

San José State University
Department of Physics and Astronomy
ASTR101, Modern Astronomy, Section 1, Spring 2009

Instructor:	Dr. Michael J. Kaufman
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Office Hours:	M 11:30-12, WF 11:30-12:30, or by appointment
Class Days/Time:	MWF 10:30-11:20
Classroom:	Science 253
Prerequisites:	Completion of core GE, satisfaction of Writing Skills Test and upper division standing and a college physical science course. For students who began continuous enrollment at a CCC or a CSU in Fall 2005 or later, completion of, or corequisite in a 100W course is required.
GE/SJSU Studies Category:	This course satisfies the Area R requirement for SJSU Studies (“Upper Division GE”). Courses to meet Areas R, S and V of SJSU Studies must be taken from three different departments or distinct academic units.

Faculty Web Page and MYSJSU Messaging (Optional)

Copies of the course materials such as the syllabus, major assignment handouts, etc. may be found on the class web page at <http://www.physics.sjsu.edu/mkaufman/astr101> . You are responsible for regularly checking with the messaging system through MySJSU.

Course Description

A general introduction to our present understanding of the origin and evolution of **Stars, Galaxies and the Universe**. The major theme of the course is how the Universe has evolved, from a system containing only the simplest elements to the chemically complex Universe we find around us, containing at least one “intelligent” species able to contemplate the Universe. I will emphasize how the scientific method has been used to construct our present understanding, and we will spend some time discussing how science is actually carried out. We will also review the physical laws acting throughout the Universe. Although many facts will be presented, the course objectives will be

developing an understanding of *concepts* rather than on memorization of facts. This understanding will be developed in the following subject areas:

- 1) Brief historical background, the scientific method, and basic physical laws.
- 2) The techniques used in modern astronomy, including the use of spectroscopy, telescopes, CCDs and computers. Emphasis will be placed on the "multi-wavelength" approach to astronomical observations.
- 3) The evolution of stars, from their births in stellar "nurseries" to their deaths as planetary nebulae, neutron stars and black holes; we will emphasize the role of stars in forming chemical elements.
- 4) The organization of our Galaxy, the structure and formation of galaxies, and the Big Bang.

We will also spend some time on "current events" including the discovery of more than 300 planets around other stars, the evidence for a Black Hole at the center of our Galaxy, and the recently discovered "acceleration" of the Universe. I will also include details of my own research on star formation, interstellar chemistry, and the earliest galaxies. The news is literally full of new astronomical results, and we will discuss new ones as they arise. I encourage you to read the news (on paper or on-line), look for stories of astronomical interest, and bring stories you find interesting to my attention!

Course Goals and Student Learning Objectives

GE/SJSU Studies Learning Outcomes (LO), if applicable

During this course:

- Students will learn to *distinguish science from pseudo-science* by:
 1. criticizing a pseudo-scientific proposal and identifying the classes of errors involved;
 2. comparing scientific results with advertising claims
 3. comparing the scientific arguments for the Big Bang to the claims of "Young Earth" Creationists.
- Students will demonstrate *an understanding of the methods of science* by:
 1. predicting the properties of stars in various evolutionary stages and then testing those predictions against observations;
 2. discussing the steps involved in grant writing, telescope time allocation, and the peer-reviewed publication process
 3. discussing the observation and classification of various astronomical objects, e.g., stellar spectra, galaxy morphology, etc.
 4. examining the experimental basis for radiation laws and atomic spectra.
- Students will demonstrate an understanding of the *limits of scientific investigation* by:
 1. discussing the inability to accurately predict solar activity and its implications for manned spaceflight missions;

2. examining the limitations placed on predictions of advanced stellar evolutionary states by the use of idealized models;
 3. identifying cases where observational bias (“selection effects”) come into play in astronomy and in opinion polling
- Students will *apply a scientific approach to questions* about the physical universe by:
 1. identifying the origins of the chemical elements and using that information to infer when the universe was “ready” for the development of life;
 2. discussing the future of the Sun and Earth in light of stellar evolutionary theory;
 3. combining various independent lines of evidence (stellar evolution models, the Hubble Law, radioactive decay of elements) to reach conclusions about the age of the universe and the beginning of Time.
 - Students will *appreciate the interrelationship of science and human beings* by:
 1. examining the impact of human light pollution on observational astronomy (based on their own observational estimates of the number of stars visible from different locations);
 2. discussing how political pressures impact funding for “abstract” research proposals (e.g., the solar neutrino experiment, SETI (Search for Extraterrestrial Intelligence)).

Required Texts/Readings

Textbook

Stars, Galaxies & Cosmology, 5th Edition, by Bennett, Donahue, Schneider and Voit (ISBN 0-321-55822-7). This book is available at the Spartan Bookstore and from many on-line outlets.

Other Readings

There will be handouts and other supplemental materials (see schedule). I will be happy to suggest additional readings for any student that wants to pursue course topics in more detail.

Other equipment / material requirements (optional)

Note that the “Mastering Astronomy” program is required for the course and comes with new copies of the book. If you do not buy a new copy of the book, you will have to buy a separate license for Mastering Astronomy. The software allows access to on-line homework, study guides, interactive applets, practice quizzes and an electronic version of the book.

Classroom Protocol

You are expected to show up on time for class and to be an active participant. In addition to lecture, there will be many collaborative learning exercises, instant response questions, and other opportunities to work with your fellow students. Note that this is a MWF class, and Fridays are just as important as the other class meetings, and all midterms are

scheduled for Fridays. If you have a schedule conflict, I recommend that you take this course during another semester.

Please turn off your cell phone ringers when arriving at class. If your phone rings during class, I'm the one who gets to answer it! This is fun for everyone EXCEPT the person with the ringing phone.

If you know you need to leave a class early, please let me know ahead of time.

Computers may only be used in class for note taking. Web surfing, AIM, etc. are forbidden.

Dropping and Adding

Students are responsible for understanding the policies and procedures about add/drops, academic renewal, etc. [Information on add/drops are available at http://info.sjsu.edu/web-dbgen/narr/soc-fall/rec-298.html](http://info.sjsu.edu/web-dbgen/narr/soc-fall/rec-298.html). [Information about late drop is available at http://www.sjsu.edu/sac/advising/latedrops/policy/](http://www.sjsu.edu/sac/advising/latedrops/policy/). Students should be aware of the current deadlines and penalties for adding and dropping classes.

Assignments and Grading Policy

The course grade will be determined from a combined score total from three midterm tests, homework, quizzes and feedback, and a **comprehensive** final exam. Regardless of your point total, **the final exam must be taken in order to pass the class**. If you do not take the final, you will receive a 'WU' grade.

Table 1 Grading Percentages

Tests, etc.	Percentage	Tentative Date
Midterm #1	20%	February 20
Midterm #2	20%	March 20
Midterm #3	20%	April 17
Final Exam	20%	May 15, 9:45-12:00
Homework, quizzes, etc.	20%	Throughout the term

The course will be graded on a curve, so no specific point total is required for an A, B, etc. The class median score is *typically* around 70% (usually a C+/B-) while 'A' grades usually require about 85% of the available points. Keep in mind that classes vary; I keep a running tally of the class average and where each student stands, so please check with me at any time to find out how you are doing individually and compared with the rest of the class.

Tests

Tests and the final exam will be based on material as it is presented in lecture, not all of which is fully discussed in the text. It is therefore strongly suggested that you attend all of the lectures (be sure to get class notes if you must miss a class). Tests will consist of multiple choice and fill-in questions as well as some short essay questions. The essay questions will be graded on the basis of **complete reasoning and grammar (see above)**,

not just reaching the right result. You will be given at least one week's notice of tests. **Make up tests are not normally allowed; if you are going to miss a test, you must have a very compelling reason and you must tell me ahead of time. (NOTE: "Ahead of time" does not mean 5AM the day of the exam!)**

Writing Requirements

All SJSU Studies courses require a minimum of 3000 words writing for which you will receive prompt feedback on content and writing proficiency. Essay questions on tests, homework problems, in class writing and email feedback serve to satisfy this requirement. The criteria used in evaluating the written assignments are summarized below. The "maximum credit" available varies from one assignment to another. See the top of the next page for the grading scheme.

Table 2 Grading of Writing

Maximum credit	Conclusions are correct and explanations are presented logically and completely; Only information pertinent to the question is presented; Writing is grammatically correct and work is neatly presented.
Partial credit	Necessary concepts, information are included but not logically reasoned or presented; Non-pertinent information is included in response; Awkward grammar, some careless misspellings; Sloppy presentation of work.
No credit	Incorrect conclusions, faulty reasoning; Written responses are not in full sentences; Multiple spelling and/or grammar errors.

Homework & Quizzes

There will be approximately twelve homework-assignments handed out during the semester, one every week to week-and-a-half. Please make an appointment with me or come to office hours if you are having trouble with the homework. I will be happy to discuss the homework with you BEFORE OR AFTER the homework is due. The homework is designed to help you develop your reasoning skills, and doing the homework is good practice for the exam essay questions. **Complete reasoning and proper grammar (see above)** are required on the homework. Some of the homework will involve reading astronomical research papers and using on-line astronomical databases. There may also be several short quizzes in class, some of which may not be announced in advance. Solutions to homework and quizzes will be posted in the display case just outside my office, Science 248.

Homework handed in one class period late will be marked down by 50%; I will not accept any homework more than one class late. Quizzes cannot be made up.

Email Feedback

In addition to homework and quizzes, you will be expected to provide feedback to me **via email** *two times* during the semester. These comments are very useful to me if they include *specific comments or questions* on parts of the course that are clear or unclear to

you. These comments should be about 1/2 to 1 page long and will be worth a few homework points. Simple lists of things we covered in class will receive less credit than detailed comments and discussion. Due dates will be announced at least one week ahead of time. I will respond to the emails in a timely manner with answers, suggestions, clarifications, etc. And, of course, ***you can always email me with questions or comments at any time during the semester.***

A Note About Homework

I fully expect and even encourage you to work together to solve the homework problems. However, you are required to write your own solutions *in your own words*. If I receive homework where two or more people have copied each other's solutions, all of those people will receive a grade of zero **for that entire homework set**. Please work together if you like, but write your answers in your own words.

A Note About Math

Although this course is mostly non-mathematical in nature, there will be times during the course where I will have to use scientific notation and some algebra, and we'll be reading lots of graphs. We'll have plenty of in-class practice with these. If you're having trouble, please let me know and I will be happy to help.

Classroom Participation

There will be many opportunities for group work and interaction with your fellow students. There are no points for this, but you will have better results on homework, quizzes and exams when you learn from your peers. I will also be testing a highly sophisticated "classroom response system. You should bring this with you to every class.

And Finally.....

You should always feel free to ask questions during the lecture or after class. As far as I'm concerned, there is no such thing as a silly or stupid question - if something is unclear to you, ask me! In my experience, there are usually 5 other people in the room wondering the same thing. We will all get more out of the class if there is plenty of discussion. Have fun!

University Policies

Academic integrity

Students should know that the University's [Academic Integrity Policy is available at http://www.sa.sjsu.edu/download/judicial_affairs/Academic_Integrity_Policy_S07-2.pdf](http://www.sa.sjsu.edu/download/judicial_affairs/Academic_Integrity_Policy_S07-2.pdf). Your own commitment to learning, as evidenced by your enrollment at San Jose State University and the University's integrity policy, require 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 website for [Student Conduct and Ethical Development is available at http://www.sa.sjsu.edu/judicial_affairs/index.html](http://www.sa.sjsu.edu/judicial_affairs/index.html).

Instances of academic dishonesty will not be tolerated. Cheating on exams or plagiarism (presenting the work of another as your own, or the use of another person's ideas without giving proper credit) will result in a failing grade and sanctions by the University. For this class, all assignments are to be completed by the individual student unless otherwise specified. If you would like to include in your assignment any material you have submitted, or plan to submit for another class, please note that SJSU's Academic Policy F06-1 requires approval of instructors.

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 requires that students with disabilities requesting accommodations must register with the DRC (Disability Resource Center) to establish a record of their disability.

Emergency Response

In the unlikely event of a tsunami, nuclear attack, revolution, etc. that requires that you leave the building, the likely warning of such an occasion will be the sounding of the fire/emergency alarm in the hallway. The "escape route" for such events is posted outside the door to this classroom. For us here in SCI 253, the indicated route is down the stairs at the end of the hall just outside our room.

ASTR101 Section 1

Modern Astronomy, Spring 2009, Course Schedule

Schedule is subject to change based on class progress.

Table 3 Course Schedule

Week Beginning:	Topics	Readings
1/23	Introduction	“How To Succeed...”, Foreward, Chapter 1
1/26	Mapping the sky, history, scientific method	Scientific method handout, 2.1, 2.4, Chapter 3
2/2	Electromagnetic radiation, waves, spectra	Chapter 5
2/9	Radiation laws, photons, spectra	Chapter 5
2/16	Forces in nature, telescopes Exam #1: Friday February 20	S4.2, Chapter 6
2/23	Sun’s properties and power	Chapter 14
3/2	Measuring the properties of stars	Chapter 15
3/9	The H-R diagram	Chapter 15
3/16	Stellar distances, interstellar medium Exam #2: Friday March 20	Chapter 16, Orion handout
3/23	Spring Break	
3/30	Star formation, extrasolar planets	Chapter 16, Star Formation handout, extrasolar planet handout
4/6	Stellar Evolution, red giants	Chapter 17
4/13	White dwarfs, neutron stars & black holes Exam #3: Friday April 17	Chapter 18
4/20	Charting the Milky Way	Chapter 19
4/27	Galaxies, active galaxies and galaxy evolution	Chapter 20, Chapter 21
5/4	Mapping the universe, big bang nucleosynthesis	Chapter 22, Chapter 23
5/11	Astrobiology and life in the universe Final Exam: Friday May 15, 9:45- 12:00	Astrobiology handout