AST 346: Galaxies and the Interstellar Medium
Spring 2023

Instructor
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ESS 456
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Course Description
This course provides an introduction to galaxies and the interstellar medium. Topics include galaxy morphologies, stellar luminosity function, galactic chemical evolution, age/metallicity relationship, globular clusters, dynamics of collisionless systems, galaxy kinematics, Oort constants, cosmic distance scale, interstellar absorption lines, interstellar emission lines, 21 cm hyperfine transition, dispersion and rotation measures, interstellar dust, bremsstrahlung, X-ray emitting plasmas, neutral and atomic Hydrogen content of galaxies, active galaxies and QSOs, QSO absorption lines, intergalactic medium, cosmic chemical evolution, photometric redshift measurements, high-redshift galaxies, and galaxy formation and evolution.

Class Meeting
MW 8:30–9:50, Humanities 3017

Text
The required text for the course is *Galaxies in the Universe: An Introduction*, by Sparke and Gallagher (2007, Cambridge University Press). A recommended text for the course is *An Introduction to Modern Astrophysics, Second Edition* by Carroll and Ostlie (2017, Cambridge University Press).

Office Hours
TBD and by appointment.

Lectures and Lecture Notes
Some material will be presented in lectures using projected slides, while other material will be presented in lectures using a black or white board. Some of the projected slides may be posted online, but students are responsible all material covered in lecture, irrespective of how the material is presented.

Homework
Homework will be assigned roughly weekly over the course of the semester. Homework must submitted electronically in PDF format via Blackboard by the due date and time.

Exams
There will be two mid-term exams over the course of the semester and a final exam at the end of the semester. The final exam will be cumulative. A scientific calculator may (and should) be used during the exams. No cell phones may be used during the exams, and no notes or books may be consulted during the exams. Students must arrive on time for the exams with their

student ID cards. Students who arrive late for an exam will not be given extra time. *Note that there will be no way to make up missed exams*, although with advanced notice or careful documentation of extenuating circumstances, a missed exam may be excused or other accommodations made. The schedule of exams is presented in the "Course Schedule" below.

Final Exam

According to the University registrar, the final exam is currently scheduled for Wednesday, May 17, 2023 from 8:00 AM to 10:45 AM. In the event of a discrepancy between what is listed here and what is listed by the registrar, what is listed by the registrar will take precedence. *Note that students are required to take the final exam, and there will be no way to make up a missed final exam.*

Class Attendance

Students are expected to attend class, and lack of attendance can affect course grade.

Course Grade

The course grade will be based on the two mid-term exams (25% each), the final exam (30%), and the homework (20%), with discretion for class attendance as described above.

Extra Credit

There will be no possibility of extra credit.

Course Schedule

Class	Date	S&G Sections	Topic
1	1/23		Organization and overview
2	1/25	1.3	Brief history of galaxies
3	1/30	1.4, 1.5, 8.3	The expanding Universe
4	2/1	1.1.5	Astronomical magnitudes
5	2/6	1.1, 2.1, 2.2	Stellar populations
6	2/8	4.3	Galactic chemical evolution
7	2/13	2.3	Galactic rotation and the Oort constants
8	2/15	3.1, 3.2	Motions under gravity and two-body relaxation
9	2/20		Catchup and review
10	2/22		Midterm exam 1 (classes 1–9)
11	2/27	3.3	Epicyclic approximation

Class	Date	S&G Sections	Topic
12	3/1	5.5	Spiral density waves and resonances
13	3/6	3.4	Collisionless Boltzmann equation
14	3/8	6	Elliptical galaxies
	3/13		No class
	3/15		No class
15	3/20	5	Spiral and S0 galaxies
16	3/22	9	AGN and QSOs
17	3/27	5, 6, 7	Dark matter
18	3/29	7, 8	Large-scale structure
19	4/3		Catchup and review
20	4/5		Midterm exam 2 (classes 11–19)
21	4/10		Radiative transfer
22	4/12		Einstein and emission and absorption coefficients
23	4/17		Absorption-line formation
24	4/19		Ionization and H II regions
25	4/24	1.2	Cosmic Dust
26	4/26	9.3	QSO absorption lines
27	5/1	9.3, 9.4	Intergalactic medium and high-redshift galaxies
28	5/3		Catchup and review

Americans with Disabilities Act

If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact Disability Support Services, ECC Building, Room 128, 631–632–6748. They will determine what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.

Academic Integrity

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology and Management, Nursing, Social Welfare, and Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary web site at http://www.stonybrook.edu/uaa/academicjudiciary/.

Critical Incident Management

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of University Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Health Sciences Center (School of Health Technology and Management, Nursing, Social Welfare, and Dental Medicine) and School of Medicine are required to follow their school-specific procedures. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.

Electronic Communication

Email to your University email account is an important way of communicating with you for this course. For most students, the email address is firstname.lastname@stonybrook.edu. *It is your responsibility to read your email received at this account*. For instructions about how to verify your University email address, see

http://it.stonybrook.edu/help/kb/checking-or-changing-your-mail-forwarding-address-in-the-epo.

You can set up email forwarding using instructions described at

http://it.stonybrook.edu/help/kb/setting-up-mail-forwarding-in-google-mail.

If you choose to forward your University email to another account, we are not responsible for any undeliverable messages.

Religious Observances

See the policy statement regarding religious holidays at

http://www.stonybrook.edu/registrar/forms/RelHolPol\%20081612\%20cr.pdf.

Students are expected to notify the course professors by email of their intention to take time out for religious observance. This should be done as soon as possible but definitely before the end of the add/drop period. At that time, they can discuss with the instructors how they will be able to make up the work covered.