

**Saint Louis University, Madrid Campus**  
**Division of Science and Engineering**

**Introduction to Astronomy (PHYS-113-M01)**  
**Spring 2015**

**Professor:** Dr. Belén López Martí

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**Office:** Room 202, Padre Arrupe Hall, First Floor

**Office hours:** 3:15-4:45 pm TR, or under appointment

**Credit Hours:** 3

**Meeting:** Padre Rubio Hall 2, 4:00 – 5:15 pm, TR

**Prerequisites:** None.

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*The schedule, policies, procedures and assignments in this course are subject to change in the event of extenuating circumstances, by mutual agreement, and/or to ensure better student learning.*

### **Course description**

This course is a **basic introduction to Astronomy**, appropriate for **students who have taken no previous college science courses and who will likely not major in science**. Students will gain a cosmic perspective –a broad understanding of the nature and evolution of the Universe–, together with some understanding of the way we have constructed our current picture of the Cosmos, and the tools involved in its study. They will also get acquainted with the history of Astronomy and the evolution of scientific ideas. The course is straightforwardly descriptive and without complex mathematics. Other characteristics of this course are the use of audio-visual materials, often including computer animations and simulations, and the use of astronomical internet-based resources. We will also perform remote observations using a NASA 34m radio telescope. The course has no prerequisites, but knowledge of basic algebra is assumed.

### **Course Goals**

This course will

- I. explain the **basic concepts about Astronomy and Astrophysics**.
- II. describe the **basic scientific and technological tools of Astrophysics**, and explain how these tools are used to obtain information about the Cosmos and to test scientific theories.
- III. teach students **how science works**, and how it progresses.
- IV. help students develop **critical thinking and reasoning** skills, make connections between concepts and be active in their learning.
- V. help students develop **effective communication** skills.
- VI. help students learn to **work effectively** alone and as part of a team.

### **Learning Outcomes**

At the end of this course, students will be able to

1. explain the basic concepts of positional Astronomy and Celestial Mechanics, and apply them to new situations.
2. explain the basic concepts of the physical laws and theories relevant for the contents discussed in the course, and apply them to simple cases.
3. explain how astronomers use the electromagnetic theory to gather information about the Cosmos, and apply this knowledge to simple cases.
4. explain how modern telescopes work, their capabilities and their limitations.
5. describe the most relevant constituents of our Solar System and their main properties.
6. describe the Sun's structure and explain the main properties of the Sun as a star.

7. explain how astronomers study the physical properties and the evolution of stars, from their formation to their final stages, and apply this knowledge to simple cases.
8. explain the main properties of normal and active galaxies, including our own Milky Way Galaxy.
9. explain the basic concepts about the current theory of the origin and evolution of the Universe.
10. discuss, from a scientific point of view, the odds of finding extraterrestrial life.
11. explain and apply the scientific method.
12. discuss the capabilities and limitations of science, and discriminate between scientific and non-scientific information.
13. use different information resources, and extract and elaborate the relevant information from them.
14. relate concepts and fit facts into a bigger picture.
15. extract information from an astronomical image.
16. interpret and extract information from a scientific plot or diagram.
17. communicate in an effective manner, both orally and in written form.
18. work effectively alone and as part of a team.

### **Course Outline (Tentative)**

A tentative outline for the course is given in Table 1. Important dates are summarized in Table 2.

**Table 1: Course outline (tentative)**

<b>Week</b>	<b>Topic</b>	<b>Assessments</b>
<b>1</b>	Introduction to the course.	Participation
<b>2-3</b>	Charting the heavens.	Participation
<b>4</b>	The birth of modern science.	Portfolio <b>Test #1</b>
<b>5</b>	Information from the Cosmos.	Participation
<b>6</b>	Telescopes, the tools of Astronomy. Radio observations.	Portfolio <b>Test #2</b>
<b>7</b>	Our planetary system.	Participation <b>Student's presentations</b>
<b>8</b>	The Sun, our parent star.	Participation
<b>9</b>	Measuring stars.	Portfolio <b>Test #3</b>
<b>11</b>	The birth of the stars.	Participation Portfolio <b>Test #4</b>
<b>12</b>	The lives and deaths of the stars.	
<b>13</b>	Strange states of matter: Neutron stars and black holes.	
<b>13</b>	The Milky Way, a spiral in space.	Participation Portfolio <b>Test #5</b>
<b>14</b>	Galaxies, the building blocks of the Universe.	
<b>15</b>	The origin and fate of the Universe.	
<b>16</b>	The search for life in the Universe.	Participation

**Table 2: Important dates**

<b>Drop without a “W”</b>	Tuesday, 27 <sup>th</sup> January
<b>Mid-term Grades</b>	Tuesday, 3 <sup>rd</sup> March
<b>Drop with a “W”</b>	Friday, 13 <sup>th</sup> March
<b>Final Exam Date</b>	Thursday, 7 <sup>th</sup> May

### **Course materials**

**The course will make extensive use of the learning platform (Blackboard Learn).** All the relevant information about the course, including the syllabus, class announcements, homework assignments, links to recommended books and other reference material, will be posted there.

**As preparation for the classes, students must read/watch the Blackboard background material indicated by the instructor,** and complete the corresponding worksheet.

The instructor’s class presentations, the videos shown in class, the material or links to the class activities, and complementary material of interest for reinforcing or broadening the topics discussed in the course will also be available through the platform for the benefit of the students. However, **students are warned that revision of the Blackboard material will never completely compensate a missed class.**

Furthermore, **it is recommended that students consult books, lecture notes and other material** in their personal study in order to complement the class explanations. References and links to recommended material are available through the learning platform.

### **Class Structure**

A typical class session will follow the structure summarized in Table 3. However, this structure may change depending on the particular goals and contents of each class.

Most activities will involve students working in pairs or small groups. Laptops may be needed for some activities (subject to availability).

**Table 3: Typical class structure**

<b>Part</b>	<b>Possible activities</b>
<b>Session Introduction</b>	Misconceptions checks Instructor’s explanation Introductory videos Introductory questions
<b>Concept review</b>	Worksheet review Concept mapping
<b>Practice</b>	Tutorials Group activities Think-pair-share activities Challenge questions
<b>Summary and conclusions</b>	Class discussions Think-pair-share activities Challenge questions
<b>Extension</b>	Instructor’s explanation Videos Challenge questions

## Class Activities

Students must actively participate in the activities proposed during the course, which may include (but are not necessarily limited to):

- **In-class activities** for practice of the course contents, such as role-play games, class discussions, tutorials, multiple-choice or open questions, ranking exercises...
- Students' **oral presentations** about a planet and another object or objects of the Solar System. Presentations will be performed individually or in small groups, depending on the number of students.
- A **remote radio observation** using a 34-m antenna located in NASA's Madrid Deep Space Communications Center in Robledo de Chavela, near Madrid. Students must attend the observation and write a short report about it.
- One **lecture** held by an expert in a particular astronomical field. (This activity is subject to the availability of the guest speaker.)

## Homework Assignments

In addition to the personal study, several types of homework will be set in this course:

- Students must become acquainted with every new topic before the corresponding class, through **background reading and/or introductory videos**. Recommended material is posted on Blackboard.
- **Formative homework:** This includes some **worksheets that must be completed after background reading or video watching**, as well as **oral questions** put by the professor **to be discussed in the following class**. Even though these tasks are not graded explicitly, they have an impact on the student's performance in class, which is taken into account in the final grade. Samples of the worksheets will be randomly corrected for assessment.
- **Summative (graded) homework:** This includes several **written assignments**, which will be graded according to performance (see Table 5 below).
- **Portfolio:** Each student must create a portfolio including the graded written assignments, a sample of the introductory worksheets, extra credit assignments (if any) and any other material he/she considers valuable for their learning. Each item must be accompanied by a brief reflection on the piece of work. Detailed instructions will be given during the course.
- **Final paper:** At the end of the course, every student will have to submit a final paper consisting on the **study of an astronomical object**, where he/she must demonstrate the knowledge and skills acquired during the course. This paper will be graded separately (see Table 4 below).

## Examinations

**A test will be done typically every two-three chapters** to test the students' understanding of the concepts explained in class. Tests may include short-answer questions and exercises similar to those solved in class.

Tentative dates for the tests will be posted on Blackboard; these dates will be confirmed or rectified as the course proceeds. The last test will be done on the date scheduled for the final exam. **Students scoring less than 60% in two or more tests will do a comprehensive final exam.**

## Grading system

The different assessment schemes and their weight in the final grade are summarized in Table 4. Written assignments will be graded according to performance as explained in Table 5. Letter grades will be given according to the scale presented in Table 6.

The midterm grade will be based on the assessment done so far in the course, following the same weighting system as in the final grade (Table 4).

**Table 4: General grading system**

Assessment	Percentage	Remarks
<b>Participation</b>	<b>25%</b>	Includes: participation in class discussions and activities, teamwork, personal effort, outstanding contributions. An evaluation rubric will be posted on Blackboard.
<b>Portfolio</b>	<b>25%</b>	An evaluation rubric will be posted on Blackboard.
<b>Oral presentations</b>	<b>10%</b>	This grade will be computed from a combination of several assessments: peer evaluation, self-evaluation and instructor's evaluation. An evaluation rubric will be posted on Blackboard. If the presentation is done in groups, the same grade will be given to all group members.
<b>Tests</b>	<b>25%</b>	An overall grade for all the tests will be computed at the end of the course by summing all the scores and scaling it to 25. The last test will be done the day scheduled for the final exam. <b>Students scoring less than 60% in two or more tests will have to do a comprehensive final exam.</b> In such case, the grade achieved in the final exam will be the grade for this part.
<b>Final paper</b>	<b>15%</b>	An evaluation rubric will be posted on Blackboard.

**Table 5: Performance grading system for written assignments**

Score	Description
<b>0</b>	The work was not submitted according to directions, or no meaningful attempt is evident in the submitted work.
<b>1</b>	<b>Below expectations:</b> The work is missing some important components, or contains some important errors that need to be solved before the student can progress. <i>Students with poor performance grades will be asked to repeat the assignment following the instructor's indications, or to complete a complementary assignment to improve their understanding of the involved concepts, and their grade.</i>
<b>2</b>	<b>According to expectations:</b> The work is essentially correct and free from major errors. <i>Note that <b>the expected achievement is a 2-score</b>: This is the grade students should aim at. Note also that it is possible for all students to get a 2-score in every assignment by repeating it or doing a complementary assignment if necessary.</i>
<b>3</b>	<b>Beyond expectations:</b> The work is unusually exemplary and goes far beyond the instructor's expectations for this particular assignment. <i>This score is rarely assigned; students achieving a 3-score should be very proud of their efforts, which will be taken into account in the final grade.</i>

**Table 6: General grading scale**

Grade	Interval	
	Minimum	Maximum
A	95.0%	100.0%
A-	90.0%	94.9%
B+	85.0%	89.9%
B	80.0%	84.9%
B-	75.0%	79.9%
C+	70.0%	74.9%
C	65.0%	69.9%
C-	60.0%	64.9%
D	50.0%	59.9%
F	0.0%	49.9%

### **Evaluation criteria**

To determine whether the student has achieved the objectives, the following parameters will be taken into account:

- On the course content:
  - Understanding of the concepts and main ideas of each of the course parts.
  - Ability to apply the concepts to different situations.
  - Synthesis capability.
- On the ability to make judgments and justify:
  - Ability to argue and support one's own ideas.
  - Critical thinking.
  - Respect to other's opinions.
- On the personal work:
  - Originality in the contributions.
  - Rigor, clarity and integration.
  - Positive learning attitude.
  - Active in learning.
  - Ability to work alone and as part of a team.
  - Compliance with formal requirements (file formats, submission deadlines, allocated time for presentations...).

### **Course Policies**

#### **Attendance to classes:**

**Attendance is mandatory.** Students are expected to attend all classes unless a reasonable excuse is given. When a student is absent, his/her performance in the course usually deteriorates, since the explanations and learning activities missed in class sessions can rarely be made up satisfactorily, even though the course materials will be available on Blackboard.

**Absences must be justified in written form by a neutral third party.** In particular, students are warned that any absence due to claimed illness will be considered unjustified unless a doctor's certification is provided. A trip that is not due to academic reasons is not a valid justification either. **A maximum of three unjustified absences is permitted. Each additional absence will cause the final course grade to be lowered by 2%.**

Students who miss classes are responsible for keeping themselves informed about class proceedings and must make an additional effort to catch up with the rest of the group. They are encouraged to contact the instructor for orientation. **Missing a class is not an excuse for failing to submit homework in due time and form.**

**Students who legitimately miss a test**, e.g. due to a doctor's visit or family emergency, **must provide written documentation of the circumstances**. A letter from the university counselor is accepted. For missed tests due to legitimate reasons, an alternative date will be fixed. **Tests that are missed illegitimately result in a score of F.**

- **Participation:**

**Students in this course must participate actively in class discussions and activities.** Students' participation in class improves students' understanding of the concepts under discussion, provides the instructor with valuable feedback information about the students' learning process and interests, and helps developing a pleasant class atmosphere.

**Participation is taken into account in the final grade** (see Table 4). An evaluation rubric is posted on Blackboard.

- **Homework policies:**

Students are responsible for submitting their written homework or any other material requested by the instructor in due time and form. Typically, written assignments are set one Friday and must be submitted before the following Thursday's class (but there may be exceptions). **Written assignments must be submitted electronically through the learning platform**; e-mail submissions will not be accepted unless there has been a previous agreement between the professor and the student(s). **Assignments will not be accepted after the scheduled due dates** unless exceptional circumstances apply.

**If a written assignment gets a poor performance grade, the student must improve his/her score either by repeating the exercise or by doing a complementary exercise** related to the assignment's topic. However, **under no circumstance will a complementary assignment replace an ordinary assignment that was not submitted in due time and form**: Students must have shown they did some effort to complete the original assignment to be given the chance to improve their performance. The grading scheme from Table 5 ensures 50% of the assignment grade by the simple fact of attempting to solve it, if some meaningful effort is appreciated on the work; and that **every student will be able to get full grades (a 2-score) provided he/she is willing to improve his/her original work if required.**

- **Extra credit:**

Extra credit assignments will be proposed during the course. They will be graded in the same way as the rest of written assignments (see Table 5), and added to the student's portfolio. Each student can do as many extra credit assignments as wished.

Students must note that outstanding contributions to the class activities or regular written assignments, as well as valuable additions to their portfolio, will also earn extra credit.

- **Class etiquette:**

**Students are expected to be punctual, to pay attention in class, to participate in class discussions and activities, and to be respectful** with their peer students and with the professor. Private conversations should be deferred until the end of the lecture. Eating in class is forbidden by University regulations, and it is considered extremely rude, at least in Spain. Drinking water is allowed.

The use of cell phones and other electronic devices is not permitted during the lectures, except for class-related activities and by express instructor permission. **Laptops must be closed if they are not required** for the ongoing activity. Students wishing to use their laptops to take notes must inform the professor first.

The use of books and notes during tests is not allowed. A pocket calculator may be useful for some exercises.

- **Academic honesty:**

Cheating in class on tests is a serious offence. **Any student caught cheating will receive an F for the course.** A student may also be suspended for one semester. For more information concerning academic dishonesty, refer to the Code of Student.

### • Communications:

Important appointments (special activities, tests...) will be posted in the course calendar on Blackboard. **Students that foresee a class absence** (e.g. owing to an academic trip) **are responsible for checking that no important appointment is scheduled for that day** and, should this be the case, are expected to contact the instructor as soon as possible to discuss the way to compensate for their absence.

In this course, **the university e-mail is a major means of communication**. Each student is responsible for checking their SLU e-mail account, and for reading and responding, if necessary, to all course-related messages. All important announcements will also be posted on the learning platform.

Students are encouraged to contact the instructor about any questions or concerns related with the course. **Interviews with the professor in times other than the scheduled office hours are only possible under previous appointment.**

### • Class cancellations:

In the event that a class meeting is unexpectedly cancelled, students are expected to continue with assignments as originally scheduled. Any assignments due or class activities (e.g., a test, or a presentation) planned for a cancelled class are due at the next class meeting unless other instructions are communicated.

### Accommodations

In recognition that people learn in a variety of ways and that learning is influenced by multiple factors (e.g., prior experience, study skills, learning disability), resources to support student success are available on campus. Students who think they might benefit from these resources can find out more about:

- Course-level support (e.g., faculty member, departmental resources, etc.) by asking your course instructor.
- University-level support (e.g., tutoring/writing services, Disability Services) by visiting the Academic Dean's Office (San Ignacio Hall) or by going to: [http://spain.slu.edu/academics/learning\\_resources.html](http://spain.slu.edu/academics/learning_resources.html).

Students who believe that, due to a disability, they could benefit from academic accommodations are encouraged to contact Disability Services at +34 915 54 58 58, ext. 204, or to visit the Counseling Office (San Ignacio Hall). Confidentiality will be observed in all inquiries. **Course instructors support student accommodation requests when an approved letter from Disability Services has been received, and when students discuss these accommodations with the instructor after receipt of the approved letter.**

In order to ensure that the required accommodations for examinations are met, **students in this course are asked to contact the instructor at least two weeks before the test date**. Too short notice may imply that the accommodations cannot be arranged.

### Collection of student work for assessment

Saint Louis University - Madrid Campus is committed to excellent and innovative educational practices. In order to maintain quality academic offerings and to conform to relevant accreditation requirements, we regularly assess our teaching, services, and programs for evidence of student learning outcomes achievement. For this purpose we keep on file "anonymized" representative examples of student work from all courses and programs such as: assignments, papers, exams, portfolios, and results from student surveys, focus groups, and reflective exercises. Thus, copies of your work for this course, including exams, oral presentations, and assignments, may be kept on file for institutional research, assessment and accreditation purposes. **If you prefer that Saint Louis University - Madrid Campus does not keep your work on file, you will need to communicate your decision in writing to your professor.**