Astronomy 89: Stars, Galaxies and the Cosmos
Spring 2017
Course Syllabus

Basic Course Information

Class meetings:
    Tuesday and Thursday, 1 - 2:15pm, Thaw 102
Credits:
    3 credits for lecture plus recitation
Prerequisites:
    Basic mathematics (any MATH course or MATH PLACEMENT SCORE of 61 or greater)
Required textbook:
Mastering Astronomy:
    We will be using the Mastering Astronomy system for homework. This is bundled with
textbook if you purchase from the bookstore. It can also be bought standalone for $65
directly from the Pearson website (see instructions on CourseWeb). The code for this class is
MANELSON08323.

Instructor: Dr. Thomas (Tommy) Nelson

Office: 311 Allen Hall (see CourseWeb for directions)
Office Hours: Everyday, 3-4pm, or by appointment
Email: tjnelson@pitt.edu
Phone: (412) 624-1831

TA: Christine Mazzola
Office: 500 Allen Hall (Desk 21)
Office Hours: TBD
Email: cnm37@pitt.edu

TA: Rudrajit (Rudi) Banerjee
Office: 523 Allen Hall
Office Hours: TBD
Email: rub18@pitt.edu

Course Description

Welcome to Astronomy 89! This semester, we’ll be exploring the universe and our place within it.
The course will focus on our modern understanding of stars, galaxies, and the Universe at large.
Astronomy is at its heart a quantitative science, and so we will use some basic arithmetic and
mathematical reasoning to inform our learning. Don’t worry if you feel your math skills are a little
rusty – you’ll have plenty of opportunity to practice them in class, recitation, and in homework
exercises.
Do not expect to sit back and passively listen/snooze in this class! Instead, anticipate lots of questions from me and plenty of time for you to ask your own. We will complete short activities that will give you an opportunity during class time to explore key concepts and ask follow-up questions. You’ll also delve into the most important items and ideas from the class in greater detail during recitation.

To give you a better sense of the work that astronomers do, you’ll complete a research project this semester using real astronomical data and a specially designed Google sheets add-on that will allow you to carry out basic data analysis.

Finally, it is my goal to create a class that allows a diverse cross-section of students to do well. There are multiple opportunities to succeed in this class. Your grade is distributed fairly evenly across the course requirements. Between homework, recitation, the research project, a visit to the Allegheny Observatory, and exams, you’ll have numerous opportunities to pick up points. I will not be grading on a traditional curve in this class (see details in grading section below), so it can never hurt your grade to help a classmate do well.

Student Learning Outcomes

By taking this course, students will:

- Develop a sense of the scale of the universe and our place within it.
- Explore the underlying reasons for the Moon’s changing phases and position in the sky.
- Be introduced to the properties of light and explore them in a variety of astrophysical contexts.
- Take a visual tour of our solar system.
- Learn about the physics behind the structure and formation of the sun and planets.
- Encounter fundamental laws of nature that describe the motion of objects and light through space.
- Explore the life cycle of stars from birth to death.
- Learn about white dwarfs, neutron stars and black holes—the weird and wonderful objects in the stellar graveyard.
- Know the basic properties of galaxies, and explore them in a research project.
- Encounter Hubble’s Law and its implications for galaxy motions.
- Explore the history of the universe from the moment of the big bang to its eventual fate
- See how extrasolar planets are discovered and characterized.

Beyond the specific astronomy content, students will also develop the following general skills:

- Using equations and arithmetic to solve simple physical problems.
- Interpreting information presented in graph or chart form.
- Working effectively in small groups.
- Recording experimental results and presenting them graphically and in a report.
Course Structure and Grading Policy

Exams: There will be three exams in this class. Each exam will be comprised of 40 multiple choice or True/False questions, and will cover approximately one third of the course material. Although exams are not cumulative, the material covered later in the course will build on earlier topics. Each exam will constitute 20% of your final course grade.

Exams will take place on the following dates:
- Exam 1: Thursday Feb 9th
- Exam 2: Thursday Mar 16th
- Exam 3: TBD

Make-up exams will only be given under extremely special circumstances, such as illness or University-approved travel, and will require a written confirmation from, for example, a medical doctor.

Students must bring their Pitt ID cards to all exams. The use of books, notes or other written materials, computers, cellular phones, and all devices that can render documents, graphics, or connect to the internet are absolutely prohibited.

Recitation: Attendance at recitation is mandatory. Recitation will be used to discuss material from lecture, to complete problems, and to go over homework questions. You will complete a worksheet each week in small groups. Your recitation grade will be calculated based on your score on these worksheets, and participation as determined by your TA. Your recitation score is 15% of your final grade.

Homework and Reading Assignments: There will be weekly homework. We will be using Mastering Astronomy, an online homework system that is included in the textbook packet. If you have your own copy of the textbook from another source, you will need to purchase Mastering Astronomy stand-alone from the Pearson website. Instructions for this will be provided on CourseWeb. The code for our course is MANELSON08323. The homework sets will be a mix of multiple choice questions, simple calculations, and tutorial activities that are designed to give you a chance to explore the course material in more depth. In my experience teaching this class, students who complete the homework and tutorials tend to do better overall in the class, particularly on exams. Homework will make up 10% of your grade.

Research Project: Working in small groups, you will complete a research project about galaxies using real data from the Sloan Digital Sky Survey. Over the course of the semester, you’ll learn how to use a set of data analysis tools built for Google Sheets, and then utilize these for your project. You’ll create a short (roughly 4 minutes) video presenting your results. The data analysis tools and the curriculum supporting this research project are being developed as part of a National Science Foundation funded project to improve undergraduate science teaching. This research is being carried out with collaborators at Northwestern University, the Adler Planetarium, Oakton Community College, and St Thomas University. As part of this project, I’ll be
asking you to complete some short surveys asking questions about your feelings about science, your experience with research, and your feedback on the analysis tools. I’ll also be analyzing your performance on a few key exam questions related to galaxies. More details on this project will be provided in a separate document on CourseWeb. The research project counts for 10% of your grade.

Visit to the Allegheny Observatory: You must make at least one visit to the Allegheny Observatory during the semester. The observatory is located a few miles north of downtown Pittsburgh and hosts one of the largest refracting telescopes in the world. Buses will take you to the observatory and return you to campus. Details on available visit dates and bus schedules can be found at http://www.physicsandastronomy.pitt.edu/content/ao-bus-schedule. Please make arrangements with your TA to visit the observatory. Visiting the observatory is worth 5% of your final grade.

Grading breakdown

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<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Exams</td>
<td>60% (3 exams, 20% each)</td>
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<tr>
<td>Recitation</td>
<td>15%</td>
</tr>
<tr>
<td>Homework</td>
<td>10%</td>
</tr>
<tr>
<td>Research Project</td>
<td>10%</td>
</tr>
<tr>
<td>Visit to Allegheny Observatory</td>
<td>5%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
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Grading Scale

The grading scale will be set such that at least 50% of students will receive a letter grade of B- or better. The following grades will be guaranteed:

- 90% of all available points earns a grade of A- or better
- 80% of all available points earns a grade of B- or better
- 70% of all available points earns a grade of C- or better
- 60% of all available points earns a grade of D- or better

If you are taking the class pass-fail, you need to achieve a score equivalent to a C or higher to receive a passing grade.

You will often be able to earn a given grade with a point percentage lower than those quoted above. Any adjustments to the above cut-offs will only be used to help your grade, never to reduce your grade.
Course Topics and Weekly Schedule

The following gives a week-by-week breakdown of the topics we’ll cover in this course. We’ll try to stick to this schedule as much as possible. Associated reading will be provided each week.

| Week 1:     | Jan 5    | Introductions, Course Logistics, What is Astronomy?  |
|            |          | The Night Sky                                       |
| Week 2:    | Jan 10,12| Phases of the Moon, Scale of the Universe          |
| Week 3:    | Jan 17, 19| Light and radiation, Telescopes                    |
| Week 4:    | Jan 24, 26| Planetary motions, Kepler’s Laws                    |
| Week 5:    | Jan 31, Feb 2| Newton’s Laws, Our Solar System, Formation of Planetary systems |
| Week 6:    | Feb 7, 9  | The Sun                                             |
|            |          | **Midterm 1** - Thursday Feb 9th                    |
| Week 7:    | Feb 14, 16| Solar Activity, Stars and the HR Diagram            |
| Week 8:    | Feb 21, 23| Stars continued, star formation                     |
| Week 9:    | Feb 28, Mar 2| Stellar Evolution, Supernovae                      |
| Break:     | Mar 7, 9  | SPRING BREAK                                        |
| Week 10:   | Mar 14, 16| Stellar remnants, the Milky Way                     |
|            |          | **Midterm 2** - Thursday, Mar 16th                  |
| Week 11:   | Mar 21, 23| External galaxies, masses of galaxies and dark matter |
| Week 12:   | Mar 28, 30| Motions of galaxies, Galaxy mergers and large scale structure |
| Week 13:   | Apr 4, 6  | The Big Bang, fate of the Universe                  |
| Week 14:   | Apr 18, 20| Extrasolar planets, life in the Universe            |
|            |          | **Final Exam**                                       |
Student Opinion of Teaching Surveys

At the end of the semester, you will be asked to complete a Student Opinion of Teaching Survey. Surveys will be sent via Pitt email and appear on your CourseWeb landing page during the last three weeks of class meeting days. Your responses are anonymous. Please take time to thoughtfully respond, your feedback is important to me.

Academic Integrity

Students in this course will be expected to comply with the University of Pittsburgh’s Policy on Academic Integrity. Any student suspected of violating this obligation for any reason during the semester will be required to participate in the procedural process, initiated at the instructor level, as outlined in the University Guidelines on Academic Integrity. This may include, but is not limited to, the confiscation of the examination of any individual suspected of violating University Policy. Furthermore, no student may bring any unauthorized materials to an exam, including dictionaries and programmable calculators.

Disability Services

If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and Disability Resources and Services (DRS), 140 William Pitt Union, (412) 648-7890, drsrecep@pitt.edu, (412) 228-5347 for P3 ASL users, as early as possible in the term. DRS will verify your disability and determine reasonable accommodations for this course.

Statement on Classroom Recording

To ensure the free and open discussion of ideas, students may not record classroom lectures, discussion and/or activities without the advance written permission of the instructor, and any such recording properly approved in advance can be used solely for the student’s own private use.