Program Review: Astronomy

Fall 2023

SOLANO
COMMUNITY COLLEGE

Program Review - Astronomy (2023)

SECTION 1: Program Overview

1.1 - Introduction - List the names of full-time and adjunct faculty in the program, along with any staff members and their titles/roles. Note major changes in personnel since the last program review.

Note: This program review covers the seven-year period between 2016-2022.

The following instructors currently contribute to the SCC Astronomy Program:

Full-time faculty

Maura Rabbette (Ph.D., University College Dublin, 1996), Astronomy/Physics, full-time instructor since 2022.

Melanie Lutz (Ph.D., UC Berkeley, 1995), Physics/Engineering; curriculum development for the Astronomy Program.

Adjunct faculty

Katie Berryhill (M.S., University of North Dakota, 1998; Ed.D., University of Wyoming, 2016), Astronomy, adjunct since 2014.

Trevor Gonzalinajec (Ph.D., UC Berkeley, 2015), Physics/Astronomy, adjunct since Spring 2018.

Tracey Johnson (M.S., UC Davis, 1996), Physics/Astronomy, adjunct since 2015.

Philip Petersen (Ph.D., UC San Diego, 1984), Astronomy/Physics, full-time 2004-2014, adjunct since 2016.

Bogdan Popescu (Ph.D., University of Cincinnati, 2010), Physics/Astronomy, adjunct since 2019.

The following instructors taught courses within the Astronomy Program within the reporting period of 2016-2022, but are no longer currently teaching in the program:

Alessandro Baldi (Ph.D., University of Milan, 2003), Astronomy/Physics, full-time temporary 2015-2016.

Randy Smith (M.S., Astronomy, Swinburne Institute, 2004); Astronomy/Physics, retired in 2018.

Zachary Hannan (M.S., UC Davis, 2002), Math/Physics.

Other associated staff include(d):

Richard Crapuchettes (B.S., San Jose State), lab technician for Physical Sciences, 1987-2020; there has been no lab technician associated with this program since Spring 2020.

1.1a - Briefly summarize any large, substantive changes made to the degrees/certificates since the last program review, and what prompted those changes. Note also any organizational changes (for example, if the program is now in a different School/Division than before). If changes have already led to noticeable improvement, please describe.

At the start of this reporting period in 2016, the Astronomy Program at Solano Community College comprised the following four courses: ASTR 010: General Astronomy; ASTR 020: Astronomy Lab; ASTR 030: The Solar System; and ASTR 040: Stars, Galaxies & Cosmology. The first Astronomy course at Solano Community College, ASTR 010, was Curriculum approved in 1979. The remaining three courses, ASTR 020, ASTR 030, and ASTR 040, were each approved in 2005, and became active in the 2006/07 academic year. As of 2016, the Astronomy Department did not offer any degrees.

During the current reporting period of 2016-2022, the following Astronomy courses were introduced:

ASTR 045: Introduction to Astrobiology and the Search for Life in the Universe (2019)
ASTR 049: Astronomy Honors (2021)
ASTR 050: Astronomical Optics (2019)

As was noted in the 2016 Astronomy Program Review, Astronomy is the largest department at SCC in the Physical Sciences, if measured by the number of students enrolled in courses. It was therefore recognized that an A.S. degree should be established, to accommodate student interest in this field. In light of this recognition, Dr. Melanie Lutz led the creation of three new Astronomy courses, and an A.S. degree in Astronomy. This degree has been available since Fall 2019.

1.1b - CTE Programs: Describe the membership of the program's advisory board. Describe how the program requirements are influenced by the advisory board, accrediting institutions, and other external organizations. Note how the membership might be expanded to get more helpful, diverse voices in the field.

NA

1.1c - CTE Programs: Provide advisory board minutes from the past two years [upload to the blue folder in the upper right corner of Section 1]. If minutes are unavailable, please describe what meetings have taken place, noting dates if possible, along with attendees' names and professional positions.

NA

1.2 – Future Outlook: describe conditions (inside the college, or beyond) that may affect the future of the program in the coming years. For example, note what factors may put a strain on the program or give it a boost in the next five years.

The Astronomy Department has recently (Fall 2022) hired a new full-time Astronomy/Physics Instructor, Dr. Maura Rabbette, to replace a position that had been unfilled since Michael Gregg resigned his tenure-track position in 2015, after one year in post. As the size of the program is expected to remain stable over the next five years, and in light of the relatively small size of our department, there should be no immediate need for additional full-time hires.

The Astronomy Department intends to gradually bring many of its course sections back to face-to-face format. As part of this process, we will need to purchase telescopes, and institute physical in-person telescope-based astronomy labs. This endeavor will require the involvement of a skilled, dedicated lab technician with expertise in telescopes and astronomy.

1.2a - CTE programs: Review the provided labor market data, including employment and wage projections for employees in fields related to the program [upload any additional data to the blue folder in the upper right-hand corner of Section 1]. Comment on any areas that appear especially relevant to the program and its graduates.

NA

1.3 Population - Address how the population of students majoring in the program and/or taking classes in the program differ from the college as a whole; note what demographics (age, race, gender, etc.), are more or less represented, if any.

The following table shows the racial/ethnic breakdown of SCC students taking Astronomy courses, contrasted with the corresponding breakdown for SCC as a whole:

	Asian	Black	Hispanic	Other/Unknown	2 or more	White
SCC	15%	15%	13%	3%	28%	26%
Astronomy	13%	10%	13%	3%	33%	28%

For most categories (Asian, Hispanic, White, 2 or more, Other), the percentages of that group in the Astronomy cohort closely mirrors the percentages for SCC as a whole. The only discrepancy is that Black students are under-represented in Astronomy. However, it is pertinent that in the 2016 Astronomy Program Review, the percentage of students taking Astronomy courses who identified as Black was 3% higher than for SCC as a whole. At that time, the category of "2 or more" races was not available as a choice. It is highly likely that many of the students who have now identified themselves as "2 or

more" in our questionnaire would have previously been in the "Black" category. Hence, this discrepancy is probably an artifact of the reporting system.

It is also worth noting that the Black component of our program (be it 10% or higher) is substantially higher than the nationwide average of 2% Black undergraduate Astronomy students (by degree awarded) as of 2020 (https://datausa.io/profile/cip/astronomy-astrophysics#degree_obtainment).

The following table shows the gender breakdown of SCC students taking Astronomy courses, contrasted with the corresponding breakdown for SCC as a whole:

	Male	Female	Other or Not-reporting
SCC	42%	55%	3%
Astronomy	42%	56%	2%

The gender breakdown for the SCC Astronomy student population is essentially the same as that for SSC as a whole. However, the percentage of female Astronomy students at SCC is higher than the US average of 38% female Astronomy students (by degree awarded) as of 2020 (https://datausa.io/profile/cip/astronomy-astrophysics#degree_obtainment).

The age distribution of Astronomy students at SCC is very nearly the same as the distribution for SCC as a whole. Both distributions peak at about age 19, and more than half of the students are in the age range of 18-21.

1.3a – In the student survey, students were asked to identify why they were taking Program courses. Please summarize and briefly discuss the results.

Currently, almost all of the students taking Astronomy course at SCC are taking them as General Education courses. Astronomy courses are, as a whole, the most popular GE courses at SCC.

END OF SECTION 1: PROGRAM OVERVIEW GOALS

SECTION 2: COURSES IN DEPARTMENT (TABLE)

2.1 Course Offerings - Specify which courses in the department and/or degree/certificate have been deleted or added since the last program review, and what prompted those changes. If these changes have already led to improvement, please describe.

As explained in previous sections of this program review, the Astronomy Department currently offers seven courses: ASTR 010, ASTR 020, ASTR 030, ASTR 040, ASTR 045, ASTR 049, and ASTR 050. The last three of these have been added since the previous program review. The course descriptions, as given in the SCC catalogue, are listed below.

ASTR 010 3.0 Units
General Astronomy
An introductory study of the universe, including the properties and evolution of galaxies, stars, pulsars, black holes, quasars, the sun, planets, and life in the universe. Field trip may be required.
Three hours lecture.

ASTR 020 1.0 Unit
Astronomy Laboratory
Prerequisites: ASTR 010, 030, 040, or 045 (courses may be taken concurrently).
Students will gain familiarity with the sky, telescopes, and other astronomical equipment. They will do experiments in Physics related to Astronomy. Topics will cover the moon, planets, stars, galaxies, and cosmology. Field trips may be required.
Three hours lab.

ASTR 030 3.0 Units
The Solar System
An introductory study of solar system astronomy, the physics related to that astronomy, the planets and their moons, the sun, solar system debris, and the possibility of extraterrestrial life. Field trips may be required.
Three hours lecture.

ASTR 040 3.0 Units
Stars, Galaxies and Cosmology
An introductory study of stars, galaxies, the universe, and the physics related to these topics. This includes an examination of the facts relating to the sun, stellar lifetimes, supernovae, black holes, and cosmology. Field trip may be required.
Three hours lecture.

ASTR 045 3.0 Units
Introduction to Astrobiology and the Search for Life in the Universe
An exploration of the possibility of life beyond the Earth. Topics include the origin and evolution of life on Earth, the formation of Earth and other planets in the solar system, the likelihood of life existing on other planets or moons within our solar system, attempts to locate life within our solar system and attempts to communicate with intelligent life in other parts of the galaxy. Field trip may be required.
Three hours lecture.

ASTR 049 1.0-3.0 Units

Astronomy Honors
Prerequisites: ASTR 020 or ASTR 045
Universities and research laboratories across the country critically depend on ordinary citizens to collect the data that they need for their research projects. These people are known as "Citizen Scientists". In this course students will contribute to a current Citizen Science research project in Astronomy. This project requires the approval of a faculty member sponsor.

ASTR 050 1.0 Unit
Astronomical Optics
Prerequisites: ASTR 010, ASTR 030, ASTR 040, or ASTR 045
An introduction to principles of astronomical optics. The student will apply these principles to the design, fabrication, and use of a telescope, which will be tested under the night sky. Primary mirrors will be ground, smoothed, polished, and figured by hand. Optics and optical testing theories will be presented. Students will design and build a custom optical tube assembly and telescope mount.
A field trip to test the finished telescope will be required.

As was noted in the 2016 Astronomy Program Review, Astronomy is the largest department at SCC in the Physical Sciences, if measured by the number of students enrolled in courses. It was therefore recognized that more Astronomy courses should be established, to accommodate student interest in this field. In light of this recognition, Dr. Melanie Lutz, Dr. Maura Rabbette, and Dr. Phil Petersen, created three new Astronomy courses: ASTR 045, ASTR 049, and ASTR 050, and an A.S. degree in Astronomy. This degree has been available since Fall 2019.

One of the new courses, ASTR 050, was offered once by adjunct Randy Smith, but we have not had anyone available to teach this course since he retired. ASTRO 049 has not been offered yet, but we intend to begin offering it in the near future, now that we have hired a full-time Astronomy instructor. ASTR 045 has been taught annually for the past five years, and enrollments have been steadily increasing.

The Associate in Science Degree in Astronomy can be obtained by completing a total of 60 units, including the required courses listed below, the general education requirements, and electives. All courses for the major must be completed with a grade of C or better, or a grade of P if the course is taken on a Pass / No Pass basis.

Category	Course No.	Course Name	Units	CSU-GE	IGETC
These eight courses are required	ASTR 010	General Astronomy	3	B1	5A
	ASTR 020	Astronomy Laboratory	1	B3	5A
	MATH 020	Analytic Geometry and Calculus I	5	B4	2A
	MATH 021	Analytic Geometry and Calculus II	5	B4	2A
	MATH 022	Analytic Geometry and Calculus III	4	B4	2A
	PHYS 006	Physics for Science & Engineering I	5	B1, B3	5A, 5C
	PHYS 007	Physics for Science & Engineering II	5	B1, B3	5A, 5C
	PHYS 008	Physics for Science & Engineering III	5	B1, B3	5A, 5C
A	ASTR 030	The Solar System	3	B1	5A

minimum of six units from these six courses	ASTR 040	Stars, Galaxies, and Cosmology	3	B1	5A
	ASTR 045	Astrobiology	3	B1	5A
	ASTR 050	Astronomical Optics	1	B3	5A
	CHEM 001	General Chemistry	5	B1, B3	5A, 5C
	CIS 022	Introduction to Programming	3		
Sample General Education courses	ENGL 001	College Composition	3	A2, A3	1A, 8A
	ENGL 002	Critical Thinking and Writing About Literature	4	A2, A3	1B, 8B
	COMM 001	Introduction to Public Speaking	3	A1	1C, 8A
	SPAN 001	First Semester Spanish	5	C2	6A

Required Technical Courses	33 units
Elective Technical Courses	6-12 units
Completion of CSU-GE Breadth or IGETC pattern	15-21 units (enough to reach 60 units)
TOTAL UNITS	60 (at least) units

2.1a - Describe what new course or courses are planned and provide reasons for these new offerings, including how these courses might address issues of equity and student success. CTE programs: Note how advisory board input has led to planned course changes. Please add any new course plans to the Course Goals table at the end of Section 2.

There are currently no plans to add any new courses to our Astronomy degrees or department.

2.2 Scheduling, Sequencing, and Fill - Describe the student survey feedback related to course scheduling. What barriers to enrollment do students report? In terms of timing, location, and instructional format of course offerings, what changes are suggested by the survey responses?
(Be sure to add any goals which address these survey responses to the Course Goals table at the end of Section 2.)

The overwhelming majority of the respondents to the student survey indicated that "I have not experienced any barriers (to) enrolling in courses in this program/department". One student replied that "the course(s) I needed were full", and one replied that "the course(s) I needed were not offered this semester".

2.2a - For courses with low enrollment numbers, note possible causes (such as the type of class, scheduling, etc.).

The main Astronomy courses that students take, ASTR 010 and ASTR 020, always fill at rates well over the target minimum fill rate of 60%. Unfortunately, the class maxima for

ASTR 030, ASTR 040, and ASTR 045 have been set at an unrealistic level of 50. These class maxima should be re-set at 30. At that level, these courses will generally fill well. Overall, the average fill rate of our Astronomy classes during this reporting period has been 85%, with a slight upward trend since the start of the COVID era.

2.2b - Note if there is a preferred sequence of classes that students should take in the department/degree/certificate, or if there is no preferred sequence, and how students are informed of your preferred sequence (if any). Describe any work done to support PACE/Guided Pathways and inform counselors.

The sample course sequence for the Astronomy AS degree is shown below; the listed GE courses are indicative only, and are shown as examples. The Guided Pathway for Astronomy is available to all students on the SCC Astronomy Program web page.

Sample Course Sequence (ASTR AS degree)

Course No.	Course Name	Units	Sequence
ASTR 010	General Astronomy	3	Year 1, Fall
ASTR 020	Astronomy Laboratory	1	Year 1, Spring
ASTR 040	Stars, Galaxies, and Cosmology	3	Year 2, Fall
ASTR 050	Astronomical Optics	1	Year 2, Spring
MATH 020	Analytic Geometry and Calculus I	5	Year 1, Fall
MATH 021	Analytic Geometry and Calculus II	5	Year 1, Spring
MATH 022	Analytic Geometry and Calculus III	4	Year 2, Fall
PHYS 006	Physics for Science & Engineering I	5	Year 1, Spring
PHYS 007	Physics for Science & Engineering II	5	Year 2, Fall
PHYS 008	Physics for Science & Engineering III	5	Year 2, Spring
CHEM 001	General Chemistry	5	Year 2, Spring
CIS 022	Introduction to Programming	3	Year 1, Fall
ENGL 001	College Composition	3	Year 1, Fall
ENGL 002	Critical Thinking and Writing About Literature	4	Year 1, Spring
COMM 001	Introduction to Public Speaking	3	Year 2, Fall
SPAN 001	First Semester Spanish	5	Year 2, Spring

Year 1, fall term	Year 1, spring term	Year 2, fall term	Year 2, spring term
MATH 020 (5)	MATH 021 (5)	MATH 022 (4)	ASTR 050 (1)
ENGL 001 (3)	PHYS 006 (5)	PHYS 007 (5)	PHYS 008 (5)
CIS 022 (3)	ENGL 002 (4)	ASTR 040 (3)	CHEM 001 (5)
ASTR 010 (3)	ASTR 020 (1)	COMM 001 (3)	SPAN 001 (5)

Year 1, Fall: 14 units
Year 1, Spring: 15 units
Year 2, Fall: 15 units

Year 2, Spring: 16 units
TOTAL UNITS: 60 units

2.3 Prerequisites, Course Advisories, and Placement. Review and summarize student survey feedback regarding prerequisites. Note how advisories and pre- and co-requisites might be changed to get students better prepared for classes in the program. Be sure to add any goals which address these survey responses to the Course Goals table at the end of Section 2.

The only Astronomy courses that have prerequisites are our two laboratory courses, ASTR 020 and ASTR 050, and our Honors Astronomy course, ASTR 049. In the Spring 2022 Student Survey, 61% of students responded that "this course has no prerequisite", 28% agreed or strongly agreed that "this course builds on the material presented in the prerequisite (or previous) class", 11% "were not sure", and none (0%) indicated any problem regarding prerequisites.

Course Goals:

Course Goals	Actions to be Taken	Person(s) Responsible	Priority (Important or Urgent)	Time frame (short term or long term)
To integrate hands-on telescope-based lab components into many of our courses, to complement our current computer-based labs.	Research needs to be carried out to investigate telescope options and costs.	Maura Rabbette and the new (to be hired) lab technician.	Important	Short Term

END OF SECTION 2: COURSE GOALS

SECTION 3: ASSESSMENT OF PLOS & SLOS (TABLES)

Assessment of PLOs

3.1 Program Learning Outcomes (PLOs) - Summarize the student survey feedback related to PLOs. To what extent do majors understand the PLOs, find the classes effective in preparing them to succeed in the PLOs, and feel they are able to achieve the PLOs?

According to the Student Survey that was sent out in Spring 2022, 76% of the respondents said that they understood the PLOs. 73% of the respondents found the classes to be effective in preparing them to succeed in the PLOs, whereas 13% replied that it was too early to tell". Only 13% felt that the courses were not preparing them to achieve the PLOs.

Assessment of SLOs

SLOs for ASTR 010	Expected Performance	Performance
SLO 1: Define astronomical terminology, such as Asteroids, Black Holes, Comets, Constellations, Eclipses, Equinox, Gibbous, Meteors, Solstice, Transits, & Zenith.	70%	32/47 = 68%
SLO 2: Clarify and apply astronomical concepts including Kepler's Laws, Newton's Laws, Special & General Relativity, the Hertzsprung-Russell Diagram, Dark Matter, Dark Energy, and Red-Shift.	70%	41/47 = 87%
SLO 3: Understand astronomical concepts and their history taken from astronomical writings and observers, including the writings of Aristarchus, Ptolemy, Pythagoras, Copernicus, Bruno, Kepler, Galileo, Einstein, Hubble, & Hubble Space Telescope observations.	70%	39/47 = 83%
SLOs for ASTR 020		
SLO 1: Demonstrate the ability to set up and use telescopes to locate objects in the sky.	70%	32/61 = 53%
SLO 2: Demonstrate the ability to utilize a star chart and astronomy software to locate objects and guide simple astronomical observations.	70%	48/61 = 79%
SLO 3: Demonstrate familiarity with the	70%	42/61 = 69%

optical components of most telescopes and the spectra of the elements, as well as conceptually expressing the concepts related to them.		
SLOs for ASTR 030		
SLO 1: Define astronomical terminology related to the solar system, planets, comets, moons, and the sun and its study.	70%	9/17 = 53%
SLO 2: Understand and apply astronomical concepts related to the solar system, such as its history, orbits, sky location.	70%	11/17 = 65%
SLO 3: Understand astronomical concepts related to the solar system taken from astronomical writings, theories, and observations.	70%	10/17 = 59%
SLOs for ASTR 040		
SLO 1: Define astronomical terminology related to stars, galaxies, and cosmology and their study.	70%	NA
SLO 2: Understand and apply astronomical concepts related to the stars, galaxies, and cosmology such as their function, history, and distribution.	70%	NA
SLO 3: Understand astronomical concepts related to stars, galaxies, and cosmology taken from astronomical writings, theories, and observations	70%	NA
SLOs for ASTR 045		
SLO 1: Analyze the origin and evolution of life on Earth.	70%	19/27 = 70%
SLO 2: Estimate the chances of technical civilizations elsewhere in the galaxy through the Drake Equation.	70%	20/27 = 74%
SLO 3: Evaluate the possibilities of microbial life in the Solar System, especially Mars and Europa.	70%	25/27 = 93%
SLOs for ASTR 049		
SLO 1: Demonstrate specific knowledge	70.0%	NA

within the field of Astronomy. This will be achieved through researching a specialized project in a current Citizen Science research project in Astronomy and professionally disseminating their results.		
SLO 2: Write a paper or give an oral presentation.	70.0%	NA
SLOs for ASTR 050		
SLO 1: Understand and apply the principles of testing optical surfaces.	70.0%	NA
SLO 2: Demonstrate an understanding of the principles of geometrical optics.	70.0%	NA

3.2 Student Learning Outcomes (SLOs) - Review the current status of SLOs in your program. Note if all course SLOs are written and up-to-date (at least two per course).
Identify which courses have not been assessed in over two years, and note which of these courses have not been offered in over two years.

All course SLOs are complete and up to date, and can be found in the Course Outline of Record (COR) within eLumen. ASTR 049 and ASTR 050 have not been offered (or assessed) within the last two years. All of the courses that have been offered in the past two years have been assessed, except ASTR 040, which was last assessed over two years ago, and is scheduled to be assessed in Fall 2023.

3.2a - Describe collaborative efforts among faculty to assess SLOs. For example, note if SLO assessments in online and face-to-face courses have been compared, and what these comparisons indicate. Note if rubrics have been used in different sections of the same course, or across courses, to aid SLO assessment.

Each instructor of a given Astronomy course uses the same rubric to assess the SLOs for that section of the course. By comparing SLO assessment results between the same course as taught face-to-face, and as taught online, it seems that SLO success rates are roughly similar. In courses such as ASTR 010 and ASTR 020 that are taught by multiple faculty members, common rubrics for SLO assessments are used.

SECTION 4: STUDENT SUCCESS (by RACE/ETHNICITY and GENDER – TABLES)

4.1 Student Success and Support - Describe the student survey feedback related to success. What barriers did students identify, and what did they find helpful? How did students address the question of equity and emotional safety?

The Student Survey that was sent out in Spring 2022 did not uncover any barriers to student success. In fact, 0% of the respondents indicated that they had experienced any barriers to their success. 91% of respondents either agreed (45.5%) or strongly agreed (45.5%) that "the courses in this department provide an emotionally safe, supportive learning environment, where I can explore ideas and express myself."

4.2 Success by Population - Review the student success rates in the program/department, if available. If possible/applicable, review student success in general education classes (across specific populations) with student success in degree-specific courses. Note if certain groups are significantly more or less successful than their peers, and if there have been any clear trends upward or downward since the last program review. Provide possible reasons for higher or lower success rates.

The success rate for all courses taught in the Astronomy Department, over the current reporting period, was 73%. This success rate was very similar to the success rate for SCC as a whole, which was 75%.

The Astronomy Department's overall success rate of 73% during the current reporting period was somewhat lower than the 78% success rate that was reported in the previous (2016) program review. Most of this decrement has in fact occurred since Fall 2020, which is the period of COVID-affected teaching. This perhaps can be attributed to the fact that during COVID, our Astronomy attracted a large number of international students who may have had difficulty in dealing with the large time-zone differences. The category of "international students" could perhaps be tracked via the Fact Book.

Very nearly all of the Astronomy courses taken at SCC are currently taken as General Education courses, by students who are not Astronomy majors. It is therefore not possible to draw any distinction between student success in general education Astronomy classes, and student success in degree-specific Astronomy courses.

The following table shows the racial/ethnic breakdown of the success rates of SCC students taking Astronomy courses, contrasted with the corresponding breakdown for SCC as a whole:

	Asian	Black	Hispanic	Other/Unknown	2 or more	White
Astronomy	80%	64%	74%	69%	71%	75%
SCC	79%	65%	73%	73%	73%	78%

The success rate for each racial/ethnic group in Astronomy was in all cases nearly the same as the success rate for that group in SCC as a whole.

The next table shows the gender breakdown of the success rates of SCC students taking Astronomy courses, contrasted with the corresponding breakdown for SCC as a whole:

	Male	Female
Astronomy	74%	72%
SCC	74%	75%

The success rate in Astronomy for female students (72%) was essentially the same as the success rate for male students (74%). The success rates for both male and female students in Astronomy were each very close to the corresponding success rates in SCC as a whole.

4.3 Degrees/Certificates Awarded (if applicable). Review the number of degrees and certificates awarded over the past five years, if available, and address any clear upward or downward trends. If students are leaving the program before earning the degree/certificate, note whether certain courses are a stumbling block, or if students don't need all the courses in the program to achieve their goals. If possible, note if certain populations of students are having greater difficulty completing the program.

The Astronomy Department has been offering an AS degree since only Fall 2019. Thus far, no ASTR AS degrees have been awarded. It is expected that, now that a full-time Astronomy faculty has been appointed (Fall 2022), students will become more aware of the opportunity to obtain this degree.

4.4 Preparation for the Future - Describe how students are informed about future options, such as the kinds of schools they might transfer to, the kinds of employment available in their field, and what further degrees might be useful to get into a particular profession. CTE programs: Note also if any agreement or MOU exists with employers to place graduates.

The Transfer Center at SCC provides prospective transfer students with direction and assistance in navigating the transfer process. The services that they offer include connecting students with university representatives, holding transfer-related workshops and transfer fairs, helping students access information on transfer websites, and assisting students with researching colleges, and arranging campus tours. SCC counselors and individual Astronomy instructors also give advice to students regarding career pathways, transfer opportunities, and degree options, that will help them to achieve their goals.

NASA Citizen Science Projects are collaborations between scientists and members of the public who are willing to volunteer their time in an effort to answer some of the most fundamental questions about our universe. Students in Prof. Maura Rabbette's ASTR 020 course have enthusiastically become NASA Citizen Scientists, helping NASA to discover new planets at the

edges of our Solar System. This project is described in the Inside Solano article that can be downloaded from the blue folder.

4.4a CTE programs: Note if there are any statewide, local or national tests that students should take, after leaving your program, in order to get employed or be more competitive in the job market. Note also if students need additional study or coursework (not provided by the college) before they are ready to take those tests. Explain how students are informed about these requirements.

NA

SECTION 5: OUTREACH

5.1 Outreach for Equity - Describe outreach efforts since the last program review to attract and retain under-represented populations (such as diversified curriculum or guest lecturers).

- Faculty member Katie Berryhill, and former SCC student Nicole Peacock participated in the SCC Women in STEM Panel, on March 21, 2019. https://www.dailyrepublic.com/all-dr-news/solano-news/fairfield/solano-college-to-host-stem-panel-discussion/.

5.2 Outreach on Campus - Describe how the program has connected with the campus community. Include any cross-discipline collaborations, student clubs, or other activities that connect students in the program to the college as a whole. Note whether there is currently need for more coordination with Counseling.

- Maura Rabbette worked with Art Instructors Rachel Smith and Jeanne Lorenz on an Astronomy Art Project in Fall 2019.

5.3 Outreach to the Community - Describe how the program has connected with the larger community. Provide examples of activities, field trips, and community/classroom partnerships since the last program review. Note who has been brought into the classroom, and where students have been brought, beyond the classroom.

- Maura Rabbette organized and chaired Special Women's History Month Presentation at the SCC Fairfield campus by Sarah Stewart, a MacArthur Genius Award winner and UC Davis Professor of Astrophysics, on March 7, 2019. http://www.solano.edu/president/insidesolano/2019/Inside030419.pdf. (Please see media article appended at the end of this document).

  The Astronomy Department is planning to initiate Start Gazing parties that will be open to the SCC campus and the surrounding community, that will allow viewing of timely

astronomical events such as comets and eclipses. This will require the assistance of a lab technician who is skilled in the use of telescopes.

END OF SECTION 5: OUTREACH GOALS

SECTION 6: RESOURCES

6.1 Human Resources - Describe the current staffing levels in the program, and whether they are currently adequate to meet students' needs. If the program has been functioning for a while without needed faculty/staff, note how long has this position been needed, and how this gap has affected the program's health.

After a seven-year period in which we had not replaced Phil Petersen, the full-time Astronomy/Physics faculty member who retired in 2014, we hired Dr. Maura Rabbette as a full-time faculty in Astronomy and Physics in Fall 2022. In combination with our five adjuncts (Berryhill, Gonzalinajec, Johnson, Petersen, Popescu), we now have sufficient staff to teach all of our Astronomy courses and sections.

However, since the retirement of lab technician Richard Crapuchettes in 2020, our Astronomy program has been without a lab technician. The assistance of a lab technician will be needed as we carry out our planned integration of hands-on telescope-based laboratory components in our courses.

6.1a - Note what gaps will need filling within the next year, and within the next five years, and why new or replacement faculty/staff will be needed.

There are no teaching gaps in the short term (0-5 years). In the longer term (5-10 years), we would like to hire a tenure-track faculty member who will split their load between teaching Astronomy courses, and managing the planetarium, which will be part of our anticipated new STEM center. This person will co-ordinate planetarium-related outreach to local K-12 schools.

6.2 Technology - If the program has been functioning for a while without needed technology (IT, software, hardware), note how long the technology/equipment has been needed, and how this gap has affected the program's health.

We currently have no telescopes. This has not posed a problem during on-line teaching, but this needs to be rectified as we return to in-person teaching.

6.2a - Note what new or special technology will be needed in the next year, and the next five years, and why it will be needed.

Telescopes are urgently needed for our face-to-face Astronomy courses. The Starry Night software needs to be continually updated, at Fairfield and Vallejo.

6.2b - Describe survey feedback describing students' experiences with technology in the classroom.

In the Student Survey that was sent out in Spring 2022, 28% of the respondents agreed that "the classroom facilities, equipment, and physical space support student learning in this class", whereas 72% replied that this question was not applicable to them, as they were taking the course online.

6.3 Facilities & Equipment - Note what classrooms, buildings, and other facilities the program currently uses/occupies. Describe how the existing facilities/equipment serve the program's needs, and in what ways the existing facilities are inadequate to meet students' needs. If the program has been functioning for a while with inadequate facilities/equipment, note how this has affected the program's health.

Prior to the COVID era, we taught ASTR 010 in room 308 at the Fairfield campus, and ASTR 020, ASTR 045, and ASTR 050 in room 301 at Fairfield. We also taught ASTR 010 in a lecture hall at the Vallejo Center, and ASTR 020 in the computer lab at Vallejo. These spaces are generally suitable for our needs. At the Fairfield campus, we need to remove the bank of Geography files drawers in room 301 and replace them with a large chalk board.

The new Science Building at Fairfield, Building 2700, which houses Biology, Chemistry, Geology, and Geography, does not contain any space for our growing Astronomy program. The need for additional space for Astronomy, including a domed planetarium and a platform for viewing, coupled with the fact that Building 300 (used by Physics, Physical Science, Engineering, and Astronomy at Fairfield) and Building 1500 (used by Math at Fairfield) will eventually approach the end of their life cycle, highlight the need for a new STEM Center at Fairfield that will house Mathematics, Physics, Engineering, Astronomy, Physical Science, along with our new Data Science Program. This new STEM Center, which will contain a state-of-the-art computer lab, was mentioned in Section 4.4 of the 2016 Astronomy Program Review: "For the longer term, the Astronomy Department faculty, along with the Physics and Engineering Departments, have been advocating the construction of a new dedicated Physical Sciences building, which would include a domed planetarium."

6.3a - Note what new facilities/equipment will be needed in the coming years.

As mentioned above, our long-term plans are to move the Astronomy program into a new STEM Center on the Fairfield campus, which will house the Astronomy, Physics, Engineering, Physical Science, and Mathematics Departments.

6.3b - Describe survey feedback describing students' experiences with the Program's facilities/equipment.

In the Student Survey that was sent out in Spring 2022, 28% of the respondents agreed that "the classroom facilities, equipment, and physical space support student learning in this class", whereas 72% replied that this question was not applicable to them, as they were taking the course online.

6.4 Library and Student Support Resources - Note how the program uses tutors and other specific support for student learning. Include any plan to change or expand student support in the goals list below.

This program does not currently use tutors or other specific support.

6.4a - Review the college's discipline-specific library resources with a librarian. Summarize the current status of the library resources and plans to supplement the collection. Upload the librarian's collection evaluation form to the blue folder in the upper right-hand corner of Section 6.

Copies of all textbooks used in the Astronomy program are kept on file in the SCC Library.

6.5 Other Resources - Note the program's routine or special costs not addressed above, such as regularly contracted services. Note whether any of the funds for these goods/services come from a special source; if so, note if the funding will run out or will continue for the foreseeable future, and potential impact on the program.

NA.

6.6 Resources Leading to Improvement - Using specific examples, describe how changes to staffing, faculty, technology, equipment, facilities, library collection, student support, and/or funding have led to an improved experience for students and greater student equity. CTE

programs: Address specifically any improvements funded by Perkin's money or other sources.

We have recently hired a full-time faculty member, astrophysicist Maura Rabbette, to teach (primarily) in our Astronomy Department. Dr. Rabbette will bring years of experience working at NASA to our program, which will help in motivating our students.

Resources: Hiring Goals

Resource Goals	Actions to be Taken	Person(s) Responsible	Priority (Important or Urgent)	Time frame (short term or long term)
1. Hire an experienced lab technician dedicated to the physical science departments.	Post job advert	HR/Dean	Urgent	Short Term

Resources: Technology Goals

Resource Goals	Actions to be Taken	Person(s) Responsible	Priority (Important or Urgent)	Time frame (short term or long term)
1. Upgrade Starry Night Software in Fairfield and Vallejo	Order new software	IT/Lab Tech	Important	Long Term
2. Upgrade laptop computers in rooms 301 and 302	Place request to IT	IT/Lab Tech	Important	Long Term

Resources: Facilities and Equipment Goals

Resource Goals	Actions to be Taken	Person(s) Responsible	Priority (Important or Urgent)	Time frame (short term or long term)

1. Remove bank of Geography files drawers in room 301 and replace with large chalk board	Work order was placed to Facilities in Aug. 2022	Melanie Lutz / Maura Rabbette Joe Ryan	Urgent	Short Term
2. Finish furnishing room 344	Place work order to Facilities	Maura Rabbette / lab technician	Urgent	Short Term
3. Order Telescopes	Place purchase order	Maura Rabbette / lab technician	Urgent	Short Term
4. New teacher's chair in room 301	Place work order to Facilities	Maura Rabbette / lab technician	Important	Short Term
5. Grinding and polishing stations in room 301 for ASTR 050	Task for new lab technician	Maura Rabbette / Melanie Lutz	Important	Short Term
6. New laser printers in rooms 301, 302	Place request to IT	Maura Rabbette / Melanie Lutz / Joe Ryan	Important	Short term
7. New STEM Center for Physical Sciences and Mathematics	Investigate funding opportunities		Important	Long-term

Resources: Student Support Goals

Resource Goals	**Actions to be Taken**	**Person(s) Responsible**	**Priority (Important or**	**Time frame (short term or**

			Urgent)	long term)
Supply desk copies of all textbooks for 2-hr reserve to library	Contact publishers for desk copies	All Astronomy faculty	Important	Short term

Resources: Other Resource Goals

Resource Goals	Actions to be Taken	Person(s) Responsible	Priority (Important or Urgent)	Time frame (short term or long term)
None at this time				

Please Note: All information regarding funding type and cost is TBD and is awaiting the hiring of a Physical Sciences lab technician.

END OF SECTION 6: HR GOALS, TECHNOLOGY GOALS, FACILITIES GOALS, STUDENT SUPPORT RESOURCES GOALS, OTHER RESOURCES GOALS

SECTION 7: CONCLUSION

7.1 Need for Improvement and Support - Summarize the program's top two or three areas most in need of improvement and support.

1. It is imperative that a full-time lab technician be hired to support all of our Astronomy courses and outreach activities.

2. It is imperative that we retain our classrooms 301 and 302 on the Fairfield campus, and their associated prep rooms, as well as use of room 308.

3. Our longer-term plan is to move Astronomy teaching into a new STEM Center on the Fairfield campus, that will include a domed planetarium.

7.2 Improvement, Success, and Strength - Summarize the program's top two or three areas of improvement, success, and strength.

Among the improvements made in the SCC Astronomy program over the period 2016-22 are the following:

- A new Associate in Science degree in Astronomy was developed, and has been available since Fall 2019.

- A new full-time Astronomy and Physics instructor, Maura Rabbette, was hired in 2022. Dr. Rabbette has a Ph.D. in Astrophysics from University College Dublin, and has worked as a research astrophysicist at NASA, and as a Program Manager for the U.S. Air Force and Space Force at Travis Air Force Base. Maura brings great experience and enthusiasm to our Astronomy program.

Among the many notable success stories of our Astronomy Program have been the following:

Faculty:
- Maura Rabbette received the SCC adjunct Distinguished Faculty Award in 2019.
- Katie Berryhill received the SCC adjunct Distinguished Faculty Award in 2021.

Students:
- Hunter Martin did an REU summer internship in Physics at UC Davis in 2017.
- James Alsip did a Summer Assure Internship at UC Berkeley in 2022.
- Mackenzie Cassell did a Summer REU Internship in Physics at UC Davis in 2022.

7.3 Signature Page - The following faculty in the program (or in a related program) have read this self-study report and have had the opportunity to provide feedback:

Melanie Lutz, full-time
Maura Rabbette, full-time
Philip Petersen, adjunct
Trevor Gonzalinajec, adjunct
Katie Berryhill, adjunct
Tracey Johnson, adjunct
Bogdan Popescu, adjunct

STAYING COMMITTED AND CONNECTED November 18, 2019

Vallejo Center Astronomy Students Answer NASA's Call for New Citizen Scientists

NASA Citizen Science Projects are collaborations between scientists and members of the public who are willing to volunteer their time in an effort to answer some of the most fundamental questions about our universe. "Citizen Scientists" have made thousands of important scientific discoveries in the fields of Astrophysics, Planetary Science, Solar Science, and Earth Science. They have co-authored publications in professional scientific journals highlighting their many contributions to science, including the discovery of hundreds of extra-solar planets, and more than half of all known comets.

Students at SCC's Vallejo campus in Prof. Maura Rabbette's astronomy course (ASTR020) have enthusiastically become NASA Citizen Scientists. Before starting to teach at SCC, Dr. Rabbette was a research scientist at NASA for fourteen years, working on the Kepler Space Telescope that was launched to search for life outside our solar system. Having been a principal investigator on a number of NASA Astrobiology projects, she saw a perfect opportunity for her students to get their hands on *real* astronomical data. Working on real data from NASA Space Telescopes, and having the opportunity to contribute to groundbreaking discoveries, is far more exciting than reading about other people's scientific work.

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The Vallejo students have been contributing to two exciting projects this term, *Backyard Worlds* and *Galaxy Zoo: Clump Scouts.*

Backyard Worlds: This project offers opportunities to discover new planets at the edges of our Solar System, as well as finding cold nearby failed stars that are known as "brown dwarfs". The students are helping NASA scientists distinguish real celestial objects from image artifacts in data from NASA's Wide-field Infrared Survey Explorer (WISE) mission. The real objects are brown dwarfs and low-mass stars, the Sun's nearest neighbors. When the students find an object of potential interest, they submit it to a research scientist for further analysis. The students then have the opportunity to ask questions and discuss their findings online with project scientists.

Galaxy Zoo - Clump Scout: In this citizen science project, the students are searching visible images of galaxies to find "giant star-forming clumps". Astronomers classify these as small regions within galaxies where stars are being born at a faster-than-usual rate. The clumps are brighter and more densely packed, and stand out against the rest of the background galaxy. If students find a galaxy with a bright clumpy region, they tag it as a "clumpy galaxy", and submit it to the project scientists for further analysis and discussion. Citizen Science projects provide learning opportunities in experimental science and research, for a broad range of SCC students. Most projects require no prior knowledge, experience, or special tools. The NASA citizen science projects teach students everything they need to know, as the project proceeds. These projects may be the only exposure that some students will have to carry out a real science project, whereas for others, Citizen Science inspires a diverse student population to pursue science careers. It is a portal into the science world, especially among community college students (57% women, 36% first-generation, and 50% non-white) that may have had limited previous exposure to science. As a result of the Citizen Science program, some students choose a major in science that they would never have otherwise considered. Apart from being engaging and enjoyable projects, these educational citizen science experiences show students the relevance of science in their lives and in the world around them.

In addition to coordinating the current Citizen Science project at the SCC Vallejo Center, Prof. Rabbette has also created a new course at SCC, ASTR 049: Honors Astronomy, for interested students to further pursue research in Astronomy.

Above Photo: *Dr. Rabbette (standing, fifth from the left) with her ASTR 020 students at the Vallejo Center.*