UNIVERSITY OF SAN FRANCISCO | College of Arts and Sciences

ASSESSMENT REPORT
FOR ACADEMIC YEAR 2023-2024

ASTRONOMY MINOR

Department of Physics & Astronomy

University of San Francisco

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1 LOGISTICS, MISSION STATEMENT & PROGRAM LEARNING OUTCOMES

1.1 PHYSICS & ASTRONOMY CONTACT PERSON (FACULTY ASSESSMENT COORDINATOR).

Name: Professor Horacio E. Camblong, Email: camblongh@usfca.edu

1.2 PHYSICS & ASTRONOMY DEPARTMENT MISSION STATEMENT

No changes were made to the program mission statement since the last assessment cycle in November 2023.

> The mission of the Physics & Astronomy Department is to provide our students with the fundamental knowledge and the practical tools of a rigorous physics education that will help them be players and leaders in shaping a more humane world. The Physics program is implemented via a comprehensive coverage of experimental, theoretical, and computational physics, and by combining coursework together with on- and off-campus research and exposure to cutting-edge equipment and laboratory techniques. This rigorous training prepares students for careers and/or graduate studies in any discipline within fundamental or applied science (physics, astronomy, mathematics, chemistry, biology, etc); in any of the standard engineering fields; in education; in medicine and related disciplines; and many other fields, such as law, financial analysis, or positions in the high-technology sector of the global economy.

1.3 ASTRONOMY MINOR LEARNING OUTCOMES (PLOs)

No changes were made to the program learning outcomes (PLOs) since the last assessment cycle in November 2023.

1. • **PLO 1.**

   Demonstrate mastery of the core concepts and general principles of astronomy.

2. • **PLO 2.**

   Conduct experiments and observations with the proper use of equipment

for a detailed comparison with physical and astronomical models and theories.

1.4 CURRICULAR MAP LINKING THE ASTRONOMY MINOR LEARNING OUTCOMES AND THE RELEVANT PHYSICS COURSES

In the curricular map below, the check-mark symbol ✓ indicates the applicable PLOs for each course.

PLOs ⟹ **PHYS** **courses** ⇓	**PLO 1** **Demonstrate** concepts/general principles of astronomy	**PLO 2** **Conduct** experiments/observations with phys/astro equipment
PHYS 120 (Astronomy: Earth/Cosmos)	✓	✓
PHYS 121 (Planetary Astronomy)	✓	✓
PHYS 122 (Geometry of the Cosmos)	✓	
PHYS 221 (Ancient Astronomy)	✓	
PHYS 100, 101, 110, 130 201, 210 (Physics Electives)		✓

1.5 PROGRAM LEARNING OUTCOME(S) ASSESSED FOR THE ACADEMIC YEAR 2023-2024

The Astronomy Minor Program Learning Outcome assessed for this one-year period, involves experimental procedures and analysis.

- **PLO 2.**

  Conduct experiments and observations with the proper use of equipment for a detailed comparison with physical and astronomical models and theories.

1.6 ASSESSMENT SCHEDULE

For the Astronomy Minor discussed in this report, the following timetable of Program Learning Outcomes has been followed in the past four academic years:

- AY 2020-21: PLO 1
- AY 2021-22: PLO 2
- AY 2022-23: PLO 1
- AY 2023-24: PLO 2

We anticipate reassessment of these PLOs and any additional adjustments according to a flexible timetable that will depend on internal factors involving course offerings (as some courses are not offered every year) and ongoing departmental discussions on the assessment procedures. For this academic year, we are already collecting data for next year's report as follows:

- AY 2024-25: PLO 1

2 METHODOLOGY

2.1 Methodology.

Assessment activities in the Astronomy Minor program were undertaken as planned during the AY 2023-2024, following multiyear departmental guidelines.

2.2 Generic Assessment Procedures.

The program learning outcome PLO 2 above was assessed in the laboratory sections of the following courses: PHYS 120 (Astronomy: From the Earth to the Cosmos). PHYS 121 (Planetary Astronomy).

The process was organized at the departmental level with cooperation of all the instructors involved and our Program Assistant, and according to our multiyear departmental guidelines. The data were stored electronically. The faculty members teaching the two lecture sections and coordinating the labs were: Horacio Camblong (PHYS 120) and Xiaosheng Huang (PHYS 121); they were responsible for the required lab-instructor coordination and

data collection of the students' work products; and the grading of the work products was conducted directly by the instructors of the multi-section lab components (Minhua Zhu, Andrew Fittingoff, Aparna Venkatesan, and Xiaosheng Huang). In addition, the overall logistics and final re-grading of the work products was conducted by Horacio Camblong.

2.3 Assessment Procedures and Data Analysis.

The relevant learning outcome was assessed by means of direct measures consisting of questions for specific laboratory exercises. The questions required understanding of the experimental procedures and interpretation of data, in addition to specific knowledge of the concepts and principles of astronomy and physics. The lab exercises were properly selected to provide the essential elements for an effective PLO 2 assessment.

The learning outcomes were gauged with the *4-level scale system* listed below. It should be noted that these 4 levels are meant to be categories defined by comparison with the minimum benchmark standard, defined as "average," regardless of the statistical course average for any given class section. This classification refers to the level of proficiency of the skill and knowledge set involved in the learning outcome.

- Outstanding = Full Mastery. This represents superior performance, with an almost complete command of the relevant skill and knowledge set.
- Proficient = Partial Mastery. This represents basic, solid performance that reflects a level of achievement where errors or omissions only affect the final results in a minimal way.
- Satisfactory = Meets Expectations. This represents performance that meets expectations as benchmark standard set up to correspond to an overall, satisfactory outcome (involving most parts of the assessed problem, question, or project), but allowing for errors or omissions whose correction would otherwise lead to considerable performance improvement (i.e., not reaching partial mastery, but showing a minimum acceptable level for most of the relevant skills).
- Inadequate = Unsatisfactory Level. This mark does not necessarily imply complete failure to perform on the given outcome, but involves serious gaps in understanding and/or problem-solving outcomes for the relevant skill and knowledge set.

For all assessed courses in this cycle, student performance was evaluated on the basis of a representative sample of laboratory experiments (usually one or two lab experiments per

course). The specific labs and the cutoff numerical grades for each category were selected via a routine discussion among the faculty involved. The data were collected and graded by the faculty teaching the courses, and subsequently discussed at two Physics & Astronomy Department meetings.

3 RESULTS & MAJOR FINDINGS

The results for the multiple sections of the course selected for assessment are summarized below:

- PHYS 120 (Astronomy: From the Earth to the Cosmos) Lab, Fall 2023:

  A representative lab experiment was selected: Lab 8, "Origin of the Cosmos: Expansion/Age of the Universe." This is one of the deepest labs in our program, combining the fundamental physics of general relativity (cosmological expansion of the universe) with electromagnetic radiation and quantum theory used to analyze the spectra of distant galaxies, within a laboratory setup. The selected experiment provides the essential ingredients for an effective learning outcome assessment (summarizing a good fraction of the most relevant foundational topics in astronomy).

  The assessment procedure involved 4 separate laboratory sections, for a total of 53 students. Of these, 2 students were absent, with one of them excused; for the other 51 students who participated in the lab experiment, the results were graded and compiled as follows.

  Number of Participants: 51 students;
  Outstanding: 51 students (100%);
  Proficient: 0 student (0%);
  Satisfactory: 0 students (0%);
  Inadequate: 0 students (0%).

- PHYS 121 (PlanetaryAstronomy) Lab, Fall 2023:

  A representative lab experiment was selected: Lab 4, "Light and Spectroscopy: Electromagnetic Radiation." This lab is critical for the study of the celestial bodies, and, specifically, the planetary bodies relevant for this course; it also provides the foundation to study a variety of properties of light and electromagnetism needed throughout

the course.

The assessment procedure involved 2 separate laboratory sections, for a total of 11 students. All the students registered in the course participated in the lab experiment, the results were graded and compiled as follows.

Number of Participants: 11 students;
Outstanding: 11 students (100%);
Proficient: 0 student (0%);
Satisfactory: 0 students (0%);
Inadequate: 0 students (0%).

Note on rubrics and grading: All lab worksheets were graded with the following parameters: full participation and "completeness" of the worksheet; answering of given questions; and "technical details" (data analysis and interpretation).

4 CLOSING THE LOOP

4.1 Follow-Up Discussion and Decision-Making.

Two Physics & Astronomy faculty meetings addressed various aspects of assessment. The discussions included a review of our assessment plan, the learning outcomes, and the results of this and last assessment cycles, as well as the feedback from our last assessment cycle. In addition, follow-up discussions are planned for the ongoing 2024-25 Physics Department meetings.

The following conclusions were drawn:

- We are using a well established model of assessment that has been successful in our Physics & Astronomy programs for several years, and received an excellent positive review during our last Academic Program Review (conducted in Spring 2018).
- All in all, the results of the assessment activities show an outstanding level of performance by all students, with an excellent command of the experimental-physics skills relevant for the astronomy-minor PLO 2.
- The assessment outcomes of this cycle are also consistent (qualitatively and quantitatively) with the assessment outcomes of earlier academic years.

- The faculty agree unanimously on the *positive impact of the recent upgrades of the astronomy lab, which included student feedback and information from earlier assessment data.* Basically, the updated labs have streamlined some of the lab procedures and added some foundational background aimed at enhancing student comprehension and performance.

- No significant curricular changes are planned/required for AY 2024-25.