-17	Equations of Stellar Structure and Polytropes	Chap 5
Oct 20-24	Numerical Methods	Hansen & Kawaler Chap 7.2.2-7.2.6 and notes
Oct 27	Maxwell Boltzmann Distribution and the Boltzmann Formula	Chap 5 and notes
Oct 29	Ideal Gas EOS	Chap 5
Oct 31	Fermi-Dirac EOS	Hansen & Kawaler Chap 3.5
Nov 3-5 hline Nov 7	Review Midterm Exam #2	
Nov 10	The Sun	Chap 5 and Hansen & Kawaler Chap 8
Nov 5-10	Variable Stars and Astroseismology	Chap 5
Nov 12-17	Reaction Rates	Chap 6
Nov 19	p-p and CNO Burning	Chap 6
Nov 21-23	Helium to Fe Burning	Chap 6
Nov 26-28	Thanksgiving Holiday	
Dec 1	Neutrino Emission	Chap 6
Dec 3	Special Topics	Chap 7
Dec 5	Review	
Dec 12	Final Exam (8:00am)	

Note:

Any student in this course who has a disability that may prevent him or her from fully demonstrating his or her abilities should contact me personally as soon as possible so we can discuss accommodations necessary to ensure full participation and facilitate your educational opportunities.