# Essentials of Astrophysics
## Syllabus

# I. Course Information

AST 4211

Spring 2021

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

Location: This class is being taught to two sections simultaneously. One is Online (100%), the other will meet in Turlington B310. Only students who are registered for our 'in person' section may attend in person. Any students, at any time, may choose to attend online. All students in both sections will have access to the exact same canvas site, will meet at the exact same time, will have all of the exact same assignments and examinations.

### Instructor

Paul Torrey – paul.torrey@ufl.edu

Office location: 310 Bryant Space Sciences

Office hours: M/W 5:10 – 6:00 p.m. (i.e. immediately after class).

Office hours location: All office hours will be held via zoom, even for those students who are registered for the 'in person' class. Unless otherwise posted, we will use the same zoom link used for the previous class. If you have an urgent or well justified need to meet face-to-face, please email the instructor and special arrangements will be made.

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

## 1. List of Graded Work

| Work | Description | Points |
|---|---|---|
| Problem Sets | Problem sets (12 in number; 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 |
| Class Prep Quizzes | Comprehension Quizzes will be assigned to ensure students have completed the assigned reading and/or lecture prior to coming to class. This is essential to facilitating classroom discussion, and is critical to the success of our HyFlex modality. Quizzes will be available via Canvas and have a strictly enforced deadline prior to the class/week when the material is to be discussed. Quizzes will be graded for accuracy. | 10 |
| 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. | 40 |
| 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. | 10 |

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<br>(1/11 – 1/15) | Describing Stellar Light | C&O, Ch. 3.2, 9.1 | Watch pre-recorded lectures and reading as assigned via canvas.<br><br>Problem Set #1 Assigned | Pre-class Quizzes. |
| 1/18 | Holiday – No Class | Holiday – No Class | Holiday – No Class | Holiday – No Class |
| Week 2<br>(1/18-1/22) | Blackbody Radiation & Absorption Lines | C&O, Ch. 3.4-3.6, 5 | Watch pre-recorded lectures and reading as assigned via canvas.<br><br>Problem Set #2 Assigned | Pre-class Quizzes.<br><br>Unit 1 Problem Set Due |
| Week 3<br>(1/25-1/29) | Stellar interiors: basic physics & structure | C&O, Ch. 8, 9, 10 | Watch pre-recorded lectures and reading as assigned via canvas.<br><br>Problem Set #3 Assigned | Pre-class Quizzes.<br><br>Unit 2 Problem Set Due |
| Week 4<br>(2/1-2/5) | Star formation, IMF, & Stellar Remnants | C&O, Ch. 12, 15, 16 | Watch pre-recorded lectures and reading as assigned via canvas.<br><br>Problem Set #4 Assigned | Pre-class Quizzes.<br><br>Unit 3 Problem Set Due |
| Week 5<br>(2/8–2/12) | Journal Club, Review/Discussion, Exam | **The Origin of the Initial Mass Function**<br>Bonnell, Larson, & Zinnecker | Read the Journal Club Paper and prepare for discussion<br><br>No New Problem Set<br><br>No Pre-class Quizzes | Unit 4 Problem Set Due |
| **Exam: 2/12** | | | | |

| Week/ Date | Topic | Text Sections | Homework: Reading & Activities for Before Class | Assigned Work Due |
|---|---|---|---|---|
| Week 6<br>(2/15-2/19) | Galactic definitions, composition of galaxies, and galaxy scaling relations | S, Ch. 2 & 3 | Watch pre-recorded lectures and reading as assigned via canvas.<br><br>Problem Set #5 Assigned | Pre-class Quizzes |
| Week 7<br>(2/22-2/26) | SMBHs, mass functions, stellar-to-halo mass | S, Ch. 3 | Watch pre-recorded lectures and reading as assigned via canvas.<br><br>Problem Set #6 Assigned | Pre-class Quizzes.<br><br>Unit 5 Problem Set Due |
| Week 8<br>(3/1-3/5) | KS Relation, Feedback regulated SF, AGN | S. Ch. 3, 5, 9 | Watch pre-recorded lectures and reading as assigned via canvas.<br><br>Problem Set #7 Assigned | Pre-class Quizzes.<br><br>Unit 6 Problem Set Due |
| Week 9<br>(3/8-3/12) | AGN, CGM, Galaxy Evolution | S. Ch. 9 | Watch pre-recorded lectures and reading as assigned via canvas.<br><br>Problem Set #8 Assigned | Pre-class Quizzes.<br><br>Unit 7 Problem Set Due |
| Week 10<br>(3/15-3/19) | Journal Club, Review/Discussion, Exam | | Read the Journal Club Paper and prepare for discussion<br><br>No New Problem Set<br><br>No Pre-class Quizzes | Unit 8 Problem Set Due |
| **Exam: 3/19** | | | | |
| Week 11<br>(3/22-3/26) | Fundamental Observables and composition of the Universe | S. Ch. 4 | Watch pre-recorded lectures and reading as assigned via canvas.<br><br>Problem Set #9 Assigned | Pre-class Quizzes. |

| Week/ Date | Topic | Text Sections | Homework: Reading & Activities for Before Class | Assigned Work Due |
|---|---|---|---|---|
| Week 12 (11/16-11/20) | Cosmological Kinematics, Cosmological parameters | S. Ch. 4, 8 | Watch pre-recorded lectures and reading as assigned via canvas.<br><br>Problem Set #10 Assigned | Pre-class Quizzes.<br><br>Unit 9 Problem Set Due |
| Week 13 (3/29-4/2) | Thermal History of Universe | S. Ch. 4 | Watch pre-recorded lectures and reading as assigned via canvas.<br><br>Problem Set #11 Assigned | Pre-class Quizzes.<br><br>Unit 10 Problem Set Due |
| Week 14 (4/12-4/16) | Achievements & Problems w/ LCDM | | Watch pre-recorded lectures and reading as assigned via canvas.<br><br>Problem Set #12 Assigned | Pre-class Quizzes.<br><br>Unit 11 Problem Set Due |
| Week 15 (4/19-4/21) | Journal Club, Review/Discussion | | Read the Journal Club Paper and prepare for discussion<br><br>No New Problem Set<br><br>No Pre-class Quizzes | Unit 12 Problem Set Due |

# III. Grading

## 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, either virtually or in person, to receive credit for their Journal Club discussion. Students participating via zoom are encouraged, but not required, to use their video. Students participating via zoom must have a working microphone, or call in via phone in order to orally participate (which is a graded element of the class).
- Two of the three exams will be given 'in class', with the third being given during the Final Exam assigned period for this class. Students registered to take this class in person must be present in the classroom for the in-class exams. Students registered to take this class online will take the class via Honorlock. Students requiring any accommodations for testing should contact the instructor immediately, but at least 3 weeks in advance of the examination when they plan to request accommodations.
- 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

## 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.

## 15. Privacy Considerations for Recorded Lectures

In order to encourage candid and open student participation, most class meeting periods will ***not*** be recorded. Instead, lecture-like material will be – as much as possible – distributed in pre-recorded videos. Thus, our class meeting periods will be focused on discussion, problem solving, and asking/answering questions.

However, from time-to-time, we may find it helpful to record a lecture in-whole or in-part for students in the class to refer back and for enrolled students who are unable to attend live. When this is to happen, it will be announced via Canvas and/or in the lecture itself. When course meetings are being recorded, students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared.

As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited. Specifically, you may not video record, audio record, screen shot, or otherwise record any course meetings. Nor may you share any recorded material from class (legitimate course recordings, or otherwise). Uniform adherence to this policy is critical to ensuring a safe and academically engaging environment. Violations of this policy will be immediately escalated to the Dean of Student Affair's office.