

**ASTR 406 — Galaxies and the Universe**  
**Syllabus for Fall 2018**  
**218 Ceramics Building — MWF 1:00-1:50**

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## Teaching Staff

	Instructor	Teaching Assistant
Name	Prof. Tony Wong	Adrienne ('Ada') Ertel
Office	227 <a href="#">Astronomy</a>	234 <a href="#">Astronomy</a>
E-mail	(redacted)	(redacted)
Office Hours	Tue 2-3 or by appt	Tue 1-2 and Thu 1-2

## Class Schedule (subject to change)

## Course Information

**Credit:** 3 credit hours.

**Prerequisites:** Credit in PHYS 212 (University Physics: E&M) is required. Credit in ASTR 210 (Introduction to Astrophysics), PHYS 213 (Thermal Physics) and 214 (Quantum Physics) is recommended. Some prior knowledge of astronomy is assumed.

**Course Web Page:** Located on <https://learn.illinois.edu/> (College of LAS Moodle)

## Course Goals

Astronomy 406 is an intermediate course covering galaxies and cosmology. The study of galaxies builds on the study of stars (covered in Astronomy 404, but the basics will be quickly reviewed) to understand how stars behave as populations and how they interact with the galaxies they populate. The study of cosmology takes a very different approach, extrapolating from a small number of key observations with the help of modern physics, particularly general relativity and particle physics. Yet the two are inextricably linked, as galaxies are key probes of cosmology, and cosmology sets the stage for the formation of galaxies.

Throughout this course we will use physics and mathematics to understand astronomical observations. We will push the very frontiers of physics as we seek to understand how the Universe began. There remain many unanswered questions, yet we will also marvel at how much of astrophysical theory continues to pass observational tests! In a sense, the theory seems to work better than we have any right to expect!

ASTR 406 is intended for advanced undergraduates with an interest in astronomy and a strong background in physics; it is also suitable for beginning graduate students. Beyond the formal prerequisites, students are expected to come in with some comfort and familiarity with data analysis and computer programming. Some exercises will be done in Python, an increasingly popular language for data analysis and scripting. You are

encouraged to bring your laptop to class on Fridays to participate in coding exercises.

## Textbooks

### Highly Recommended Texts (available at bookstore and on reserve at Grainger Library):

- *Galaxies in the Universe: An Introduction* by L. S. Sparke & J. S. Gallagher, III (2nd Ed., 2007). Publisher: Cambridge U. Press. ISBN: 978-0-521-67186-6.  
[Textbook website](#)  
This textbook covers galactic and extragalactic astronomy at an appropriate level for our course. It also covers some of the basics of cosmology.
- *Introduction to Cosmology* by Barbara Ryden (2nd Ed., 2016). Publisher: Cambridge U. Press. ISBN: 978-1-107-15483-4.  
[Textbook website](#)  
This is a more thorough textbook on cosmology.

Any additional readings will be available for download from the Moodle website.

## Grading

Component	Points
Homeworks (best 10 of 11)	400 (40 pts each)
Computer Exercise	50
Clicker Score	100
Midterm Hour Exams (2)	200
Final Exam	250
<b>Total Points</b>	<b>1000</b>

There are 40 lectures for which clicker points will be recorded (starting at Lecture 2), and you must attend 33 of these to get full clicker points (unless otherwise announced). No makeups will be allowed for missed classes for any reason except for fully documented, prolonged illness. Each lecture has 3 course points allocated: 2 course points for responding to at least 75% of the questions and an additional 1 point for providing a correct response to at least one of the questions. The total clicker score will then be added to 1 to give a score out of 100.

The course point total will be converted to a percentage, with A's corresponding to 90-100%, B's corresponding to 80-89%, C's corresponding to 70-79%, and D's corresponding to 60-69%. Pluses and minuses will be used.

## Assignments

Regular assignments are an important part of the course, helping to reinforce concepts covered in the lectures.

1. **Homework assignments** (accessed through the course web page). These will consist of about 4-5 problems each, and will be based primarily on lectures, although referring to the reading is recommended. Handwritten solutions are acceptable, but should be legible. Regardless of whether

handwritten or typed, assignments should be uploaded to the course website in PDF format. Occasionally exercises will need to be completed on a computer. Credit will only be given to well-explained answers, and all important steps in a calculation must be shown.

2. **Keep a copy of your work.** You are expected to maintain an electronic or paper copy of anything you submit. If you are unsure of whether your assignment was properly submitted, please contact the TA.
3. **Late assignments.** Assignments are due by 10 P.M. on Wednesdays. We typically allow a grace period of 15-20 minutes after the due date. Assignments received after the deadline but by 5 P.M. on Friday will attract a fixed, 10 point penalty. For special circumstances the penalty may be waived at the instructor's discretion. After 5 P.M. Friday, further submissions are disabled and will NOT be accepted by any other means.

## Rules of Etiquette

For the benefit of your fellow students and your instructor, you are expected to follow these basic rules of decorum.

- Show up for class on time. If you must be late on a regular basis, please inform the instructor.
- Silence and put away your cell phone before class begins.
- Laptop computers are allowed during Friday coding sessions, but must be put away at all other times. An exception is if you use a tablet for notetaking; this must lie flat on your desk so the screen is not easily visible to other students.  
*Computer privileges will be revoked if you are found using your device for purposes other than notetaking and class participation.*
- Do not leave class early, and do not rustle papers or pack up bags in preparation for leaving before class time is up.
- Be attentive in class. Do not use headphones, read newspapers, or prop your feet up on other chairs or desks.
- Be respectful in your interactions with your fellow students and your teachers, whether in person or in cyberspace.

## Class Policies

- **General:** This course will follow all policies in the *Student Code* (<http://studentcode.illinois.edu>).
- **Class Participation:** Regular attendance is important, and there will be frequent i-clicker questions and in-class exercises to test your knowledge and prepare for upcoming homeworks. If you miss too many classes your grade will begin to suffer. You are also encouraged to volunteer or ask questions in class and come to office hours; this is a good way to develop familiarity with the instructors. **To encourage you to post on the discussion forum non-anonymously, extra participation points will be offered to the top 10 contributors to the discussion forum.**
- **Working With Others:** Discussing course material with your classmates is encouraged, but each student is expected to do his or her own work. You are allowed to work together on homework problems, but each student should write up an individual description of the solution. Some activities may allow you to work together in gathering data. Each student who participated in a joint measurement may make use of that jointly acquired data, but each student should prepare an individual report. If you are in any doubt about whether something is allowed or not, ask the instructor or TA.

- **Make-up exams** will be offered in well-justified circumstances, in accordance with sections 1-501, 1-502, and 3-201 of the *Student Code*. Advance notice is **required** for approved school events (e.g., athletic events), religious observances, and other planned absences. Sudden illness requires documentation from McKinley Health Center or the Emergency Dean. The Emergency Dean must be contacted in other cases of unforeseen circumstances (e.g., death in the family). The format of the make-up may differ from the standard exam. In all cases, the make-up will be scheduled *after* the main exam.
- **Special accommodations:** To insure that concerns are properly addressed from the beginning, students who require reasonable accommodations to participate in this class are asked to see the instructor as soon as possible. All accommodations will follow the procedures as stated in sections 1-107 and 1-110 of the *Student Code*.
- **Academic Integrity:** Any instance of academic dishonesty (including cheating and plagiarism) will result in a grade of 0 for that component and be documented in the student's academic file. This includes copying written material from the Internet without proper attribution. Please refer to sections 1-401 to 1-406 of the *Student Code*.

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