

# Essentials of Astrophysics

## Syllabus

### I. Course Information

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AST 4211

Spring 2023

Meeting Day/Time: M/W/F 4:05 p.m. – 4:55 p.m.

Location: BRT 0003 (Bryant Space Science Center – Room 3)

#### **Instructor**

Paul Torrey – [paul.torrey@ufl.edu](mailto:paul.torrey@ufl.edu)

Office location: 310 Bryant Space Sciences

Office hours: TBD based on class poll

Office hours location: 310 Bryant Space Sciences Center

Phone: (352) 294-1846

The preferred method for contacting the instructor is via the canvas messaging system. There are multiple reasons for this, but in particular: (i) it keeps all class related matters in the same location, (ii) it is a (more) secure messaging platform.

#### **Course Description**

This course is about the astrophysics of stars, galaxies, and cosmology. The course will accordingly be split roughly into three sections, each with a primary focus on stars, galaxies, and cosmology, respectively. Each module of the course (roughly 1 week in duration) will be accompanied by one homework assignment. There will be three in class tests corresponding to the Stars, Galaxies, and Cosmology sections. Additionally, at the culmination of each course section, we will read and discuss a published research or review paper in a journal club like setting. The course outline below lists the topics as well as approximate lecture dates in relation to chapters in the relevant textbooks.

#### **Required Course Materials (to purchase/rent)**

- *Extragalactic Astronomy and Cosmology*, Peter Schneider, Springer, ISBN: 9783540331759
- *An Introduction to Modern Astrophysics*, B.W. Carroll & D.A. Ostlie, Addison-Wesley, ISBN: 9781108422161

#### **Statement on Materials and Supplies Fees**

N/A

## II. Coursework & Schedule

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### 1. List of Graded Work

Work	Description	Points
Problem Sets	Problem sets (estimated at 12 in number; 4 per section; see weekly schedule for details) including physical calculations and analysis. One problem set will be assigned with each course module (roughly 1 week in duration). Problem sets will assess student comprehension of the physical concepts covered in the course. Problem sets will be graded for accuracy. All problem sets must be submitted through the canvas website.	40
Exams	There will be three exams in this course: One for 'Stars'; one for 'Galaxies'; and one for 'Cosmology'. Each exam will be worth 15 per cent of your final grade. The tests are designed to assess student comprehension of the physical concepts covered in the course, and will feature topics from lecture, problem sets, and course meetings. Exams will be graded for accuracy.	45
Journal Club Discussions	At the end of each course section, we will have a journal club discussion. Students will be assigned a paper to read, and are expected to show up to class prepared to discuss the paper. The goal of Journal Club Discussions is to give students 'real world' context to the topics that are being explored in this class, as seen in modern/present-day research papers. Grades will be assigned based on (i) student participation, (ii) demonstrated comprehension of the paper, and (iii) linking the paper back to course topics.	15

The course canvas site will make clear all assignment dates and deadlines. Any questions about deadlines should be directed to the Instructor, ideally through the course Discussion pages.

## 2. Weekly Course Schedule

Week/ Date	Topic	Text Sections	Homework: Reading & Activities for Before Class	Assigned Work Due
Week 1 (1/9 – 1/13)	Describing Stellar Light	C&O, Ch. 3.2, 9.1	Reading is assigned via canvas.  Pre-recorded lectures are available.  Problem Set #1 Assigned	
1/16	Holiday – No Class	Holiday – No Class	Holiday – No Class	Holiday – No Class
Week 2 (1/16-1/20)	Blackbody Radiation & Absorption Lines	C&O, Ch. 3.4-3.6, 5	Watch pre-recorded lectures and reading as assigned via canvas.  Problem Set #2 Assigned	Unit 1 Problem Set Due
Week 3 (1/23-1/27)	Stellar interiors: basic physics & structure	C&O, Ch. 8, 9, 10	Watch pre-recorded lectures and reading as assigned via canvas.  Problem Set #3 Assigned	Unit 2 Problem Set Due
Week 4 (1/30-2/3)	Energy Transport, Stellar Evolution, & Stellar Remnants	C&O, Ch. 12, 15, 16	Watch pre-recorded lectures and reading as assigned via canvas.	Unit 3 Problem Set Due
Week 5 (2/6–2/10)	Journal Club (2/6), Review/Discussion (2/8), Exam (2/10)	<b>The Origin of the Initial Mass Function</b> Bonnell, Larson, & Zinnecker	Read the Journal Club Paper and prepare for discussion  No New Problem Set  No Pre-class Quizzes	

Week/ Date	Topic	Text Sections	Homework: Reading & Activities for Before Class	Assigned Work Due
<b>Exam: 2/10</b>				
Week 6 (2/13-2/17)	Jeans Collapse, IMF, Kennicutt-Schmidt Relation	S, Ch. 2 & 3	Watch pre-recorded lectures and reading as assigned via canvas.  Problem Set #4 Assigned	
Week 7 (2/20-2/24)	Galaxy Scaling Relations, Closed Box Models	S, Ch. 3	Watch pre-recorded lectures and reading as assigned via canvas.  Problem Set #5 Assigned	Unit 5 Problem Set Due
Week 8 (2/27-3/3)	Stellar Feedback, Semi-analytic models of galaxy growth	S. Ch. 3, 5, 9	Watch pre-recorded lectures and reading as assigned via canvas.  Problem Set #7 Assigned	Unit 6 Problem Set Due
Week 9 (3/6-3/10)	AGN, CGM, Galaxy Evolution	S. Ch. 9	Watch pre-recorded lectures and reading as assigned via canvas.  Problem Set #8 Assigned	Unit 7 Problem Set Due
<b>Spring Break -- 3/13-3/17 -- (No Class or Assignments)</b>				
Week 10 (3/20-3/24)	Journal Club, Review/Discussion, Exam		Read the Journal Club Paper and prepare for discussion  No New Problem Set  No Pre-class Quizzes	Unit 8 Problem Set Due
<b>Exam: 3/24</b>				
Week 11	Fundamental Observables and	S. Ch. 4	Watch pre-recorded lectures and reading as assigned via canvas.	

<b>Week/ Date</b>	<b>Topic</b>	<b>Text Sections</b>	<b>Homework: Reading &amp; Activities for Before Class</b>	<b>Assigned Work Due</b>
(3/27-3/31)	composition of the Universe		Problem Set #9 Assigned	
Week 12 (4/3-4/7)	Cosmological Kinematics, Cosmological parameters	S. Ch. 4, 8	Watch pre-recorded lectures and reading as assigned via canvas.  Problem Set #10 Assigned	Unit 9 Problem Set Due
Week 13 (4/10-4/14)	Thermal History of Universe	S. Ch. 4	Watch pre-recorded lectures and reading as assigned via canvas.  Problem Set #11 Assigned	Unit 10 Problem Set Due
Week 14 (4/17-4/21)	Achievements & Problems w/ LCDM		Watch pre-recorded lectures and reading as assigned via canvas.  Problem Set #12 Assigned	Unit 11 Problem Set Due
Week 15 (4/24-4/26)	Journal Club, Review/Discussion		Read the Journal Club Paper and prepare for discussion  No New Problem Set  No Pre-class Quizzes	Unit 12 Problem Set Due
<b>Final Exam: 4/26</b>				

## III. Grading

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### 3. Statement on Attendance and Participation

#### Attendance and Participation:

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at: <https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/>

- Attendance itself is not a graded component of this class. Nevertheless, critical information will be disseminated through our class meetings. Thus, students are expected to either attend class, or otherwise obtain the material discussed during class.
- Students must be present to receive credit for their Journal Club discussion.
- The exams will be given in class, in the normal classroom, at the normally schedule class time. The dates of the exams are indicated in the course schedule in this syllabus.
- All assignments (homework, writing, and experiential learning labs) are due at 5 p.m. on the assigned due date. Students must submit completed assignments via canvas in the format specified in the assignment. Late assignments will generally not be accepted unless a documented reason is provided that qualifies under UF's approved/excused absences.

### 4. Grading Scale

For information on how UF assigns grade points, visit: <https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/>

A	90 – 100% of possible points		C	70 – 73.99%
A-	87 – 89.99%		C-	67 – 69.99%
B+	84 – 86.99%		D+	64 – 66.99%
B	80 – 83.99%		D	60 – 63.99%
B-	77 – 79.99%		D-	57 – 59.99%
C+	74 – 76.99%		F	<56.99

## IV. Required Policies

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### 11. Students Requiring Accommodation

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://disability.ufl.edu/>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

## **12. UF Evaluations 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/>.

## **13. 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.

## **14. Counseling and Wellness Center**

Contact information for the Counseling and Wellness Center: <http://www.counseling.ufl.edu/cwc/Default.aspx>, 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

## **15. The Writing Studio**

The writing studio is committed to helping University of Florida students meet their academic and professional goals by becoming better writers. Visit the writing studio online at <http://writing.ufl.edu/writing-studio/> or in 2215 Turlington Hall for one-on-one consultations and workshops.

## **16. In Class Recording**

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.