

AST 6309 Galaxies and Cosmology - Fall 2019

Instructor: Paul Torrey

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Office Hours: After class, or by appointment

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Lecture Times:

Tuesday -- 12:50 PM - 2:45 PM

Thursday -- 1:55 PM - 2:45 PM

Location: Room 3, Bryant Space Science Center

Course Web Page: We will use the UF e-learning course website.

Required Text:

- 1) *Galactic Dynamics: Second Edition*, Binney, J. and Tremaine, S.
- 2) *Galactic Astronomy*, Binney, J. and Merrifield, M
- 3) *Galaxy Formation and Evolution*, Mo, Van den Bosch, & White

Course Content: This course is one of several core courses required in the graduate astronomy curriculum but is also open to interested students in other departments. In addition to a general familiarity with astronomy at the introductory level, the course requires knowledge of calculus and differential equations. It aims to provide an observational survey of the general characteristics of galaxies, introduction to the methods of stellar dynamics and their application to galaxies, and the theoretical underpinnings of modern cosmology. The intent is to cover both the fundamental topics in the field and explore areas that are the subject of active research in the field.

Grading:	Homework	40%
	Projects	30%
	<u>Paper Discussion</u>	<u>30%</u>
		100%

Homework assignments (estimated at 3 in number) will be handed out in class and are due in class one week later. Point assignments will be associated with each problem. Homework assignments must be completed on time to receive full credit. Partial credit will be assigned where work has been carried out the full correct answer is not provided. I will not accept any homeworks handed in after I have returned the graded homeworks to the rest of the class – usually the first lecture after the due date.

Two projects will be carried out during the semester. The first will be assigned within the first week of class and be due Oct. 8th. The second project will be assigned the week of Oct 8th and be due Nov. 26th. Each project will involve carrying out an extended analysis project which will give you a flavor for how observational and/or theoretical galaxy research is carried out. Each project will contribute equally (15%) to your final grade. Full grading rubric information will be included with the project assignments.

Each student is expected to give two oral presentations during the semester on ARAA articles. The goal of student presentations is three-fold: (i) to disseminate the material from the paper to the class, (ii) to gain practice reading papers, and (iii) to gain practice giving presentations. Students will submit a rank-ordered list of preferred articles to present during the second week and paper assignments and presentation dates will be assigned immediately following. Presentations will take place on Tuesdays during the second half of the class. The timing/duration of each presentation will not be graded because we want to encourage discussion without penalizing the presenter. However, each presentation is expected to last roughly 15 minutes if carried out interruption free. The grading rubric to be used will be as follows:

- 1) Preparedness [5 points]:
 - i. Is the student present and on-time? [1 point]
 - ii. Has the student prepared slides, notes, or other material that will enable them to lead the presentation/discussion? [2 points]
 - iii. Does the student begin their presentation with a well-thought-out introduction to the paper and topic? [2 points]

- 2) Knowledge of the subject [3 points]:
 - i. The students presentation of the material was:
 - Without significant errors that impeded classroom learning (3 points)
 - Very clear, but with several minor errors or blanks-spaces (2 points)
 - Adequate, but with numerous errors or blank-spaces (1 point)
 - Generally not an accurate reflection of the assigned article. (0 points)

- 3) Effectiveness of communication [4 points]:
 - i. Is the verbal presentation sufficiently clear and understandable to members of the audience? [1 point]
 - ii. Does the student identify, emphasize, and clearly present important take-away points? [1 point]
 - iii. Does the student make effective and clear use of visuals (pre-prepared slides, chalk-drawn plots, or otherwise)? [1 point]

UF grade policies may be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

The strictest grading policy I will adhere to is:

Letter	%Points	GPA	Letter	%Points	GPA	Letter	%Points	GPA
A	93-100	4.0	B-	80-82	2.67	D+	67-69	1.33
A-	90-92	3.67	C+	77-79	2.333	D	63-66	1.0
B+	87-89	3.33	C	73-76	2.0	D-	60-62	0.67
B+	83-86	3.0	C-	70-72	1.67	E	0-60	0

I reserve the right to make this grading standard more lenient.

You are responsible for the material covered in class. There are topics covered in the textbook that we will not cover in lectures. And, there are topics covered in class that are not fully covered in the textbooks! The outline below includes approximate textbook chapters to be covered, but sub-sections of these chapters will be skipped. You are not responsible for that material. I will advise in advance of each class what text sections we will specifically cover. I therefore recommend that you come to class and use your lecture notes as a guide while reading the text. If you miss a lecture, please get notes from a fellow student.

Honor Code:

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 (<http://www.dso.ufl.edu/scct/process/student-conduct-honorcode/>) 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 in this class.

Evaluations:

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.

Students are strongly encouraged to give feedback at any point through the semester. Lets make this an instructive, helpful, positive class for everyone.

Disabilities:

If you need a special accommodation due to a disability, please let me know. Students with disabilities requesting accommodations should additionally register with the Disability Resource Center (352-392-8565), www.dso.ufl.edu/drc by providing appropriate documentation. Once registered, students will receive an accommodation letter which should be presented to the instructor when requesting accommodation.

Learning Environment and Day to Day:

We will all be working closely together throughout the semester, and I expect that all students will contribute to a respectful, welcoming, and inclusive environment. This includes showing respect for all questions asked by members of the class.

Class Attendance and Make-Up Policy:

Class attendance is expected, and special accommodation will not be made for students with unexcused absences. Excused absences are treaded consistently with university policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>) and require appropriate documentation.

Known Class Cancellation:

Course Outline

Estimation only. Subject to modification.

Dates	Topic	Text & Chapters
8/20	The MW Galaxy: structure, components, & models	B&M 10
8/22	The MW Galaxy: Gaia, SgA*, CMZ	
8/27	Galaxy Morphology Classification & relations between morphology and galaxy properties	B&M 4.1
8/27	<i>No Student Discussions</i>	
8/29	Potential Theory: Basics & Spherical systems	B&T 2
9/3	Photometric properties of Elliptical Galaxies	B&M 4.2, 4.3
9/3	Student Discussion: <i>Structure and Kinematics of Early-Type Galaxies from Integral Field Spectroscopy</i>	
9/5	Potential Theory for Flattened Systems & Photometry of Disk Galaxies	B&T 2.2 B&M 4.4
9/10	Schwarzschild, JAM, and other Mass Modeling	
9/12	Galaxy Interactions: implications and morphology	
9/14	IMF: common definitions, importance in deriving physical galaxy properties, (non-)redshift evolution	B&M 5.1.9
9/19	Stellar evolution: Impact for galaxies (SN, feedback, metal production, gas recycling)	
9/24	Models of chemical evolution	B&M 5.3
9/26	Galaxy Scaling Relations	
10/1	Galaxy Scaling Relations (continued)	
10/3	AGN feedback (observations)	
10/8	AGN feedback (theory and implications)	
10/10	Galaxy clusters	
10/15	SZ effect	
10/17	CGM — evidence of existence, ubiquity, direct observations	

10/22	CGM — inferred properties, theory, link to galaxy growth	
10/24	Redshift surveys	
10/29	Large Scale Structure	
10/31	High Redshift Galaxy Properties	
11/5	High Redshift Galaxy Properties	
11/7	Reionization	
11/12	Galaxy formation within a cosmological context: PS theory,	
11/14	Semi-analytic models, abundance matching, halo occupation distribution	
11/19		
11/21		
11/26	Numerical Simulations of Galaxy Formation	
12/3	Numerical Simulations of Galaxy Formation	