

Galactic Astrophysics

PHYS 6372

Syllabus and Course Information

Instructor: Professor Krista Lynne Smith
Lectures: 3:30 – 4:50 PM Tuesdays and Thursdays
Location: Heroy Hall 129

Professor's Contact Information:

Office: Fondren Science 41

Office hours:

Tuesday 11 – 12 AM

Thursday 5 – 6 PM

Note: office hours may be visited either in-person or on Zoom.

E-mail: kristas@smu.edu

Office phone: (214) 768-9879

Zoom info: <https://smu.zoom.us/j/9665323179>
Meeting ID: 966 532 3179

Texts: Galaxy Formation and Evolution, 2nd ed., Mo, van den Bosch & White (2010) *Required*
An Introduction to Modern Astrophysics, 2nd ed., Carroll & Ostlie (2017) *Recommended*

Course Objectives: This course is a graduate course on the astrophysics of galaxies and their evolution. At the end of this course, the student will be able to:

- 1) Explain the fundamentals of galactic morphologies and environments.
- 2) Describe galaxy formation history and interactions in a cosmological context.
- 3) Predict how internal and external factors, such as active nuclei or galaxy mergers, affect galaxy evolution.
- 4) Analyze observational data of galaxies.
- 5) Interpret analyzed observational data in light of theoretical predictions.

Course Description: The course is designed to provide a comprehensive introduction to the classification, structure, environments and evolution of galaxies. Material includes the distribution and motions of gas and stars in the major galaxy types and the formation history of galaxies and the groups in which they reside. Significant attention will be paid to the underlying physics governing the structure and dynamics of galactic components, galaxy interaction, and the critical role played by active galactic nuclei and galaxy mergers in the evolution of the galaxies themselves and the appearance of the universe as we observe it today.

Method of Instruction and Grading: The course will utilize both traditional, in-person lectures as well as asynchronous recorded or reading material to be discussed in class. Homework is a valuable aid in learning the material in the course, and will be worth 35% of the course grade. A mid-term and final exam will each be worth 15% of the grade. The combined score of the proposal and conference projects (see next section) are worth 20% of the course grade. Participation in in-class discussions and quiz activities is worth 15% of the course grade.

Proposal and Conference Projects: The course will have two small projects, which can be linked. The first requires the student to draft a proposal for observing time on any major telescope facility in any waveband (radio through gamma rays) to solve a hypothetical research problem. The second is participation in a pseudo-conference, at which the student presents the results of a literature review based on the proposal they submitted earlier. The grade for each portion, which are weighted equally, will reflect both the scientific content of the proposals and presentation, as well as the professional nature of the proposal and the student's presentation and communication skills.

General Attendance Policy: You are expected to attend all lecture periods. Anticipated absences resulting from religious observance or officially sanctioned extracurricular activity must be brought to the instructor's attention at least 2 weeks in advance. In the case of unexpected absence due to illness or other circumstances, prompt communication with the professor is required to ensure your absence is excused and any accommodation, such as make-up exams or access to recorded material, can be arranged.

COVID-19 Policies:

- **Attendance:** If you are ill, or have had a known or even a suspected exposure to COVID-19, let the professor know *as soon as possible* and we will work with you to accommodate remote / recorded lectures and negotiated deadlines. **Do not come to class if you feel ill or if you worry you have been exposed to COVID-19!** Communicate your concern as soon as you are able, and we will work around it, we will be flexible, and you will not be penalized!
- **Masks:** As of the beginning of Fall 2022, masks are recommended but optional.

Course Schedule	Material	Reading
Week 1 Aug 22-26	Overview: Formation, Classes, Observations	Ch 1.1-1.3, 2.1-2.3
Week 2 Aug 29 – Sept 2	Disk Dynamics: Stars	Ch 5.4 – 5.5, 11.1.1 11.1.2, 11.1.5
Week 3 Sept 5-9	Disk Dynamics: Gas and Dark Matter	Ch 7.5, 11.1.3-11.1.4, 11.4.3, 11.5, 11.6
Week 4 Sept 12-16	Dynamics of Ellipticals	Ch 13.1 – 13.4
Week 5 Sept 19 - 23	The Interstellar Medium: Disk Galaxies	Ch 8.4 – 8.6
Week 6 Sept 26 – 30	The Interstellar Medium: Elliptical Galaxies	
Week 7 Oct 3 – 7	Star Formation and Star Forming Regions	Ch 9
Week 8 Oct 10 – 14 (<i>Note: Fall Break Oct 10 – 11, class on Thu Oct 13 only</i>)	Stars I	Ch 10.3, 10.4, 10.5
Week 9 Oct 17 - 21	Stars II (part 1) MIDTERM EXAM on Thursday, Oct 20	Ch 11.7, 11.8, 13.5
Week 10 Oct 24 – 28	Stars II (part 2)	
Week 11 Oct 31 – Nov 4	Galaxy Environments and Interactions	Ch 12
Week 12 Nov 7 – 11	Active Galactic Nuclei: The Central Engine	Ch 14.1, 14.2
Week 13 Nov 14 – 18	Active Galactic Nuclei: Galaxy Evolution	Ch 14.3, 14.4
Week 14 Nov 21 – 25 (<i>Note: Thanksgiving Nov 23-25, class on Tue Nov 22 only</i>)	Gravitational Lensing	Ch 6.6
Week 15 Nov 28 – Dec 2	Special Topics, Project Presentations Presentation Due Thursday, Dec. 2	

**TAKE @ HOME FINAL EXAM: Available on Canvas at 8AM on Thursday, Dec. 8
Due to office folder at 6PM on Friday, Dec. 9**

Relevant Student Learning Outcomes

- **Quantitative Reasoning:** Students will demonstrate an ability to interpret mathematical models in the form of formulas, graphs, and/or tables and draw inferences from them.
- **Exploring Science:** Students will demonstrate an ability to engage in scientific inquiry with respect to the natural world.
- **Oral Communication:** Students will demonstrate an ability to engage in clear and concise live communication.

Student Support

Student Academic Success Programs: Students needing assistance with writing assignments for SMU courses may schedule an appointment with the Writing Center through Canvas. Students who would like support for subject-specific tutoring or success strategies should contact SASP, Loyd All Sports Center, Suite 202; 214-768-3648; <https://www.smu.edu/sasp>.

Caring Community Connections Program: CCC is a resource for anyone in the SMU community to refer students of concern to the Office of the Dean of Students. The online referral form can be found at smu.edu/deanofstudentsccc. After a referral form is submitted, students will be contacted to discuss the concern, strategize options, and be connected to appropriate resources. Anyone who is unclear about what steps to take if they have concerns about students should either consult the [CCC Reference Guide](#) or contact the Office of the Dean of Students at 214-768-4564.

Mental Health Resources: On-Call and Ongoing Counseling Services: Throughout the academic year, students may encounter different stressors or go through life experiences which impact their mental health and academic performance. Students who are in distress or have concerns about their mental health can schedule a same-day or next-day appointment to speak with a counselor by calling [Counseling Services](#). Counselors are available at any time, day or night for students in crisis at this number: 214-768-2277 (then select option 2) They will be connected with a counselor immediately. Students seeking ongoing counseling should call the same number (214-768-2277, then select option 1) during normal business hours to schedule an initial appointment.

University Policies

Disability Accommodations: Students who need academic accommodations for a disability must first register with Disability Accommodations & Success Strategies (DASS). Students can call 214-768-1470 or visit <http://www.smu.edu/Provost/SASP/DASS> to begin the process. Once they are registered and approved, students then submit a DASS Accommodation Letter through the electronic portal, *DASS Link*, and then communicate directly with each of their instructors to make appropriate arrangements. Please note that accommodations are not retroactive, but rather require advance notice in order to implement.

Sexual Harassment: All forms of sexual harassment, including sexual assault, dating violence, domestic violence and stalking, are violations of SMU’s Title IX Sexual Harassment Policy and may also violate Texas law. Students who wish to file a complaint or to receive more information about the grievance process may contact Samantha Thomas, SMU’s Title IX Coordinator, at accessequity@smu.edu or 214-768-3601. Please note that faculty and staff are mandatory reporters. If students notify faculty or staff of sexual harassment, they must report it to the Title IX Coordinator. For more information about sexual harassment, including resources available to assist students, please visit www.smu.edu/sexualmisconduct.

Pregnant and Parenting Students: Under Title IX, students who are pregnant or parenting may request academic adjustments by contacting Elsie Johnson (elsiej@smu.edu) in the Office of the Dean of Students, or by calling 214-768-4564. Students seeking assistance must schedule an appointment with their professors as early as possible, present a letter from the Office of the Dean of Students, and make appropriate arrangements. Please note that academic adjustments are not retroactive and, when feasible, require advance notice to implement.

Religious Observance: Religiously observant students wishing to be absent on holidays that require missing class should notify their professors in writing at the beginning of the semester and should discuss with them, in advance, acceptable ways of making up any work missed because of the absence. [Click here for a list of holidays.](#)

COVID-19 and Other Medical-Related Absences: Students who test positive for COVID-19 and need to isolate, or who are notified of potential exposure, must follow [SMU’s Contact Tracing Protocol](#). To ensure academic continuity and avoid any course penalties, students should follow the same procedures described by their instructors as they would for any other medical-related absence in order to be provided with appropriate modifications to assignments, deadlines, and exams.

Excused Absences for University Extracurricular Activities: Students participating in an officially sanctioned, scheduled university extracurricular activity should be given the opportunity to make up class assignments or other graded assignments that were missed as a result of their participation. It is the responsibility of the student to make arrangements for make-up work with the instructor prior to any missed scheduled examinations or other missed assignments. (See [2020-2021 SMU Undergraduate Catalog](#) under “Enrollment and Academic Records/Excused Absences.”)

Final Exams: Final course examinations shall be given in all courses where appropriate, and some form of final assessment is essential. Final exams and assessments must be administered as specified in the official examination schedule. Exams cannot be administered or due during the last week of classes or during the Reading Period. Syllabi must state clearly the form of the final exam or assessment, and the due date and time must match the official SMU exam schedule. Final exams are not required to be provided online.

Academic Dishonesty: Students are expected to embrace and uphold the SMU Honor Code. Violations of the Honor Code will be acted upon in accordance with the policies and procedures outlined in the Mustang Student Handbook.