

**Astronomy and Astrophysics  
(BS) - Reviewer's Report -  
Academic Data**

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## Astronomy and Astrophysics (BS)

### B.S. Astronomy Mission

**Mission:**

The mission of the BS in Astronomy is help students acquire and disseminate knowledge about the universe, through exemplary performance in the areas of research, teaching, and service. The formation and evolution of planets, stars and galaxies is a unifying theme for the department's varied research interests. Our modes of inquiry include observational, theoretical and instrumentation research. The program's mission is aligned with that of the University of Florida in its commitment to pursuing and disseminating knowledge about the universe through teaching, research, and service. It is an integral part of the mission of the College of Liberal Arts and Sciences insofar as it seeks to advance intellectual inquiry and to train new generations of leaders, both in the field itself and outside it.

**Program Type and Level:** Bachelor (includes all bachelors level degrees)**Start:** 07/01/2021**End:** 06/30/2022**Program:** Astronomy and Astrophysics (BS)**Program CIP:** 40.0201**Site Information:** On Campus (Residential)**If Other Site:** :**Responsible Roles:** Elizabeth Lada (elada@ufl.edu)

### PG 1 Increase number of students

**Goal:** Increase the number of students in the BS degree program.**Program:** Astronomy and Astrophysics (BS)**Evaluation Method:**

Monitor the number of students on an annual basis

**Results:**

As of the Spring 2022 semester, we have 66 BS majors. This is a very slight decrease from the Spring 2021 semester (71 majors), though is consistent with a long term period of growth in our major:

Spring 2022:	66 BS Majors
Spring 2021:	71 BS Majors
Fall 2020:	53 BS Majors
Fall 2019:	68 Majors
Fall 2018:	49 Majors
Fall 2017:	33 Majors

### PG 2 Enhance research opportunities for BS students.

**Goal:** Enhance research opportunities for astronomy students yearly.**Program:** Astronomy and Astrophysics (BS)**Evaluation Method:**

Monitor the number of students engaged in research

**Results:**

In the 2021-2022 academic year, 27 students were involved in research, based on reporting from 9 faculty. Like our major counts, this is consistent with a long term trend of increased participation in student research, though in recent years has plateaued. For reference

Year Number of Students Participating in Research

2021-2022 27  
2020-2021 23  
2019-2020 29  
2018-2019 20  
2017-2018 15

### **PG 3 Flexibility in course selection for BS students.**

**Goal:** Increase flexibility in course selection for majors as well as science and engineering students.

**Program:** Astronomy and Astrophysics (BS)

**Evaluation Method:**

Undergraduate coordinator and undergraduate curriculum committee assess the number and range of courses offered to students on an annual basis.

**Results:**

In the 2021-2022 academic year, we increased the diversity of electives that we offer significantly. These include:

1. AST4930 (now numbered AST2730): Python Programming for Astrophysics (Professor Desika Narayanan). This course taught predominantly 1st and 2nd year students the fundamentals of python programming.
  2. AST4930: Special Topics: Machine Learning (Professor Jaehan Bae). This course covers the fundamentals of artificial intelligence and machine learning as it pertains to the physical sciences.
  3. IDS2935: Stars and the Nuclear Arms Race (Professor Rana Ezzeddine). This course discusses nucleosynthesis in environments ranging from stars through the atomic bomb.
  4. IDS2935: Are we Alone: Probability and Implications of finding ET Life (Professor Naibi Marinas). This course investigates the star, planet, and biological life cycle in the cosmos.
- Beyond this, we have begun to offer an Astrobiology elective (AST4939) due to heavy demand for this topic, and have developed the roadmap for applying for an astrobiology concentration within our major. Similarly, we have the frequency with which we offer "Computational Astrophysics" from every two years to every year to meet the significant undergraduate demand.

### **SLO 1 Content Knowledge**

**Outcome:**

Students identify, describe and explain the fundamentals of astrophysics, including mechanics, electromagnetism, modern physics, and the basic concepts, theories, and observational results for planetary systems, stars, stellar systems, and cosmology.

**SLO Area (select one):** Content (UG)

**Assessment Methods Checklist:**

**Assessment Method Narrative:**

**SLO Not Assessed This Year:** true

**Threshold of Acceptability:**

**How many students did you assess for this outcome?:**

**How many students met the outcome?:**

**What percentage of students met the outcome?:**

**Does this meet your threshold of acceptability?:**

**Results:**

### **SLO 2 Content Knowledge**

**Outcome:** Students identify and use the techniques of astronomical observation.

**SLO Area (select one):** Content (UG)

**Assessment Methods Checklist:** Paper(s) - includes reports, plans, other documents

**Assessment Method Narrative:**

AST3722 "Observational Techniques 1" observed multiple nights of data at the Campus Teaching Observatory (CTO) acquiring and image processing CCD images of open star clusters, and wrote reports.

**SLO Not Assessed This Year:**

**Threshold of Acceptability:** 70

**How many students did you assess for this outcome?:** 12

**How many students met the outcome?:** 12

**What percentage of students met the outcome?:** 100

**Does this meet your threshold of acceptability?:** Yes

**Results:**

12 of 12 students acquired and image processed CCD images of open star clusters and wrote reports that were graded by faculty as satisfactory. The threshold of acceptability was met. The assessment methods functioned well.

Strengths: Students have demonstrated the ability to employ advanced techniques, including the analysis of data from charged coupled devices, in order to process high-resolution images for scientific analysis.

Weaknesses: None

### **SLO 3 Critical Thinking**

**Outcome:** Student critically evaluates the results of astronomical research.

**SLO Area (select one):** Critical Thinking (UG)

**Assessment Methods Checklist:**

**Assessment Method Narrative:**

**SLO Not Assessed This Year:** true

**Threshold of Acceptability:**

**How many students did you assess for this outcome?:**

**How many students met the outcome?:**

**What percentage of students met the outcome?:**

**Does this meet your threshold of acceptability?:**

**Results:**

### **SLO 4 Communication**

**Outcome:**

4. Student effectively and clearly communicates ideas and results in speech and in writing in an accepted style of presentation.

**SLO Area (select one):** Communication (UG)

**Assessment Methods Checklist:** Project(s)  
Presentation(s)

**Assessment Method Narrative:**

Students in AST4930 Special Topics: Machine Learning led an independent term project, and then wrote a report describing the project and its outcomes. Students additionally delivered a 10 minute oral presentation.

**SLO Not Assessed This Year:**

**Threshold of Acceptability:** 70

**How many students did you assess for this outcome?:** 7

**How many students met the outcome?:** 7

**What percentage of students met the outcome?:** 86

**Does this meet your threshold of acceptability?:** Yes

**Results:**

Six out of the seven B.S. students were deemed by faculty to give satisfactory presentations and reports. The assessment methods functioned well.

Strengths: Students have demonstrated the ability to develop new projects within the realm of Machine Learning (as the topic was open-ended). Students have applied novel AI/ML techniques to scientific investigation and analysis, that will help enable their careers beyond their undergraduate education.

Weaknesses: None

### **Astronomy and Astrophysics BS Use of Results for Improvement**

**Improvement Types Checklist:** Other changes (please describe in your narrative)

**Use of Results for Improvement Narrative - Required:**

The results were reviewed by the Undergraduate Coordinator, Department Chair and curriculum committee. The faculty decided to design ways to incorporate SLOs in all of the astronomy classes. The faculty agreed to discuss how the department can allocate the space to increase the number of students able to take the class from the current limits of 21 as there is sufficient interest amongst our majors to participate in undergraduate observation. Faculty developed group research projects for students to participate in at the Campus Teaching Observatory, and Rosemary Hill Observatory. The undergraduate curriculum committee decided to increase the number of electives offered which will be facilitated by our dramatic increase in faculty numbers.

**Program Results Not Reported This Year:**

**Program Results Reporting Complete:** true

**B.S. Astronomy Detail**

**Providing Department:** Astronomy and Astrophysics (BS)

**Assessment Cycle:**

Analysis and Interpretation: May 31 -- June 30

Improvement Actions: Completed by August 15

Dissemination: Completed by September 15

SLOs	Year	20-21	21-22	22-23	23-24	24-25	25-26
<b>Content Knowledge</b>							
#1		X		X		X	
#2			X		X		X
<b>Critical Thinking</b>							
#3		X		X		X	
<b>Communication</b>							
#4			X		X		X

**SLO Assessment Rubric:**

Attached Files

**Assessment Oversight:**

Name	Department Affiliation	Email Address	Phone Number
Dr. Haywood Smith, Jr.	Undergraduate Coordinator and UAC, Astronomy	hsmith@astro.ufl.edu	(352) 294-1842
Dr. Francisco Reyes	UAC member	reyes@astro.ufl.edu	(352) 294-1885
Dr. Vicki Sarajedini	UAC member	vicki@astro.ufl.edu	(352) 294-1863

**Methods and Procedures - Undergraduate and All Certificate Programs:**

Student Learning Outcome	Assessment Method	Measurement Procedure
Student knows the fundamentals of astrophysics, including mechanics, electromagnetism, modern physics, and the basic concepts, theories, and observational results for planetary systems, stars, stellar systems, and cosmology	Portfolio	Committee determined grade
Students know techniques of astronomical observation.	Portfolio	Committee determined grade
Students critically evaluate results of astronomical research.	Senior Seminar (2 papers and presentations)	Rubric
Students effectively and clearly communicate ideas and results in speech and in writing in an accepted style of presentation.	Senior Seminar (2 papers and presentations)	Rubric

Students' knowledge and skills appropriate to the discipline are evaluated by the Undergraduate Advisory Committee through examination and grading of a portfolio of coursework samples from the upper-division courses in the major. Grades will be assigned on each sample by each committee member on a scale from 1 (minimal knowledge/facility) to 5 (mastery) for SLO's 1 and 2 separately. An average score of 3 indicates adequacy (i.e., passing).

Students' critical thinking and communication skills are evaluated in a capstone course, Senior Seminar, which is required of all graduating students in their last fall term. Each student submits two papers on research articles from the professional literature and gives two presentations to the class with members of the Undergraduate Advisory Committee in attendance. The presentations are evaluated using the AACU VALUE rubric for Oral Communication: [http://assessment.aa.ufl.edu/Data/Sites/22/media/value-rubrics/oral\\_communication-value\\_rubric.pdf](http://assessment.aa.ufl.edu/Data/Sites/22/media/value-rubrics/oral_communication-value_rubric.pdf)

#### Indirect Assessment

Each student also has an exit interview with a member of the committee as an element of the course. This interview is for the purpose of probing the student's perception of how well the program has accomplished all four SLO's in her or his case.

#### Curriculum Map - Undergraduate Degree Programs:

Key: Introduced                      Reinforced                      Assessed

Courses	AST 3018	AST 3019	AST 3722C	Required AST 4000 level course*	AST 4930  Planetary System  Astrophysics	AST 4930  Senior Seminar <sup>1</sup>
SLOs						
<b>Content Knowledge</b>						
#1	I	I	I R	R A portfolio	R A portfolio	
#2			I A portfolio	R		
<b>Critical Thinking</b>						
#3	I	I	R	R	R	A Paper
<b>Communication</b>						
#4	I	I	R	R	R	A Paper

<sup>1</sup>Oral Presentation

<sup>2</sup>\*AST4211, AST 4300, AST4402, AST4723C one each must be taken beginning semester 5 through semester 8

**Research :**

The degree program is not a research degree. Students complete assignments about research papers but do not conduct research.

**SLO Measures - Graduate and Professional Programs:**

**Assessment Timeline - Graduate and Professional Programs:**