UNIVERSITY OF SAN FRANCISCO | College of Arts and Sciences

ASSESSMENT REPORT
FOR ACADEMIC YEAR 2019-2020

ASTRONOMY MINOR

Department of Physics & Astronomy

University of San Francisco

December 2nd, 2020

Submitted by Prof. Horacio E. Camblong

camblongh@usfca.edu

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 2019.

> 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 2019.

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 2019-2020

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.

2 METHODOLOGY

2.1 Methodology.

Assessment activities in the Astronomy Minor program were undertaken as planned during the AY 2019-2020, following multiyear departmental guidelines.

2.2 Generic Assessment Procedures.

The program learning outcome PLO2 above was assessed in the laboratory sections of the following two courses: PHYS 120 (Astronomy: From the Earth to the Cosmos) and 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 lecture sections of these courses were responsible for the required lab-instructor coordination and data collection of the students' work products: Horacio Camblong (PHYS 120) and Andrew Fittingoff (PHYS 121); and the grading of the work products was conducted directly by the instructors of the multi-section lab components (William Golightly, Aaron White, Minhua Zhu, Marija Djordjevic, and Andrew Fittingoff). 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 courses selected for assessment are summarized below:

- PHYS 121 (Planetary Astronomy) Lab, Fall 2019:

  A representative lab experiment was selected: Lab 7, "Impact Craters and Volcanoes." This laboratory combines basic physics and astronomy with data analysis in a setting that provides an ideal blend of the essential ingredients for an effective learning-outcome assessment. See Subsection 2.2.

  The assessment procedure involved 4 separate laboratory sections, for a total of 46 students. For the students who participated in the lab experiment, the results were graded and compiled as follows.

Number of Participants: 46 students;
Outstanding: 32 students (69.6%);
Proficient: 14 students (30.4%);
Satisfactory: 0 students (0%);
Inadequate: 0 students (0%).

- PHYS 120 (Astronomy: From the Earth to the Cosmos) Lab, Spring 2020:

  A representative lab experiment was selected: Lab 9, "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 45 separate laboratory sections, for a total of 117 students. As this lab was scheduled at the peak of the pandemic, it is not surprising that a large number of absences was recorded (19 out of 117 students). For the students who participated in the lab experiment, the results were graded and compiled as follows.

  Number of Participants: 98 students;
  Outstanding: 83 students (84.7%);
  Proficient: 15 students (15.3%);
  Satisfactory: 0 students (0%);
  Inadequate: 0 students (0%).

  Note on rubrics and grading: 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. In addition, follow-up discussions are planned for the ongoing 2020-21 Physics Department meetings.

The following conclusions were drawn:

- All in all, the results of the assessment activities show a relatively high level of performance by most students, with an excellent command of the core concepts and general principles of astronomy, as 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.

- We are using a model that has been successful in our Physics & Astronomy programs for several years. The External Program of the Academic Program Review conducted in Spring 2018 praised our assessment program as follows.

  > "The overall P&A assessment program is well designed and appears mature. The probes are robust and appropriate, and the reports provided by the department are easy to interpret and contain useful information about student performance. P&A does very good work in many areas and students are a dominant focus in much of that work. ... The assessment program for P&A is more than sufficient, and it is managed extremely well."

  This is consistent with our own self-evaluation.

- No significant curricular changes are planned/required for AY 2020-21. It has also been agreed that the ongoing pandemic creates additional constraints and challenges that far exceed the boundaries of a regular assessment plan—for now, no further adjustments are needed.