

**San José State University**  
**Department of Physics and Astronomy**  
**ASTR 155, Topics in Modern Astronomy and Astrophysics, Fall 2014**

**Course and Contact Information**

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<b>Office Hours:</b>	Mondays (SCI 242), Wednesdays (SCI 235), 12:15–1:15pm
<b>Class Days/Time:</b>	Mondays, Wednesdays, 11:00am–12:15pm
<b>Classroom:</b>	SCI 242
<b>Prerequisites:</b>	PHYS 50–52 or equivalent (ASTR 117A–B useful but optional)

**Course Format**

It is anticipated that this course will involve extensive internet-based activities and assignments. Steady access to an internet connection and a web browser are essential. Additional software will be available on the classroom computers as needed.

**Course webpage**

The Canvas online course management system will be an integral part of this course. Its usage may include announcements, distribution of handouts, submission and grading of assignments, online quizzes, coordination of class projects, etc. Your enrollment in the course gives you access to the site – please check there for further information and updates, including to the syllabus. Canvas is accessed via <http://sjsu.instructure.com>, and more information and help can be found at [http://www.sjsu.edu/at/ec/canvas/student\\_resources/index.html](http://www.sjsu.edu/at/ec/canvas/student_resources/index.html). Note that besides using a web browser to access Canvas, there are also Apps for iOS and Android (with a few minor gaps in functionality).

You are responsible for regularly checking your email for course news, and Canvas for feedback on your assignments. You may also want to make use of the Canvas Notifications system to receive updates about upcoming deadlines, etc. Canvas also provides “Modules” and “Assignments” pages that are useful for keeping track of course progress and deadlines. Feedback on assignments will be posted on Canvas, but please do not use the Canvas messaging system for any urgent matters: **use direct email instead.**

**Course Description**

This is a course on selected topics in astronomy and astrophysics, following (but independent from) the ASTR 117A–B sequence which covers the fundamentals in the field. The course is repeatable for a total of 9 units, may be used as an upper-division physics elective for the physics B.A. and B.S., and is a required course for the astronomy minor. Prerequisites include the calculus-based introductory physics sequence.

This semester, the focus of the course will be on **research methods**, with training in the essential strategies and tools for developing, implementing, and communicating original research projects, with a tentative goal of producing one or more publications in a peer-reviewed journal. This research emphasis will be in the context of observational astronomy at optical wavelengths, using public online databases, while connecting both to current astrophysical topics of interest, and to fundamental physical principles. Specific topics may include compact stellar systems, supermassive black holes, dark matter, and/or exoplanets.

## **Learning Outcomes and Course Goals**

### **Course Learning Outcomes (CLO)**

The goals of this course are (1) to learn about current topics of interest in astronomy and astrophysics; (2) to connect fresh results in astronomy with fundamental principles of physics; (3) to gain an understanding of observational methods and data in optical astronomy; (4) to learn and practice the essential steps in astronomical inquiry, including identifying interesting topics, formulating specific research questions, designing strategies to acquire evidence about the questions, carrying out experiments and analyses, and synthesizing and defining conclusions based on the results obtained; and (5) to gain experience with practical skills used in the professional astronomy community, such as collaboration, communication (reading, writing, and oral presentations), literature searches, data mining, statistics, and computing applications.

Upon successful completion of this course, students will be able to:

1. understand the observational and physical underpinnings of new results in astronomy and astrophysics
2. investigate a topic in the astronomical literature
3. formulate and explore a research question
4. write an astronomy-based report in a professional electronic format

### **Required Readings**

The course has no formal textbook, but instead various required readings will be posted or linked on Canvas at the appropriate times.

### **Other equipment / material requirements**

Computer usage outside of class hours will be required for most assignments. Students should identify early a lab or personal computer that will be suitable for word processing, internet access, and programming. The SCI 242 computer lab will also be available during certain hours (see the schedule on the door):

Mondays 12:15–4:00pm, Wednesdays 1:20–4:00pm, Fridays 10:50am–4:00pm.

Close the door when you leave. If you find the room locked, go to the department office (SCI 148) for help.

### **Library Liaison**

Physics & Astronomy library liaison: Jennifer Dinalo, [jennifer.dinalo@sjsu.edu](mailto:jennifer.dinalo@sjsu.edu)

See also Physics & Astronomy LibGuide at [http://libguides.sjsu.edu/physics\\_astronomy](http://libguides.sjsu.edu/physics_astronomy).

### **Course Requirements and Assignments**

SJSU classes are designed such that in order to be successful, it is expected that students will spend a minimum of forty-five hours for each unit of credit (normally three hours per unit per week), including preparing for class, participating in course activities, completing assignments, and so on. More details about student workload can be found in [University Policy S12-3](http://www.sjsu.edu/senate/docs/S12-3.pdf) at <http://www.sjsu.edu/senate/docs/S12-3.pdf>.

This course is intended to partially mirror a scientific research environment, and thus will not have exams, and will have a relatively open-ended assignment structure, along with a strong emphasis on active participation. Participation will be assessed by in-class exercises and by contributions to online class projects and discussions. Assignments will include a variety of exercises including online astronomy research, writing, and oral presentation. Activities off campus may be arranged (with flexible scheduling) as part of the course. The “final exam” meeting will consist of a series of class project presentations.

The assignment logistics and due dates will be announced in class. In general, the assignments will be due (normally via Canvas) by the beginning of class, one week after they are given out.

The required “final exam” meeting will be held on Monday, December 15, 9:45am–12:00pm.

## Grading Policy

The overall grading scheme is as follows:

Assignments:	50%
Participation:	30%
Final report and presentation:	20%

The letter-grade assignment is:

A+	97–100	A	93–96	A–	90–92
B+	87–89	B	83–86	B–	80–82
C+	77–79	C	73–76	C–	70–72
D+	67–69	D	63–66	D–	60–62
F	0–59				

Late submissions may be accepted for some assignments, but with diminishing credit.

A few extra-credit options may be available during the semester, involving additional work that expands on the normal class assignments.

## Classroom Protocol

Attendance, on-time arrival, and participation both in the classroom and in online activities are crucial for success in this course. Cell phones on ‘silent’, please. Additional guidelines for using the classroom computers will be provided.

## University Policies

### Dropping and Adding

Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, etc. Refer to the current semester’s [Catalog Policies](http://info.sjsu.edu/static/catalog/policies.html) section at <http://info.sjsu.edu/static/catalog/policies.html>. Add/drop deadlines can be found on the current academic year calendars document on the [Academic Calendars webpage](http://www.sjsu.edu/provost/services/academic_calendars/) at [http://www.sjsu.edu/provost/services/academic\\_calendars/](http://www.sjsu.edu/provost/services/academic_calendars/). The [Late Drop Policy](http://www.sjsu.edu/aars/policies/latedrops/policy/) is available at <http://www.sjsu.edu/aars/policies/latedrops/policy/>. Students should be aware of the current deadlines and penalties for dropping classes.

Information about the latest changes and news is available at the [Advising Hub](http://www.sjsu.edu/advising/) at <http://www.sjsu.edu/advising/>.

## **Consent for Recording of Class and Public Sharing of Instructor Material**

[University Policy S12-7](http://www.sjsu.edu/senate/docs/S12-7.pdf), <http://www.sjsu.edu/senate/docs/S12-7.pdf>, requires students to obtain instructor's permission to record the course.

- “Common courtesy and professional behavior dictate that you notify someone when you are recording him/her. You must obtain the instructor's permission to make audio or video recordings in this class. Such permission allows the recordings to be used for your private, study purposes only. The recordings are the intellectual property of the instructor; you have not been given any rights to reproduce or distribute the material.”
  - It is suggested that the greensheet include the instructor's process for granting permission, whether in writing or orally and whether for the whole semester or on a class by class basis.
  - In classes where active participation of students or guests may be on the recording, permission of those students or guests should be obtained as well.
- “Course material developed by the instructor is the intellectual property of the instructor and cannot be shared publicly without his/her approval. You may not publicly share or upload instructor generated material for this course such as exam questions, lecture notes, or homework solutions without instructor consent.”

## **Academic integrity**

Your commitment, as a student, to learning is evidenced by your enrollment at San Jose State University. The [University Academic Integrity Policy S07-2](http://www.sjsu.edu/senate/docs/S07-2.pdf) at <http://www.sjsu.edu/senate/docs/S07-2.pdf> requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development. The [Student Conduct and Ethical Development website](http://www.sjsu.edu/studentconduct/) is available at <http://www.sjsu.edu/studentconduct/>.

## **Campus Policy in Compliance with the American Disabilities Act**

If you need course adaptations or accommodations because of a disability, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. [Presidential Directive 97-03](http://www.sjsu.edu/president/docs/directives/PD_1997-03.pdf) at [http://www.sjsu.edu/president/docs/directives/PD\\_1997-03.pdf](http://www.sjsu.edu/president/docs/directives/PD_1997-03.pdf) requires that students with disabilities requesting accommodations must register with the [Accessible Education Center](http://www.sjsu.edu/aec) (AEC) at <http://www.sjsu.edu/aec> to establish a record of their disability.

## **Student Technology Resources**

The computers in SCI 242 will be available for certain assignments. For more general usage, computer labs are available in the [Academic Success Center](http://www.sjsu.edu/at/asc/) at <http://www.sjsu.edu/at/asc/> located on the 1st floor of Clark Hall and in the Associated Students Lab on the 2nd floor of the Student Union. Computers are also available in the Martin Luther King Library.

## **SJSU Peer Connections**

For brief information about Peer Connections, see Canvas page here: <https://sjsu.instructure.com/courses/1111532/assignments/syllabus#peer> or the Peer Connections website at <http://peerconnections.sjsu.edu>.

## **SJSU Writing Center**

For brief information about the Writing Center, see Canvas page here:

<https://sjsu.instructure.com/courses/1111532/assignments/syllabus#writing>,

or the Writing Center website at <http://www.sjsu.edu/writingcenter>.

## **SJSU Counseling Services**

The SJSU Counseling Services is located on the corner of 7<sup>th</sup> Street and San Fernando Street, in Room 201, Administration Building. Professional psychologists, social workers, and counselors are available to provide consultations on issues of student mental health, campus climate or psychological and academic issues on an individual, couple, or group basis. To schedule an appointment or learn more information, visit [Counseling Services website](http://www.sjsu.edu/counseling) at <http://www.sjsu.edu/counseling>.

# ASTR 155 / Topics in Modern Astronomy and Astrophysics, Fall 2014, Course Schedule

Topics, readings, and schedule are provisional.

## Course Schedule

Week	Date	Topics, Readings, Assignments, Deadlines
1	August 25	course introduction; research skills; galaxies, star clusters, and transition objects
1	August 27	angular size; color and temperature; <i>Hubble</i> Ultra Deep Field reading: Lang ( <i>Essential Astrophysics</i> ), Sec. 1.4, 2.4 assignment: <i>Hubble</i> Ultra Deep Field exercises
2	September 1	LABOR DAY: no class
2	September 3	scales and distances: parallax and parsecs; galaxy types reading: Lang, Sec. 2.5.1, 10.1.1 assignment: Galaxy Zoo exercises
3	September 8	magnitudes, fluxes, inverse square law, colors, digital sky surveys reading: Lang, Sec. 10.1.2, 10.1.3, 10.1.5; Canvas links
3	September 10	Galaxy Zoo; SDSS; automated spiral arm detection (guest: Dr. Wayne Hayes) reading: Canvas links assignment: finding the densest galaxies
4	September 15	spectroscopy; Doppler shift; gravity and orbits; black holes reading: Lang, Sec. 6.1, 4.3.4, 6.5.1, 3.2, 3.3, 13.8.1, 13.8.3
4	September 17	densest galaxies search; supermassive black holes reading: Lang, Sec. 14.1.5, 15.5.2 assignment: M60-UCD1 supermassive black hole: paper reading, press coverage
5	September 22	journals and literature; velocity dispersions and virial mass estimator Reading: Lang, Sec 4.3.6
5	September 24	mass estimates; adaptive optics; M60-UCD1 supermassive black hole; LaTeX assignment: LaTeX and dwarf galaxy spectra
6	September 29	M60-UCD1 stripping history; Fermi estimates
6	October 1	Virgo cluster; Python and plotting assignment: plotting circumgalactic objects
7	October 6	big telescopes reading: Lang, Sec 1.8
7	October 8	SDSS spectroscopic searches and visualization assignment: more spectroscopic searching
8	October 13	supermassive black hole scaling relations, influence; adaptive optics; proposals
8	October 15	compact stellar systems; stellar colors, types, ages; color–magnitude diagrams reading: Lang, Sec 2.4, 10.1.3–10.1.6, 10.1.8, 10.2.1, 10.2.3, 10.3.2, 10.4 assignment: SDSS photometric search with SQL

Week	Date	Topics, Readings, Assignments, Deadlines
9	October 20	Sloan Digital Sky Survey SQL searches; stellar evolution, white dwarfs reading: Lang, Sec 8.3.4, 10.2.4, 10.3.3, 13.1–13.4
9	October 22	supernovae, nucleosynthesis, neutron stars, binary accretion reading: Lang Sec 10.5–10.5.4, 13.5.3–13.5.6, 13.7; Choudhuri Sec 4.7, 5.4–5.6 assignment: <i>Chandra</i> –SDSS matching
10	October 27	galaxy mergers reading: Lang, Sec 14.4.3; Mo, Sec 1.2.7, 12.1–12.5.1, 13.2.2, 13.2.3, 13.3.5
10	October 29	X-ray telescopes and binaries reading: Courvoisier, Ch 1.3.3, 16; Seward Sec 3.2.5, 3.5.6, 3.5.10, 9.2, 11, 12 assignment: project idea
11	November 3	project ideas and resources
11	November 5	Project proposals; radiation pressure and Eddington limit reading: Lang Focus 10.1, 13.4; Courvoisier Sec 10.1, Choudhuri Sec 3.6.1, 5.6 assignment: project proposal
12	November 10	project proposals; accretion power, ultra-luminous X-ray sources, classifications
12	November 12	ALMA planetary system; Rosetta comet landing; ultra-luminous X-ray source assignment: project progress #1
13	November 17	National Science Foundation grants; optical/infrared properties of X-ray sources assignments: peer review
13	November 19	project updates: UCDs in spirals search; SDSS search/thumbnails code reading: Paudel et al. (2013) assignment: project progress #2
14	November 24	more hypervelocity objects; project tips: SQL and color–color plots reading: Guillochon & Loeb
14	November 26	SDSS: more SQL search methods, and object classifications assignment: project progress and literature search
15	December 1	guest speaker: Jennifer Dinalo – the library for physicists
15	December 3	Python coding tips; photometric redshifts assignment: final project report
16	December 8	projects workshop
16	December 10	presentations; planning observations; CSS diagnostics; hypercompact cluster assignment: final project presentation
Final Exam	December 15	FINAL PRESENTATIONS, SCI 242, 9:45am–12:00pm