San José State University
School/Department
Astronomy 101, Modern Astronomy, Section 4, Spring, 2018

Course and Contact Information

Instructor: Ignacio Mosqueira
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Email: Ignacio.Mosqueira@sjsu.edu
Office Hours: MW 1:30-3:00
Class Days/Time: MW 3:00-4:15 PM
Classroom: Science Building 258

Prerequisites: Completion of core GE, satisfaction of Writing Skills Test and upper division standing and a college physical science course. For students who begin 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.

Course Format

Faculty Web Page
Course materials can be found at http://www.sjsu.edu/people/Ignacio.Mosqueira

Course Description

A general introduction to our present understanding of the origin and evolution of Stars, Galaxies and the Universe. Of particular interest to me 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 form 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, spacecraft 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 100 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 a topic of my own research and incorporate discussion of "astronomy in the news", whenever appropriate.
Course Goals

Student Learning Objectives: 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. appraising the claims of causal relationships between sunspot activity and human behavior;
  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 observation and classification of various astronomical objects, e.g., stellar spectra, galaxy morphology, etc.
  3. examining the experimental basis for radiation laws and atomic spectra.
- Students will demonstrate an understanding of the scope and limits of scientific investigation by:
  1. discussing the level of confidence and uncertainty underlying the science of global warming, beginning with an understanding of the mechanisms responsible for setting the average temperature of planetary objects;
  2. examining the limitations placed on predictions of advanced stellar evolutionary states by the use of idealized models;
  3. considering the merit in claims regarding the cause of the Big Bang.
- 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));
  3. presenting the current status of the "anthropic principle", the idea that key parameters are observed to have specific values in our universe because other values would result in an inhospitable universe devoid of complex life forms capable of asking the question (such as ourselves).

WRITING

The amount of writing required is 3000 words, distributed across a short and a long essay.
The three midterms will also involve short essays.

Students are expected to participate in class and peer group discussions.

SJSU Studies Area R Course Learning Objectives (CLO)/GE Learning Outcomes (GELO)

The GE requirement will be met in this class by means of 2 written assignments:
1) Analytical/Critical Essay = 700+ Words
3) Long Essay with research = 2300+ words

b. The Course Learning Outcomes that are fulfilled by the course and the class activities
and assignments linked to those outcomes are described below:

GELO/CLO 1: Students will be able to understand how the scientific method works to weed out hypotheses and paint an increasingly detailed and reliable canvas of physical reality.

This CLO will be met as students complete an assigned short essay based on the popular show "Mythbusters". In this essay the students will be called upon to select a hypothesis and describe how they would go about testing it.

GELO/CLO 2: Students will cultivate knowledge of the scientific study of the physical universe and its life forms. Students will understand and appreciate the interrelationship of science and human beings to each other.

This CLO will be met as students conduct research, give presentations, and engage in discussions during class.
Student success in achieving this goal will be assessed by means of specific questions included in numerous in-class assignments and homeworks. Specifically, an assignment will establish a quantitative connection between solar energy and energy consumption by human beings.

GELO/CLO 3: Students will be able to describe astronomical topics in detail up to the limits of our present knowledge.

This CLO will be gleaned from class lectures, class assignments to be conducted individually and in groups, and from a long format essay. This long essay will be conducted on an astronomical topic of the student’s own choosing. The students will be expected to describe in their own words what they learned from their research into their chosen topic.

**Required Texts/Readings**

**Textbook:** [https://openstax.org/details/astronomy](https://openstax.org/details/astronomy)


In addition, there will be handouts and other supplemental materials.

**Other Readings**

I will be happy to suggest additional reading materials for anyone who wants to pursue topics in more detail.

**Course Requirements and Assignments**

**Writing requirements:** All SJU 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.

<table>
<thead>
<tr>
<th>Maximum credit</th>
<th>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.</th>
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<tbody>
<tr>
<td>Partial credit</td>
<td>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.</td>
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<tr>
<td>No credit</td>
<td>Incorrect conclusions, faulty reasoning; Written responses are not in full sentences; Multiple spelling and/or grammar errors.</td>
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**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 reason and you must tell me ahead of time.

**Homework & Quizzes:** 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. There may also be several short quizzes in class, some of which may not be announced in advance.

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.
Final Examination

There will be a cumulative final exam at the scheduled time. Every student must take this exam without exception.

Grading Information

The course grade will be determined from a combined score total from three midterm tests, homework and quizzes, 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 'U' grade.

<table>
<thead>
<tr>
<th>Tests, etc.</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Midterm #1</td>
<td>20%</td>
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<tr>
<td>Midterm #2</td>
<td>20%</td>
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<tr>
<td>Midterm #3</td>
<td>20%</td>
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<tr>
<td>Final Exam</td>
<td>20%</td>
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<tr>
<td>Homework/quizzes/feedback</td>
<td>20%</td>
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</table>

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 compared with the rest of the class. Limited extra credit options will be offered and discussed in class, including a possible in class presentation. A penalty will be imposed for late work.

Grading information for GE/100W

“This course must be passed with a C- or better as a CSU graduation requirement.”

“Passage of the Writing Skills Test (WST) or ENGL/LLD 100A with a C or better (C- not accepted), and completion of Core General Education are prerequisite to all SJSU Studies courses. Completion of, or co-registration in, 100W is strongly recommended. A minimum aggregate GPA of 2.0 in GE Areas R, S, & V shall be required of all students.”

Classroom Protocol

There is no record of class attendance. However, frequent in-class assignments will be handed-out.

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: Your own commitment to learning, as evidenced by your enrollment at San Jose State University, and the University's Academic 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 policy on academic integrity can be found at http://sa.sjsu.edu/student_conduct

Campus policy in compliance with the Americans with Disabilities Act: If you need course adaptations or accommodations because of a disability, or if you need 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 Disabilities Resource Center (DRC) to establish a record of their disability.

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs’ Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo/”
<table>
<thead>
<tr>
<th>Week beginning:</th>
<th>Topics</th>
<th>Reading</th>
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<tbody>
<tr>
<td>Jan. 22</td>
<td>Introduction, mapping the sky</td>
<td>Chapter 1, 2</td>
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<tr>
<td>Jan. 29</td>
<td>History, scientific method</td>
<td>Chapter 2,3,4 Scientific method handout</td>
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<tr>
<td>Feb. 5</td>
<td>Electromagnetic radiation, waves, spectra</td>
<td>Chapter 5</td>
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<tr>
<td>Feb. 12</td>
<td>Radiation laws, photons, spectra</td>
<td>Chapter 5</td>
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<tr>
<td>Feb. 12</td>
<td>Exam #1</td>
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<td>Feb. 19</td>
<td>Forces in nature, telescopes</td>
<td>Chapter 6</td>
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<td>Feb. 26</td>
<td>Sun’s properties &amp; power</td>
<td>Chapter 15</td>
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<td>Mar. 5</td>
<td>Measuring the properties of stars</td>
<td>Chapter 17</td>
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<td>Mar. 12</td>
<td>H-R diagram</td>
<td>Chapter 18</td>
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<tr>
<td>Mar. 12</td>
<td>Exam #2</td>
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<td>Mar. 19</td>
<td>Stellar distances, the interstellar medium</td>
<td>Chapter 19, 20</td>
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<tr>
<td>Apr. 2</td>
<td>Star formation, extrasolar planets</td>
<td>Chapter 21, Starbirth, planet search</td>
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<td>Apr. 9</td>
<td>Stellar evolution, giants</td>
<td>Chapter 22</td>
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<td>Apr. 16</td>
<td>White dwarfs, neutron stars &amp; black holes</td>
<td>Chapter 23,24</td>
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<td>Apr. 23</td>
<td>Charting the Milky Way</td>
<td>Chapter 25</td>
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<td>Apr. 23</td>
<td>Exam #3</td>
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<tr>
<td>May 30</td>
<td>Galaxies, AGN and galactic evolution</td>
<td>Chapter 26, 27</td>
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<tr>
<td>May 7</td>
<td>Mapping the universe, big bang nucleosynthesis</td>
<td>Chapter 28, 29</td>
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<tr>
<td>May 14</td>
<td>&quot;Astrobiology&quot;, life in the Universe</td>
<td>Chapter 30 (may not get to it)</td>
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<td>May 17 (Thursday)</td>
<td>Final Exam 12:15-</td>
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