PHSC 12710: Galaxies

Course Syllabus

Winter 2020 @ UChicago

Course: PHSC 12710/ASTR 12710: “Galaxies”
Lectures: Tu/Th 3:30PM–4:50PM
Room: Hinds 101, Geophysical Science Lecture Hall
Website: https://canvas.uchicago.edu/courses/25121
PollEverywhere: https://pollev.com/phsc12710

Instructor: Prof. Alex Drlica-Wagner <kadrlica@uchicago.edu> (ERC 457)
Lab Manager: Dr. Brent Barker <bbarker@uchicago.edu> (ERC 573)
Administrative Support: Dr. Julia Brazas <julia@uchicago.edu> (ERC 599A)
Teaching Assistants:

- Jazmine Jefferson <jjefferson1111@uchicago.edu>
- Abigail Lee <abbyl@uchicago.edu>
- Samantha Usman <samanthausman@uchicago.edu>

Office hours:

Prof. Drlica-Wagner: Tuesdays at 5PM in ERC 457 (overflow to ERC 445)
TAs: Wednesdays from 11AM-12:30PM in ERC 517

Course Description: Galaxies have been called “island universes”: places where stars are concentrated, where they are born, and where they die. The study of galaxies reaches back to the Renaissance; Galileo Galilei first pointed a telescope skyward in 1610 and confirmed an ancient Greek conjecture about the nature of our own galaxy—the Milky Way. This course will use extensive modern observational data from a wide range of telescopes to trace the modern picture for the formation and evolution of galaxies and the stars in them. Galaxies will then be used as markers of yet larger scale structures, in order to explore the influence of gravity over cosmic time. The extensive scientific investigation of galaxies has led to our profound discovery that most of the mass in galaxies (and the Universe as a whole) is in fact an exotic form of matter—dark matter—that we cannot directly see. Quantitative analysis will be an important part of the course in both laboratory work and lectures, but mathematics beyond algebra and some geometric understanding will not be required. This course will feature several observationally-oriented labs that will allow students to directly experience how some of the modern understanding of galaxies has arisen.

Course Goals – as in the course catalog:

1. To instill the confidence to be a life-long learner in areas involving numbers, scientific concepts, and technology;

2. To develop an ability to evaluate strengths and weaknesses of arguments based on the use of data, technical claims, and scientific theories;
3. To gain an understanding of the intellectual beauty of the subject, that is, understanding why some people devote their lives to the field;
4. To master at least one area in real depth.

Course Policies: A more detailed description of the course policies can be found on Canvas. The essentials are included below.
Assignments: Homework will be assigned on Friday and will be due by 5 PM on the following Thursday. Please submit a legible copy of your assignment as a PDF through Canvas. Expect homework to be assigned most weeks and to be challenging at times.
Group Work: Group work on the assignments and labs is encouraged. Collaboration is sharing of ideas, as you teach one another. Each person must use their own words in each submission, and give credit to those who collaborated on the work. Solutions and phrases that appear on multiple students' work will result in no credit and proportional disciplinary action.
Exams: There will be a midterm and a cumulative final exam.
Grading Breakdown: Homework assignments (**30%**); lab participation and reports (**30%**); in-class midterm (**15%**), final exam (**25%**). Late assignments and reports will get 10% off per day. Late work will not be accepted after the solutions are posted.
Attendance: Attendance is important for your success in this class! If you miss a lecture, please get related material from the website and follow up with your TA about the key points. Lab attendance is mandatory.
Lab Section: The laboratory sessions are an essential component of this class.They are designed to complement the other parts of the course with computer and hands-on experiments that demonstrate the observations and analyses that underpin our understanding of galaxies. Labs will start in Week 02 and more information can be found in the lab syllabus on Canvas.
Reference Text: The lecture notes will serve as the primary written reference. "The Cosmic Perspective" by Bennett et al. (7th edition or more recent) will be used as a secondary text. Purchase of this textbook is not required. Some excerpts will be available on Canvas, a copy is on reserve at the library, and used copies can be rented/purchased on Amazon.

Rough Schedule of Topics (slides will be available on Canvas)

Week 01 (Jan 7/Jan 9) - Light, Distance, and Telescopes
Week 02 (Jan 14/Jan 16) - Stars, Stellar Populations, Star Clusters
Week 03 (Jan 21/Jan 23) - The Motion of the Stars
Week 04 (Jan 28/Jan 30) - Our Milky Way Galaxy
Week 05 (Feb 4/Feb 6) - **Exam 1** / The Local Group
Week 06 (Feb 11/Feb 13) - Distant Galaxies
Week 07 (Feb 18/Feb 20) - Galaxy Evolution & Black Holes
Week 08 (Feb 25/Feb 27) - Expansion of the Universe
Week 09 (Mar 3/Mar 5) - Dark Matter
Week 10 (Mar 10) - Dark Energy

Final Exam: TBD by registrar (possibly Tuesday March 17)