

Stars and the Galaxy (AST 6215) Syllabus

- Fall 2022

Instructor

Rana Ezzeddine

Email

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Class Location & time

Bryant Space Science
Center, room 003

MWF - 1:55pm -2:45pm

Office Hours

Tuesdays 3-4pm, or by
email appointment

Office

Bryant Space Science
Center, office 324

Course Overview

This course is intended to give you a solid foundation in the subject of stellar structure and their properties, and how it relates to our understanding of the Milky Way Galaxy specifically, and other galaxies in general. The course will cover the observable properties, structure, composition, as well as, evolution and death of stars — in light of the resounding successes of modern physics. It brings together elements from almost every subfield of physics (from atomic and nuclear physics, through to classical mechanics and relativity) allowing us to understand stars, which lie at the core of our understanding of all major areas of Astrophysics.

Course Pre-requisites

In addition to a general familiarity with astronomy at the introductory level, this course requires knowledge of calculus, differential equations, as well as basic knowledge of thermodynamics, atomic and nuclear physics.

Suggested Textbooks, Online notes and Software

Non-exhaustive, but sufficient information will be presented by slides during the talks. The slides will be made available on Canvas before class, along with any additional materials or papers discussed in class. Below are some additional recommendations for reading materials:

1- “Stellar Interiors” by C.J. Hansen, Kawaler, & Trimble, 2nd edition, Springer publication.

2- “Stars and Stellar Processes” by M. Guidry, 1st edition, Cambridge University Press publication.

3- “Stellar Structure and Evolution” by R. Kippenhahn & A. Weigert, 1990, Springer-Verlag publication.

4- “Stellar Structure and Evolution” by Onno Pols (**available free online** https://www.astro.ru.nl/~onnop/education/stev_utrecht_notes/)

Course Objectives

This course is one of several core courses required in the graduate astronomy curriculum but is also open to interested students in other departments. We will discuss both the theoretical and observational aspects of the topic. In all facets of the course, relevant journal articles from the active research in the literature will be used to augment and extend the topics discussed in lecture. During the course we will aim to:

- understand the global properties of stars: energies and timescales
- study the micro-physics relevant for stars: the equation of state, nuclear reactions, energy transport and opacity
- derive the equations necessary to model the internal structure of stars
- examine (quantitatively) the properties of simplified stellar models
- survey (mostly qualitatively) how stars of different masses evolve, and the endpoints of stellar evolution (white dwarfs, neutron stars, etc..)
- discuss a few ongoing research areas in stellar evolution
- place stars in the context of the Milky Way Galaxy, to understand its structure, formation and evolution via stars.

Course Schedule (Provisory)

Week	Subject
Week 1 (08/24 - 08/26)	Basic concepts, Observable quantities, Fundamental equations
Week 2 (08/29 - 09/02)	Stellar Structure equations I
Week 3 (09/05 Holiday , 09/07 - 09/09)	Stellar Structure equations II
Week 4 (09/12 No Class , 09/12 - 09/16)	Energy transport in stars, Radiative transfer
Week 5 (09/19 - 09/23)	Stellar atmospheres
Week 6 (09/26 - 09/30)	Nuclear burning processes and element formation in stars
Week 7 (10/03 - 10/07)	Stellar models, Evolution of stars: Massive stars
Week 8 (10/10 - 10/14)	Evolution of stars: Low and Intermediate mass stars
Week 9 (10/17 - 10/21)	End lives of stars & Compact Objects
Week 10 (10/24 - 10/26, Midterm10/28)	Star formation, Stellar clusters and moving groups
Week 11 (10/31 - 11/04)	Dwarf galaxies, Stellar streams
Week 12 (11/07 - 11/09, 11/11 Holiday)	Milky Way Galactic stellar populations
Week 13 (11/14- 11/18)	Galaxy formation and Galactic structure I
Week 13 (11/21-11/25 No Classes)	
Week 14 (11/28 - 12/02)	Galaxy formation and Galactic structure II
Week 15 (12/05 - 12/07)	Recap and conclusions

Grading & Class Expectation

Information on UF grading policy may be found at: <https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/>

Assignment	Percentage of Final Grade
Midterm Exam	30.00 %
Assignments (6-7 total)	30.00 %
Review Paper Lectures	20.00 %
Final Project	20.00 %

Your final grade will be divided between (~biweekly) assignments, a midterm exam, review paper lectures (see below) and a final project.

Homework assignments (estimated at ~6-7 in total) will be posted on Canvas, and are due two weeks later. Point assignments will be associated with each problem. Assignments must be completed on time to receive full credit. Partial credit will be assigned where work has been carried out. Assignments handed in after the graded, corrected projects have been distributed out to the rest of the class will not be accepted.

A midterm exam, covering all material covered in class before the date of the exam, is scheduled on 10/28 (total time ~1.5 hours).

Oral and written communication skills are very important for a scientist. You will thus be required to present an in-class review lecture, as well as a summary paper (5-10 pages) on a topic related to stellar physics. The Annual Reviews of Astronomy & Astrophysics is a good place to look for topics. Your chosen topic must be approved before midterm. You should submit a rank-ordered list of preferred articles to present, two weeks before the midterm. Paper assignments and presentation dates will be assigned immediately following. Presentations will take place every Friday, right after midterms. Each presentation is expected to last roughly 20 minutes if carried out interruption free. A grading rubric will be assigned.

A final project will be provided and explained in class, one month before the final grades are due.

Attendance Policy

Class attendance is expected. Excused absences must be consistent with university policies in the Graduate Catalog <https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/>

Other University Policies and Information

1. Students Requiring Accommodation

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is

important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

2. UF Evaluation process

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

3. University Honesty Policy

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

4. Campus Resources:

Health and Wellness

U Matter, We Care:

If you or a friend is in distress, please contact umatter@uf.edu or 352 392-1575 so that a team member can reach out to the student.

Counseling and Wellness Center:

<http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Assault Recovery Services (SARS):

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or

<http://www.police.ufl.edu/>.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@uf.edu.

<https://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling.

<https://www.crc.ufl.edu/>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.
<https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.
<https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.