Ever wonder how everything in the universe came to be? In this course we will learn about the universe beyond the Solar System out to distances of billions of light years and back in time to the first trillionth of a second after it came into existence. We'll learn about the lives and deaths of stars, galaxies, and encounter cosmic problems we have yet to solve.

Fall 2024
Space Sciences Building (SSB) 105
Tuesdays & Thursdays 11:40 AM - 12:55 PM

Instructor: Prof. Anna Ho (512 SSB, ayh24@cornell.edu)
TA: Nick Corso (njc86@cornell.edu)
Office Hours: See Canvas homepage

Grading Options: Letter Grade or S/U, 3 credit hours

I. Rationale:

This course is designed to provide a survey of the cosmos beyond the Solar System for students who wish to go more in depth than ASTRO 1101/ASTRO 1103. Topics to be covered include the evolution of the universe from the Big Bang onwards: what happens in the first few minutes of the universe's life; star formation, structure, and evolution; the physics of white dwarfs, neutron stars, and black holes; galaxy formation and structure; and cosmology. The course assumes that every student has some knowledge of basic physics and mathematics including calculus at the level of MATH 1110 or MATH 1910 or at least is co-registered in one of these courses or their equivalents.

II. Course Aims and Outcomes:

Aims

This course is designed to give students exposure to key concepts in Astrophysics and exercise/develop a mixture of physics, mathematical, and astronomical skills. Obtaining a broad knowledge base and exercising such skills provides a foundation for further related coursework as well as development of critical thinking skills that can be carried into any future profession.

Specific Learning Outcomes

By the end of this course, students will:

- Apply the conceptual tools that astrophysicists use to explore the universe.
- Describe the physical properties of stars form and how they form and evolve.
- Describe the physical properties of galaxies and how they form and evolve.
- Examine observational evidence for the big bang and the large-scale structure of the universe

- Apply a mixture of quantum, nuclear and thermal physics, as well as classical mechanics and General Relativity concepts.
- Collaborate in groups to interpret recent scientific results in the context of course materials.

III. Format and Procedures:

The format of this course will consist primarily of lectures and in-class exercises. Problem Sets and exams will be used to provide further exercise and test retention of key concepts. **Canvas** will be used to distribute lecture notes, problem sets, as well as solution sets additional notes and materials (e.g. relevant video clips). **Please use the native Canvas inbox/messaging service to contact the instructors regarding ASTRO2211.** This ensures that messages won't get missed.

Students in this class are expected to conduct themselves in a mature, courteous, and professional manner. Talking during in-class exercises is encouraged but discouraged during other points in the lecture. Please refrain from activities that might prove distracting to your classmates such as cell phone usage and internet surfing. Unacceptable in class behavior may be treated as a matter of academic misconduct, for which a grade penalty may be issued.

IV. Course Requirements:

Class Attendance and Participation

You are not required to attend the lectures and participation points will not be used to determine your final grade in the course. However, the lectures will be structured in such a way to provide ample opportunities to practice concepts in both individual and group settings. Note that there are in class group exercises that will form a portion of your final grade (see description below and section V on grading policies). The lectures that will include these group exercises are noted on the tentative course schedule below (section IX) but are subject to change.

Course Readings and Lecture Notes

There is no compulsory textbook for this course. Problem sets, in-class exercises, and exams will be based on the lecture notes. The following optional textbook is a good complement to the lecture notes: **Astronomy: A Physical Perspective** (2nd edition) by Marc Kutner. Lecture notes will be posted the day before each lecture on the Canvas website (**note: students need to sign-up for this course in Canvas)**. It may be helpful to bring the lecture notes on your laptop or tablet, or as a printed copy, to be able to annotation as needed. You may also want to have a look at the notes before the lecture to help you formulate questions and discussion points during the lecture.

In Class Exercises and Problem Sets

There will be six in-class exercises and six problem sets that will be submitted for credit toward your final grade. The in-class exercises will consist of working in groups of three to four students to discuss recent astrophysical results in the context of concepts presented in recent lectures. Each group will submit a write-up that summarizes their discussion at the end of the relevant lecture (see schedule in section IX). Problem sets are intended to provide opportunities outside of lecture to exercise relevant analytical and reasoning skills. Problem sets will be made available on Canvas according to the schedule in section IX.

Online Quizzes

Each week, one to two short quizzes will be offered through Canvas, typically linked to a video that supplements the in-class materials. These quizzes are intended to provide periodic checks on your level of understanding of the course materials. The quizzes will be opened on Sunday of each week and closed on Saturday of that week.

Exams

There will be one prelim (taken during the lecture period) and one final exam (taken during the assigned date and time for this course: http://registrar.sas.cornell.edu/Sched/exams.html). These are both required exams that will contribute to your final grade. They will be a mix of testing concepts and analytical calculations. The exams will be closed notes/book, but each student will be allowed a single review sheet's worth of material.

V. Grading Procedures

Your final grade will be calculated based on the following point distribution:

Course Requirement	Percent
Problem Sets (6 in total)	40%
In Class Group Exercises (6 in total)	10%
Online Quizzes	10%
Prelim Exam	20%
Final Exam	20%
Total	100%

Late problem sets will be downgraded by 10% for each day of being late. Homework handed in after solutions become available will not receive any points.

Make-ups for in class group exercises are available under exceptional circumstances (e.g. illness, religious holidays, required travel, etc.) or by making prior arrangements with us. Under such circumstances, the in-class group exercise can be completed on an individual basis and submitted within three days of the original exercise for full credit.

Make-ups for prelim and final exams are available under exceptional circumstances only (e.g. illness, religious holiday, required travel, etc.). Please contact on of us in such an event.

For S/U grading option: a grade of C- (typically 65%) or higher on the course materials is required to receive a Satisfactory (S) grade

For Letter grade option: Letter grades will be roughly assigned according to the following cumulative percentages, these might be modified depending on class averages:

98% and above: A+	78% - 79%: C+	below 60%: F
93% - 97%: A	73% - 77%: C	
90% - 92%: A-	70% - 72%: C-	
88% - 89%: B+	68% - 69%: D+	
83% - 87%: B	63% - 67%: D	
80% - 82%: B-	60% - 62%: D-	

Bonus Point Opportunity

In addition to course requirement points, everyone can earn bonus points equivalent to a 2% increase in your final grade by volunteering to give a 3 to 5-minute synopsis of a recent Astronomy/Astrophysics related news story. To sign-up for this opportunity, contact Prof. Herter or Prof. Ho. We will only be able to accommodate 1-2 presentations per lecture, so sign up early!

VI. Academic Integrity

Each student in this course is expected to abide by the Cornell University Code of Academic Integrity. Any work submitted by a student in this course for academic credit will be the student's own work. For this course, collaboration is allowed and expected for the in-class group exercises.

You are encouraged to study together and to discuss information and concepts covered in lecture and the sections with other students. You can give "consulting" help to or receive "consulting" help from such students. However, this permissible cooperation should never involve one student having possession of a copy of all or part of work done by someone else, in the form of an email, an email attachment file, a diskette, or a hard copy.

Should copying occur, both the student who copied work from another student and the student who gave material to be copied will both automatically receive a zero for the assignment. Penalty for violation of this Code can also be extended to include failure of the course and University disciplinary action.

During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor may you compare papers, copy from others, or collaborate in any way. Any collaborative behavior during the examinations will result in failure of the exam and may lead to failure of the course and University disciplinary action.

VII. Accommodations for Students with Disabilities

In compliance with the Cornell University policy and equal access laws, I am available to discuss appropriate academic accommodations that may be required for student with disabilities. Requests for academic accommodations are to be made during the first three weeks of the semester, except for unusual circumstances, so arrangements can be made. Students are encouraged to register with Student Disability Services to verify their eligibility for appropriate accommodations.

VIII. Inclusivity Statement

We understand that our members represent a rich variety of backgrounds and perspectives. The Astronomy department is committed to providing an atmosphere for learning that respects diversity. While working together to build this community we ask all members to:

- share their unique experiences, values, and beliefs.
- be open to the views of others.
- honor the uniqueness of their colleagues.
- appreciate the opportunity that we have to learn from each other in this community.

- value each other's opinions and communicate in a respectful manner.
- keep confidential discussions that the community has of a personal (or professional) nature.
- use this opportunity together to discuss ways in which we can create an inclusive environment in this course and across the Cornell community.

IX. Tentative Course Schedule

The nominal class schedule is on the Canvas homepage. This covers lecture topics, suggested textbook readings, quizzes, group exercises, problem sets, and exams. Weekly online quizzes are published on Sunday and normally due Thursday. In-class group exercises are done every other week. Problem sets are made available on Thursday and are due one week later.