PHY317: Stellar and Interstellar Astrophysics

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Office Hours	By appointment on Zoom		

Course Description:

Introduction to astrophysics, with emphasis on stars and the interstellar medium. Physical laws of gravitation, charged particles, and radiation, applied to nucleosynthesis and stellar formation/evolution. Physical and chemical processes in the interstellar medium.

Additional Course Description

Although the title of this class is “stellar and interstellar astrophysics,” the fact that the universe is basically “stars and the stuff between them in a four-dimensional spacetime” gives us license to discuss anything in the universe from its beginning into the far future. The specific topics that we cover will be guided by our discussions in class.

Prerequisites:

PHY216 or PHY212.

Audience:

Students who wish to gain an understanding of astronomy and astrophysics, and have a good background in calculus-based physics.

Credits:

3 units

Learning Objectives:

After taking this course, students will be able to:

Understand how astronomy advances our knowledge of physics.

Describe in detail several topics of interest in astrophysics.

Understand how research in astrophysics is performed.

Write scientifically and present research findings orally.

Required Texts / Supplies:

There is no formally assigned textbook for this course. Content will be drawn from readings assigned during the semester, and supplemented through directed study and discussion. The following textbooks may be helpful when you study the course content, but are not required:

- OpenStax Astronomy https://openstax.org/details/books/astronomy is a textbook aimed primarily at non-scientists, but it still has some helpful readings and diagrams.
- Foundations of Astrophysics, Ryden and Peterson, Addison-Wesley (ISBN-13 978-0321595584) is a useful reference that contains a lot of technical details on topics that we will discuss in this class.
- An Introduction to Modern Astrophysics, Carroll and Ostlie, (ISBN-13 978-0805304022) covers almost every topic in modern astrophysics.

Course Requirements and Expectations:

The class will meet during the scheduled 2:15 pm - 3:35 pm block on Mondays and Wednesdays. Class will take place in person and will be simulcast on Zoom for students who are unable to attend in person due to health reasons. Attendance either in person or synchronously on Zoom is required. If the university transitions to an online mode during the semester then class will meet synchronously on Zoom during the scheduled times.

One of the goals of this course is to gain an understanding of how research in astrophysics is performed. Since research in astrophysics is **not** performed by sitting in a classroom listening to a professor lecture and then doing problem sets and exams, this course will follow a “reading class” format.

The class will be divided into working groups of three or four people. In each class, two of the groups will be given a topic that they will research and present the following week. I will pick the topics for the first presentations and then subsequent topics will be picked by discussion in class. You will be given a broad topic to research and a set of specific questions that your research should look into. You will also be provided with readings and papers relevant to the topic that you are researching. Based on this material, your group will make a presentation on the topic in class the following week. Each group’s presentation should be a minimum of 20 minutes and a maximum of 25 minutes in length. You may use slides, real or virtual whiteboards, or any other visual aids as allowed by social distancing. The remaining class time will be used for everyone to ask questions, and to discuss and critique the presentations.

The presenting groups will be able to meet with the teaching assistant and me prior to class to discuss what you will present and get feedback and guidance. The groups not presenting on a topic will critique the presentations. Weekly homework will be set based on the content of the class presentations.

The in-class presentations will be graded based on:

- Understanding of the topic
- Answering the topic-specific questions posed
- Presentation

Each member of the group will receive the same score for the group's presentation.

Each week, a homework set will be assigned based on that week's presentations. Deadlines will be provided when the homework is assigned. Collaboration on the homework is encouraged, but each student should submit their own solutions. Late homework will lose 10% for each day late.

In place of mid-term exams or a final examination, you will write a report of at least 1500 words in length (shorter essays will lose points) on a topic that you will pick and agree with me. Example topics are:

- The discovery of gravitational waves.
- The main sequence evolution of stars.
- The fate of massive stars.
- Neutron stars.
- Gamma ray bursts.
- The search for exo-planets.

Reports should be written in good literary style with complete sentences, correct grammar, punctuation, and use of mathematics. Avoid skimping on words at the expense of clarity. Imagine that you are writing your report for a fellow student, not writing for someone who is already an expert in the field. You should use tables and figures where appropriate. Your report should be written using LaTeX (I recommend using https://overleaf.com for document preparation) and should include appropriate citations with a bibliography that provides references to all source material used.

You must agree on your report topic with me by Friday April 30, 2021 at the latest (although you are welcome to start working on the report earlier in the semester). The report will be due at 5pm on Friday May 21, 2021. Late essays will lose 10% for each day that they are late.

Grading:

Your grade in this course will be based on:

- In-class presentations (30%)
- Answers to your homework problem sets (30%)
- Your final report (30%)
- Participation (10%)

Grading Table

Grades	Grade Points /Credit	Percentage Range
A	**4.000**	93-100%
A-	**3.667**	90-93%
B+	**3.333**	87-90%
B	**3.000**	83-87%
B-	**2.667**	80-83%
C+	**2.333**	77-80%
C	**2.000**	73-77%
C-	**1.667**	70-73%
D	**1.000**	60-70%
F	**0**	0-60%

Grades are not curved and you are **not** in competition with your fellow students.
It is possible for everyone in the class to get an A grade.

Stay Safe Pledge

Syracuse University's Stay Safe Pledge reflects the high value that we, as a university community, place on the well-being of our community members. This pledge defines norms for behavior that will promote community health and wellbeing. Classroom expectations include the following: wearing a mask that covers the nose and mouth at all times, maintaining a distance of six feet from others, and staying away from class if you feel unwell. Students who do not follow these norms will not be allowed to continue in face-to-face classes; repeated violations will be treated as violations of the Code of Student Conduct and may result in disciplinary action.

Eating and drinking require the lowering of a face mask, creating a potentially dangerous situation. For this reason, students are not allowed to eat or drink in class during the COVID-19 pandemic.

Mental health and overall well-being are significant predictors of academic success. As such it is essential that during your college experience you develop the skills and resources effectively to navigate stress, anxiety, depression, and other mental health concerns. Please familiarize yourself with the range of resources the Barnes Center provides (https://ese.syr.edu/bewell/) and seek out support for mental health concerns as needed. Counseling services are available 24/7, 365 days, at 315-443-8000.

University Attendance Policy

Attendance in classes is expected in all courses at Syracuse University. Students are expected to arrive on campus in time to attend the first meeting of all classes for which they are registered. Students who do not attend classes starting with the first scheduled meeting may be academically withdrawn as not making progress toward degree by failure to attend. Instructors set course-specific policies for absences from scheduled class meetings in their syllabi.

It is a federal requirement that students who do not attend or cease to attend a class to be reported at the time of determination by the faculty. Faculty should use "ESPR" and "MSPR" in Orange Success to alert the Office of the Registrar and the Office of Financial Aid. A grade of NA is posted to any student for whom the Never Attended flag is raised in Orange SUccess. More information regarding Orange SUccess can be found here, at http://orangesuccess.syr.edu/getting-started-2/.

Students should also review the University's religious observance policy and make the required arrangements at the beginning of each semester.

Syracuse University Policies: Syracuse University has a variety of other policies designed to guarantee that students live and study in a community respectful of their needs and those of fellow students. Some of the most important of these concern:

Diversity and Disability (ensuring that students are aware of their rights and responsibilities in a diverse, inclusive, accessible, bias-free campus community) can be found here, at: https://www.syracuse.edu/life/accessibilitydiversity/.

Religious Observances Notification and Policy (steps to follow to request accommodations for the observance of religious holidays) can be found here, at: http://supolicies.syr.edu/studs/religious_observance.htm

Orange SUccess (tools to access a variety of SU resources, including ways to communicate with advisors and faculty members) can be found here, at: http://orangesuccess.syr.edu/getting-started-2/

Disability-Related Accommodations:

Syracuse University values diversity and inclusion; we are committed to a climate of mutual respect and full participation. There may be aspects of the instruction or design of this course that result in barriers to your inclusion and full participation in this course. I invite any student to meet with me to discuss strategies and/or accommodations (academic adjustments) that may be essential to your success and to collaborate with the Center for Disability Resources (CDR) in this process.

If you would like to discuss disability-accommodations or register with CDR, please visit Center for Disability Resources. Please call (315) 443-4498 or email disabilityresources@syr.edu for more detailed information.

CDR is responsible for coordinating disability-related academic accommodations and will work with the student to develop an access plan. Since academic accommodations may require early planning and generally are not provided retroactively, please contact CDR as soon as possible to begin this process. https://disabilityresources.syr.edu/

Academic Integrity Policy:

Syracuse University's Academic Integrity Policy reflects the high value that we, as a university community, place on honesty in academic work. The policy defines our expectations for academic honesty and holds students accountable for the integrity of all work they submit. Students should understand that it is their responsibility to learn about course-specific expectations, as well as about university-wide academic integrity expectations. The policy governs appropriate citation and use of sources, the integrity of work submitted in exams and assignments, and the veracity of signatures on attendance sheets and other verification of participation in class activities. The policy also prohibits students from submitting the same work in more than one class without receiving written authorization in advance from both instructors. Under the policy, students found in violation are subject to grade sanctions determined by the course instructor and non-grade sanctions determined by the School or College where the course is offered as described in the Violation and Sanction Classification Rubric. SU students are required to read an online summary of the University's academic integrity expectations and provide an electronic signature agreeing to abide by them twice a year during pre-term check-in on MySlice.