

Astronomy

Cover

Overview

Program Review Year

Title Astronomy

Year of Last Comprehensive Review Fall 2018

Year of Last Mini Update, if applicable

Originator Batalha, Celso

Area Dean Dr. Antoinette Herrera

Division

Math, Sci. & Engineering

Department

Physical Science

Subject

- ASTRO - Astronomy
- PHYS - Physics
- PHYSC - Physical Science

Is this a review for a degree/certificate or all the courses in the subject?

Degree

- General Studies with Emphasis in Astronomy, Associate in Arts - Historical

Co-Contributors

*Co-Contributor must be chosen before proposal is launched

- Brown, Robert
- Fakhruddin, Fahmida
- Herrera, Antoinette
- Masuda, Michael

Overview

Evergreen Valley College guides all students to pathways that reach their educational and career goals through equity-centered, innovative academic programs and support services. By creating a learning environment where everyone feels welcomed and supported, we are committed to a culture of inquiry, growth, and respect that creates an equitable society in which all can participate and prosper.

1.Student-Centered: We provide access to quality and efficient programs and services to ensure student success.

- Access
- Curriculum and programs
- Services

2. Community Engagement: We will transform the college image and enhance partnerships with community, business and educational institutions.

Areas of focus are:

- Increase visibility
- Develop strategic partnerships
- Building campus community

3.Organizational Transformation: We create a trusting environment where everyone is valued and empowered.

Areas of focus are:

- Communication
- Employee development
- Transparent Infrastructure

- **1. Provide a brief summary of your program. Please include a brief history and discuss any factors that been important to the program's development.**

The astronomy program shares and upholds the EVC mission of promoting an environment where students can achieve their educational and career goals through equity-centered courses and enriched out-of-classroom activities with incentives towards STEM, in particular, space science. The courses in the program have been submitted to constant review and incorporated new technologies, especially on the asynchronous online section of ASTRO 010 where both full-timers are now certified to teach its asynchronous section.

The Astronomy Department oversees one of the most popular GE courses for non-science majors in two or four-year colleges: *Descriptive Astronomy* or *ASTRO 010*. Its popularity led instructors and classified personnel in early 2000 to join efforts in convincing the district and Board of Trustees that an observatory on campus would raise student enrollment and bring waves of visitors to our campus, fulfilling our mission of integrating the community into our academics and goals. In the fall of 2003, the Montgomery Hill Observatory had its grand opening ceremony, followed by stargazing with a significant presence of visitors and members of other community colleges.

The lecture course ASTRO 010 was joined years later by an independent laboratory course for non-science majors, ASTRO 10L. It started with one evening section, growing to a second section later. More recently, it incorporated two other daytime sections. About ten years later, to diversify and deepen the learning on specific topics covered in the abridged format of ASTRO 010, we launched ASTRO 014, Solar System Astronomy, and ASTRO 016, Stars & Galaxies, enabling students to get a closer look into processes at play in planetary objects, stars, and galaxies. Community colleges have taken this same route, splitting their descriptive course into two, easier-to-cover courses attending

students' interests: solar system topics or stars & galaxies. We have recently re-designed ASTRO 014 and ASTRO 016 to serve a growing clientele of online students, making lectures asynchronous online with laboratory exercises delivered at the observatory, weather permitting.

The program "General Studies With Emphasis in Astronomy (AA)" was created in 2015 to be a possible career change for students already taking ASTRO 010 and ASTRO 10L. We thought of using these populous courses to invite students to expand their knowledge by enrolling in the newly created ASTRO 014 and ASTRO 016 courses. We were hoping for increased awareness of Space Sciences, leading more students into STEM pathways requiring additional Calculus-Based Physics courses, such as in PHYS 4-series. This first version of this AA program brought only one student to graduation in the following five years. It followed a steadily declining enrollment in ASTRO 014 and ASTRO 016 and the consequent "not offering" of both courses in the following years. We decided to keep these courses alive, but redesign them to attend STEM students rather than the non-science majors enrolling in ASTRO 10. We are relaunching ASTRO 014 and ASTRO 016 in spring 2023, including associated labs completed at the Montgomery Hill Observatory, with lectures asynchronous. In addition, we redesigned the AA program as well, including all calculus-based physics courses and ASTRO 014 and ASTRO 016 as core courses.

Astronomy is a science drawing significant attention from different segments of society, blending observing elements with belief systems of world religions. Consequently, our regular stargazing has attracted a significant crowd to our campus, including children. Since the very early days of our observatory in 2003, and in response to different requests, we have organized several group visits, including churches, girls' and boys' scouts, schools, elderly centers, and others. In addition, parents asked us to initiate programs for their children to complement the STEM education received at their schools, using the technical resources available at the observatory. Parallel to this inquiry from parents, our department's faculty initiated outside-classroom research experience for a handful of EVC students interested in embracing an astronomy-related career. The number of students interested was not large but significant enough to keep alive the idea of eventually promoting undergraduate research on our campus. Providing enrichment experience in STEM for K-8 students and advancing undergraduate research at EVC led us to create the EVC- Citizen Sciences Initiatives (EVC-CSI), congregating citizens with technical or science backgrounds to promote STEM education to underserved communities while providing EVC students with research skills not delivered in current course labs.

The Montgomery Hill Observatory is a treasure still capable of expanding its reach if proper institutional support is given. An observatory with over ten portable telescopes and two dedicated buildings cannot function properly without the permanent oversight of an Instructional Lab Technician. In addition, undergraduate research can only be expanded if instruments designed to collect and store light are available. The department has pursued the acquisition of a spectrometer for several years, without institutional support, leading us to write grants to fulfill this need.

As of 2021, the department is engaged in two main lines of development and outreach: 1) expanding the course offerings, making them more dependable on data taken at the observatory, and 2) expanding efforts to bring STEM to underserved communities with the help of Service Learning students and volunteers.

- **2. Please provide an update on the program's progress in achieving the goals (3 years) set during the last comprehensive program review.**

We are commenting on the goals listed in our last 2017 Program Review and their current status:

1 – Update ASTRO 014 and ASTRO 016 Courses – In the previous Program Review, we suggested keeping these courses with the same units but adding a lab component and reducing lecture hours. The courses have gone through proper reform, submission, approval, and transferability to CSU and UC approved. ASTRO 014 will be offered in spring 2023, and ASTRO 016 in Fall 2023.

2 – Propose Courses: Introduction to Astrobiology, Astro-imaging, Elements of Research I & II.

We have not initiated an Astrobiology course yet, and for now, we have no plans to advance it as a standing-alone course. We might introduce elements of Astrobiology as a research topic in the new course ASTRO 20 A & B. Same applies to Astro-imaging. The two courses, Elements of Research I and II, are now labeled ASTRO 020A and ASTRO 020B, currently in CurriQunet and being revised by the Division Curriculum Committee. ASTRO 20A and ASTRO 20B will enable undergraduate research within the framework of “Independent Studies,” bringing together one instructor and up to three students. We are working hard to convince our senior administrators about the need of a spectrometer to support this initiative.

3 – Redesign Astronomy AA program – This has been completed and approved. It is based on redesigned ASTRO 014 and ASTRO 016, and in addition to the updated Calculus-Based General Physics courses, PHYS -7A/07B/07C.

4 – Create the environment “Space and Technology Academy.” – This is a big dream still unfulfilled and certainly in the making for many years to come. It attempts to integrate K12, particularly K-8, into the community college atmosphere while connecting this pipeline to local universities. It tackles the equity gaps in education so ostensibly perpetuated in underserved communities, linking participant children with community colleges and universities through STEM education. It is an opportunity for young children without role models in higher education to interact with older peers in the community college system and college faculty. It is also an opportunity for local citizen scientists to partake in the process of minimizing the equity gap by sharing their academic talents with the underserved community. As an example, some of our K12 students, EVC faculty, classified administrators, and our President and VP of Academic Instruction were selected to participate in the event “Artemis Pledge,” a NASA-originated project designed to send a verbal statement to the moon, committing our college to implement space education to our students and K12. Our “pledge” will be on the space probe landing on the moon in 2024, along with the first female astronaut.

The EVC-CSI project congregates faculty, classified staff, and community college students serving participants K 12. At the time of our last Program Review, we began working weekly with a group of eight middle schoolers that grew to 36 in the last academic year. It runs on volunteering time, sometimes using “Service Learning” students to help deliver content to our middle schoolers. Unfortunately, without a funding source, this project cannot grow, and it is not sustainable. In searching for a funding source, the department applied for several small and large grants. Since the last program review, and having in mind supporting the EVC-CSI project, we submitted without success the following significant NSF grant proposals:

- a. NSF-SSTEM, Track I: Advanced STEM Laboratory: Research Mentorship and Social Integration, on 08/22/2020
- b. NSF-INCLUDES: Planning Grant: An Equity-minded Citizen Science, on 11/25/2020
- c. NSF-SSTEM, Track II: Quantum Information, Research, and Service Learning - Preparing Transfer Students for a Leap in Technologies That Will Change Society: STEM Pathways, on 02/22/2022
- d. NSF-IUSE-HIS: Cross-Disciplinary Data Science for a Two-Year College, on 05/02/2022

Grant proposal #4 was written in collaboration with the Computer Science Department, and we specifically asked for the long-waiting spectrometer to increase student success and retention. It is also important to emphasize that these proposals affected other STEM areas, although the leading traction was the Astronomy program and its observatory.

Other smaller grants came our way with most funds allocated to our K12 EVC-CSI program: Kiwanis International, Synopsys Foundation, various fundraisings led by SJECCD Foundation and local residents, scattered private donations, and others. We also dedicated efforts to providing EVC students with essential skills in space sciences. In particular, we were recipients of the California Space Grant Consortium (CaSGC), a coordinated effort from NASA and UC San Diego, supporting cohorts of 12 students per semester since spring 2021. Another collaboration has been recently established with the Search for Extra-Terrestrial Intelligence Institute (SETI). SETI fundraised \$5,000 for two paid internships for six months in 2023-2024 for two low-income and talented EVC students.

The partnership with SETI has also given us a new digital telescope, the eVscope, a fantastic tool air dropping images of faint sky objects, such as galaxies and globular clusters, directly to people's cell phones. It has been one of the "stars" of our stargazing. We are designing lab handouts to incorporate such a technology in our ASTRO 10L and upcoming ASTRO 014 and ASTRO 016 courses.

5- Implement a State-of-Art Planetarium: The Evergreen Planetarium – Certainly, this cannot be built with our yearly budget and requires EVC and district engagement. The community of residents supporting our K12 initiative (EVC-CSI) has embraced this vision for a museum on the 27 acres of land, believing such a facility would serve as a magnet attracting children from East-Side San Jose (ESSJ). Their parents and relatives would be exposed to adult education and the range of available non-credit courses setting, perhaps, on pathways toward higher education. ESSJ hosts a population of over 120,000 residents with a racial diversity of 54% of Hispanics and 36% of Asian Americans as the major ethnic groups (Niche, 2022). Although bordering Silicon Valley with companies leading the 6th largest economy globally, 69% of the household income lies below \$100,000 in one of California's most densely populated urban areas. More recently, the Silicon Valley Index report (SVI, 2022) has warned that although jobs are back to pre-pandemic levels, income inequality has widened, housing prices have risen, and inflation exploded. In this county, the U.S. Department of Housing and Urban Development (USDHUD, 2021) classifies low income for a family of four as \$117,750. On the educational front, only 20% of the residents carry a Bachelor's degree or higher, and additional work is called upon to improve adult education and reverse the 31% non-completion of high school diplomas (Niche, 2022). The low percentage of graduates in ESSJ households (45% - Niche, 2022) hints at the significant number of future first-generation college students (FGCS) entering community college grounds in their first years. Investing in such a museum is one of the best moves to tackle inequities in basic education that the school system (K12) and institutes of high learning, such as EVC, can do for future generations. The idea of a planetarium has grown to incorporate other academic areas, such as Biology and its EVC Museum of Natural Sciences, Arts and Languages, Anthropology, Computer Sciences, and others. Representatives from these different departments are making efforts through EVC Academic Senate to craft a resolution that can bring an EVC Museum to the attention of our senior officers.

Faculty from different departments and representatives of our community of residents visited Modesto Junior College and its fantastic Great Valley Museum in the summer of 2022. Their Chancellor, Dr. Henry Yong, received us, along with And the Museum Director. They shared their yearly budgetary information and showed us a run filled with projects and classwork they delivered to the local K12.

- **3. Please state and recent accomplishments for your program and show how it contribute to the College's mission and success.**

Astronomy courses have maintained a high level of enrollment with multiple sections, attending the diverse population of EVC students. However, as we write this program review, a negligible percentage of the students taking our courses are STEM students. The vast majority are from other divisions seeking to complete a required science course with a lab to fulfill their GE. These are some of the implementations done in the last three years to attend non-science majors taking ASTRO 10 and ASTRO 10L courses:

1. Our full-time instructors have completed certification in EDIT 022, and we now offer two asynchronous online sections per term. These sections tend to enroll faster than the in-person section.
2. We implement software during in-person sections to increase student participation and engagement. They replace the old "clicker" devices and can be easily accessed by cell phones. In addition, the server allows students to upload graphs and images and comment on discussed topics, enabling the old multiple-choice questions and pooling.
3. Students seeking advanced instruction in astronomical processes have joined the faculty in undergraduate research. In addition, active undergraduate research has been undertaken with students under the "Honors Program," or Physical Science Student Club, or during weekly informal zoom gatherings hosted by the EVC-CSI project.

These additions meet the college mission of guiding students to "succeed academically," boosting retention and student success, and, in the case of undergraduate research efforts, providing them with skills necessary to compete in advanced STEM careers.

The Montgomery Hill Observatory is doing well, fulfilling its mission to serve students from the ASTRO 10L laboratory and the ASTRO 10 or physics students on seldom field trips. In addition, it...

1. brings news about the skies to over 1,500 subscribers in our [mailing list](https://www.meetup.com/starry-evergreen-at-the-montgomery-hill-observatory/) (<https://www.meetup.com/starry-evergreen-at-the-montgomery-hill-observatory/>), primarily residents in our neighborhood or supporters of the EVC-CSI project. This mailing list has been used by the district to publicize events requiring community support and is paid for and maintained by the volunteering work of our classified and faculty. It is maintained by our Astronomy Laboratory Technician and paid for by faculty donations.
2. holds monthly stargazing events with a regular attendance of over 100 visitors. Special events such as eclipses have attracted significant crowds of over 300 visitors. During the monthly stargazing, it opens the two observing facilities: the dome and the roll-off-roof buildings, with more technically loaded telescopes holding lines of curious visitors waiting for their turn to spy on some star cluster or galaxy. We have also implemented the use of a digital telescope (The Unistellar EVscope) to process and image deep sky objects onto a TV monitor and the smart phones of visitors. We are also looking into expanding the use of the EVscope as a stellar spectrometer for use in our astronomy courses.
3. engages parents with their children in a scientific and fun game of finding stars during the monthly stargazing.

Thanks to our partnership with the "Search for Extraterrestrial Intelligence (SETI)," we received the donation of an eVscope, one of the first generation of digital telescopes capable of delivering sky images of impressive resolution to visitors by "airdropping" it to their cell phones. As we write this

program review, faculty are writing lab handouts to incorporate this high-tech instrument into our existing ASTRO 10L and future ASTRO 014 and ASTRO 016 courses.

How do we attend 100 visitors a month, offering light refreshments and overseeing 10 highly technical instruments in different areas inside and outside buildings while keeping the visitors safe and organized in lines? The Montgomery Hill Observatory could not be open to the public without the dedicated work of several volunteers, including EVC's alumni and an Instructional Laboratory Technician currently supported by seasonal grants. The observatory would be closed without their presence--compromising the vibrant outreach that has been built over almost 20 years and our current student academics.

We have used our mailing list to host panel discussions and talks open to the public before the stargazing, and they have been re-started after restrictions on free circulation on our campus were lifted. In 2022, we have promoted:

1. Astronomy During Pandemic (Earth Day 4/22/22): The evening started with multiple speakers from different EVC divisions giving stimulating and thought provoking talks about Mesoamerican ancient astronomy. The evening then proceeded outside, where the visitors were met with a Mariachi band (c/o Jorge Vallin, and EVC faculty member) and a food truck with Mexican dishes. The evening was attended by EVC President Tammeil Gilkerson.
2. James Webb Space Telescope: First Image Release in partnership with the SETI Institute (7/15/22). The evening included visually stimulating talks by Dr. Natalie Batalha and Dr. Natasha Batalha--who gave attendees the exciting news of being able to detect the gases found on the surface of an exoplanet (this news was made public in August 2022).

We plan on scheduling lectures every other month beginning in 2023 and re-create our previous program.

By engaging our community of residents in STEM activities on our campus, the Montgomery Hill Observatory fulfills the college mission of "creating a learning environment where everyone feels welcomed and supported."

- **4. If you received resource allocation for your last program review cycle, please indicate the resources you received and how these resources were utilized to impact student success and / or importance to your program. (The resources can be personnel or fiscal)**

Given that we have not received any of the resources requested in our last program review, we will take the space here to list what we would like to have accepted to propel our existing astronomy program.

Based on existing SLO assessments, course loads, and out-of-classroom activities we consider key for the success of our Astronomy program, we have requested and not received the following:

1. A full-time faculty – This request has been repeated in the last two Faculty Hiring Prioritization, so far, without success. We carry a 35% load for the entire physics, astronomy, and natural sciences programs, with two full-time and 6 or more associate faculty overseeing existing courses. Physics prepares STEM majors to achieve success, and Astronomy provides non-STEM students with, perhaps, the only opportunity they will have to learn how science works. Our reach has been limited given the historically high presence of associate faculty leading our sections: 65% now; and 66% in our last program review (2017). Although we recognize the immense contribution and commitment of our adjuncts, they are naturally absent in day-by-day decision-making and planning for growth. Indeed, they cannot volunteer in the various out-of-

classroom activities we have invested in the past five years to increase retention and student success. The need for hiring another FT was identified in the last Program Review (PR 2017) and reiterated in 2022, particularly concerning the urgent need to increase student enrollment - especially in STEM, where 70% of this country's wealth originates. To increase student enrollment in STEM, we have invested in a suite of out-of-classroom programs designed to provide students with skills to help them to compete in a highly technological environment. In addition, we have re-designed and re-launched two courses in Astronomy to attract high school students. For more than five years, our faculty and staff have volunteered their time to provide STEM "excitations" to K12 students in low-income areas serving EVC. We still run a project we named EVC Citizen Science Initiatives (EVC-CSI), currently working with 36 children of different ages. In coordination with the EVC Adult Education Program, we submitted four courses for parents and their children in Astronomy and Physics, targeting the K-2 and 3-5 age groups and their parents. A new full-timer would be sought among those willing to make this program effective and long-lived, having in mind to increase student enrollment in the far future.

Another full-timer would strengthen our astronomy program, including more physics in astronomy, making astrophysics a more robust and diverse program at EVC. The subscribers to our astronomy webpage have passed the 1500 headcount and can be summoned to our campus anytime to attend events or enrichment activities.

2. A Full-Time Lab Technician – To our knowledge, Evergreen Valley College is among the few community colleges owning an observatory – most community colleges would not dream of such an investment. However, it has not yet taken steps to recognize the need for an Instructional Lab technician to manage it.

The hiring of a full-time lab technician has been included in the 2010-2011 and 2017-2018 Physics & Astronomy program reviews. Today, we count on a permanent 0.5 FTE lab technician load allocated to these departments, one with a multimillion-dollar facility to attend - our observatory. To supply the needs of our observatory, we received a grant from XXXX to support a full-time Instructional Lab Technician, subject yearly to a renewal process.

3. Upgrade of Equipment at the Montgomery Hill Observatory – Although of impressive public interest, the equipment at the observatory is inadequate for data collection, which is an integral part of the scientific method. In the 2017 Program Review, we identified the following instruments needed for bringing the observatory a step closer to being a facility worth of supporting STEM students:
 - a. CCD Camera – SBIG STXL – 16200 at \$13,541.00
 - b. 20" Telescope – ALLUNA RC20 Ritchey-Chretien Telescope at \$47,206.00
 - c. Mount PARALLAX HD300C GEM at \$25,000.00
 - d. Spectrograph – Shelyak ESHL at \$19,005.00

Given that we manage a multimillion dollars facility, a \$100,000.00 investment to modernize it and engage more students and the community seems to be a move in the right direction. We partnered with the Computer Science Department on an NSF grant proposal to bring a new Data Sciences Program to EVC. We included the spectrograph as a needed instrument for student success.

- **5. Please describe where you would like your program to be three years from now (program goals) and how these support the college mission, strategic initiatives and student success.**

At the closing of the year 2025, we envision the astronomy department acting on the following fronts:

1. **Maintain and improve the quality of the existing asynchronous online ASTRO 010.** A key aspect of asynchronous online courses is ensuring students receive proper one-on-one support from instructors, similar to in-person classes. After completing certification with EDIT 022, the quality has improved tremendously, but we still see areas to explore, such as in discussions. In STEM courses, we do not necessarily "discuss" a law but "apply" and "predict" situations. In a descriptive non-science major course such as ASTRO 010, we have strived to elevate the discussions to a general level beyond the usual "Hi JS; I really enjoyed your post...you really made me understand dark matters now.." in other words, sentences without substance. We have improved by providing one-on-one responses to students' posts and regularly sharing comments with the rest of the class. In three years, we would like our asynchronous online students to be looking forward to interacting with their peers and sharing their expectations and awe about the universe with their classmates.
2. **More graduations in General Studies with Emphasis in Astronomy** – As we relaunch this program in 2023, we would like to graduate at least 10 STEM students and observe a positive trend in the future. For that, we will initiate intense recruitment during our public viewings, on feeding high schools, and in in-person classes of our STEM majors. More graduations will directly impact the strategic initiative of increasing the number of students earning a degree.
3. **Success in newly updated courses** - As we relaunch ASTRO 014 and ASTRO 016 in 2023, we would like to use these courses as bait for students interested in space sciences careers. Students taking this course might be incentivized to complete the PHYS 07- series, with a petition away from graduating in General Studies with an Emphasis on Astronomy Degree. Updating these two courses will directly impact EVC's strategic initiative of improving student success by expanding the development of educational and career pathways.
4. **A spectrograph** - We will once more submit a grand proposal to purchase a spectrograph for the observatory. Maybe a grant award or college support will supply us with the long-waiting request for an instrument essential to an observatory such as the Montgomery Hill Observatory. If so, in three years, we hope to see students and alumni engaged in data-taking and funneling incoming students toward STEM-oriented careers. This instrument will also impact the strategic initiative of expanding career pathways.
5. **The EVC-CSI is recognized as an official program** – The EVC – Citizen Science Initiatives is like a Medusa with several heads (but a good one). The two most prominent are the K12 project and the undergraduate research project. Others are in a somewhat dormant stage, like the "Stonehenge at EVC" project attempting to build a replica of Stonehenge at EVC using the moon and sun local coordinates instead of those in England. We have partnered with the SJECCD Foundation over the last few years, promoting fundraising for supplies. We are in conversation to take this partnership to a higher level, establishing direct intervention of our college in middle and elementary schools in underserved areas that will eventually feed students to our college. The EVC-CSI project will tremendously impact the strategic initiative of increasing the community use of EVC grounds and increasing mutually beneficial activities in the San Jose surrounding our campus.
6. **All courses actively submit preliminary evaluation through the "Early Alert System"** - As noted elsewhere, Latinx. constitutes one of the top enrolled groups in Astronomy and yet the one with the lowest success. Some of our sections have used the system, but we will intensify its use, sending constant reminders to our associate faculty. This system has been publicized in our Division meetings, but not all associate faculty participate in these meetings. If achieved,

this action will positively impact EVC's strategic initiative of supporting student success through early interventions.

These broad goals will contribute to student retention and success, especially the EVC-CSI variant of establishing a pipeline between underserved middle schools and the college, which will improve the learning and preparation of future college students and tackle existing inequities in education and wealth.

Program Set Standards (Summary Tab)

Overall, EVC's Institution Set Standard for success rate is 72%, and the aspirational goal for student success is 75%.

Success Rate (completion with "C" or better)	Program	EVC	Program Set Standard (established during last comprehensive PR)	Program Success Goal (new)
F'15-F'21 average		72.00%		

Program Success Rate 66.42%

Program Set Standard: It is recommended that programs identify a success standard. This standard should reflect the baseline success rate.

Program Set Standard 60.00%

Recommendation: 90% of the 6 year average success rate could be your program standard (average x 0.9).

Program Success Goal: It is recommended that programs identify a success goal. This goal should reflect the success rate to which your program aspires.

Program Success Goal 70.00%

- Is your program success rate higher or lower than the campus?

The success rate of the Astronomy program is significantly lower than that of the campus.

- If your success rate is higher than the campus, how are you helping students succeed in and outside the classroom? If your program success rate is lower, what are some strategies your program is implementing to improve?

ASTRO 010 is a science course for non-science majors. We belong to a listserver congregating instructors from two-and four-year-institutions of higher education, and one of the recurrent debates is the low success rate of students on a descriptive course such as ASTRO 010. One of their studies indicates a correlation between students who struggle with Math in high school with those failing or struggling in descriptive astronomy courses when in college. Although our course is set to be Math free, symbols, graphics, and table notation have become a deterrent to learning and success. In addition, some astronomy topics clash with belief systems, such as the origins of the universe from a singularity named "Big Bang", Astrology as a pseudo-science, the formation of the sun and the moon, and others. These are three broad investments we have made to improve student success:

1 - **Observatory** - Set up efforts to modernize the Montgomery Hill Observatory and provide it with instruments and staffing that will spark students' interest in science and in the scientific method in general. These include requesting resources from the college budget committee and college council, applying for grants, looking for donations, submitting proposals to the "Faculty Hire Prioritization" and "Classified Hire Prioritization", and others.

2 - **Middle School & College Connection** - Maintain for over four years a pipeline connecting low-income students in middle school with EVC students and volunteers on the EVC-CSI project. We understand this leg resembles more of a "Don Quixote" adventure rather than a normal institutional movement, but we expect this project to become strong enough to receive support from the SJECCD and mimic the success story of the Cabrillo Advancement Program managed by Cabrillo College and its Foundation. Our goal is to raise this project to the institutional sphere and serve 400 low-income children who might join EVC in five or more years with stronger Math skills and not perceive science as a distant subject.

3 - **Improve One-On-One Conversations with Online Students** - Our Asynchronous online course has shown a slightly lower student success than the in-person section counterpart. We have made changes to improve direct responses to students' ideas, giving almost daily personal feedback on their work. In addition, we have incorporated more visuals into the course and made use of EVC's early alert system.

- **Is the current program success rate higher than the program set standard?**

Yes

- **How close is the program to meeting the program success goal?**

The program is about 5.00% off from the goal.

- **Are these measures (program set standard and program success goal) still current/accurate? If not, please describe here and reset the standards.**

The measures are current and accurate.

Success Rates: Measures by IPEDs Race/Ethnicity

- **American Indian: 102 - 78.380%**
Program Average Total Enrolled
 1.450
Program Success Rate
 60.610
- **Asian: 9380 - 79.320%**
Program Average Total Enrolled
 100.460
Program Success Rate
 74.690

- **Black or African American: 464 - 61.430%**

Program Average Total Enrolled

9.380

Program Success Rate

53.550

- **Hawaiian/Pacific Islander: 95 - 65.790%**

Program Average Total Enrolled

2.450

Program Success Rate

46.210

- **Latinx: 9005 - 64.730%**

Program Average Total Enrolled

157.760

Program Success Rate

60.420

- **Two or More Races: 614 - 70.030%**

Program Average Total Enrolled

11.000

Program Success Rate

67.940

- **Unknown: 1655 - 72.640%**

Program Average Total Enrolled

21.540

Program Success Rate

62.920

- **White: 1256 - 73.480%**

Program Average Total Enrolled

24.000

Program Success Rate

75.520

Success Rates: Measures by Gender

- **Female: 12340 - 73.970%**

Program Average Total Enrolled

154.150

Program Success Rate

65.280

- **Male: 10154 - 69.610%**

Program Average Total Enrolled

172.150

Program Success Rate

67.450

- **No Value Entered: 77 - 72.590%**

Program Average Total Enrolled

1.500

Program Success Rate

86.670

Success Rates: Measures by Age

- **17 & Below: 736 - 86.260%**

Program Average Total Enrolled

16.230

Program Success Rate

82.470

- **18-24: 15285 - 69.350%**

Program Average Total Enrolled

253.460

Program Success Rate

64.140

- **25-39: 4470 - 75.390%**

Program Average Total Enrolled

48.380

Program Success Rate

71.700

- **40 & Over: 2065 - 78.860%**

Program Average Total Enrolled

9.310

Program Success Rate

77.330

- **Unknown: 16 - 71.080%**

Program Average Total Enrolled

1.000

Program Success Rate

100.000

- **a. With respect to disaggregated success rates, list any equity gaps that are identified and discuss interventions your program will implement to address these equity gaps? Please include a timeline of implementation and reassessment.**

1 - The success rate of recent high school graduates is lower than the college and program average, although the trend is observed in other disciplines where the college average also falls. Curiously, these same students list Astronomy as a major, perhaps because the Astronomy program appears as one of the first in the list of options. As emphasized elsewhere, the number of students actually petitioning to graduate from the AA program is currently negligible.

2 - Although without statistical significance due to enrollment of less than 10 (this number is arbitrary), American Indians, Blacks, and Pacific Islanders show major gaps when compared with the college average, while the other groups show an average success rate slightly below college data.

These are the interventions planned:

1 - Intensify the current use of the early alert system, especially directing associate faculty to submit alerts on time. Implement spring 2023 and re-evaluate in spring 2024.

2 - Direct associate faculty to send information about tutoring through Canvas. These are communicated to all faculty by the college tutoring center at the beginning of a semester. Implement spring 2023 and re-evaluate in spring 2024.

3 - Persist in making the EVC-CSI project an institutional program that can benefit the education of low-income students who will be EVC students in the years to come. This project began in 2015.

4 - Promote multi-cultural panel discussions and talks highlighting the cultural achievements of ethnic groups in the past, and how current astronomy relates to their findings. Implement a schedule of talks on a bi-monthly basis beginning in spring 2023, and announce it through our Meetup account.

- **b. With respect to disaggregated success rates (ethnicity / race, gender and age), discuss student performance in reaching your program set standard for student success as well as reaching the program success goal.**

Of the significant group enrolling in our courses, Asian Americans are reaching our Program Goals while Latinx are at the Program Set Standard (60.0%) but 10% below our Program Set Goals (70%). We have set in place:

1 - Intensifying early alert efforts,

2 - Promote more of the Multicultural Nights, exploring their strong astronomy traditions.

3 - Attempting to make the EVC-CSI an institutional program capable of bringing science to middle schoolers attending underserved schools.

- **c. If your program offers course sections fully online, please contact the office of Research, Planning and Institutional Effectiveness to obtain a student success report on the online sections. Address any differences in student success rates between fully online courses and classroom courses.**

This analysis considers the two major student groups enrolling in in-person astronomy courses. About 80 Asian Americans scored a 75% success rate, while 130 Latinx scored 61%. Data from asynchronous online courses indicate 20 Asian Americans enrolling with approximately the same

student success (76%), while 27 Latinx perform at a low 58%. We suspect, as commented previously, students struggling in Math during K12 develop the wrong perception of science and Math as a subject and an out-of-reach career. In addition, basic K-5 math and science in underserved schools

We have been working on the EVC-CSI project to increase our presence in low-income areas that will feed future students to EVC. If so, we can provide more direct interventions to K-5 students through a partnership with Service Learning and college students receiving Service Learning credits and their teachers by organizing training workshops during the summer. The low-income area we are targeting is primarily populated by Latinx families.

Program Awards - If Applicable

If the classes in your program lead to a degree or certificate, please visit the DataMart and indicate how many degrees/certificates were awarded in your program:

http://datamart.cccco.edu/Outcomes/Program_Awards.aspx

(http://datamart.cccco.edu/Outcomes/Program_Awards.aspx)

You will need to select drop down menus and then “select program type by major of study” (for example, select Legal for paralegal studies).

Then at the bottom of the report, select the box “program type- four digits TOP”, then update report to get program specific information.

Degree Type

- **AA**

Number of Awards (Examine 2017-18, 2018-19 data, 2019-20 data and 2020-21 data)

1

Discussion

The AA - Astronomy degree was conceived as an opportunity for non-science majors to expand their horizons in science, particularly in Astronomy, by taking a few extra physics courses (Algebra-Based). It did not fly, and the negligible graduation rate tells the whole story. We decided to redesign the program by targeting a student population already in STEM, especially talented high school students already taking Calculus-Based physics courses. The new program includes the PHYS -07A series as part of the core courses and redesigned ASTRO 014 and ASTRO 016 courses that extensively use the observatory or observing techniques. Courses and program have been approved and will be relacuhed in spring 2023.

Student Enrollment Types

Student Enrollment Type: Day or Evening Student

- **Day: 4639 - 50.900%**

Program Average Headcount

160.000

Program Percentage of Total

55.300

- **Day & Evening: 2929 - 32.100%**

Program Average Headcount

96.000

Program Percentage of Total

33.100

- **Evening: 1022 - 11.200%**

Program Average Headcount

21.000

Program Percentage of Total

7.400

- **Unknown: 530 - 5.800%**

Program Average Headcount

12.000

Program Percentage of Total

4.300

Student Enrollment Type: Academic Load

- **Full Time: 2259 - 24.800%**

Program Average Headcount

100.000

Program Percentage of Total

34.700

- **Half Time or less than half time: 6084 - 66.700%**

Program Average Headcount

173.000

Program Percentage of Total

59.900

- **a. Discuss any changes in program enrollment types (day vs evening, full-time vs part-time) since your last program review?**

In this program review, Astronomy is separated from Physics and Natural Sciences, and conclusions and action items discussed in the previous two program reviews had overtones from the physics department, rendering impossible direct comparisons with this program review unless we request data. We did experience a 30% decline in student enrollment after the pandemic hit, consistent with what is observed in other areas or community colleges. This decrease in enrollment has impacted our evening ASTRO 010 lectures, which are no longer offered. Instead, the asynchronous online section has received students at full capacity, leading us to open a second online section in the fall of 2022. Likewise, the day-laboratory sections have been filled more efficiently than in the evening.

- **b. Discuss how do your program enrollments (Pct of total) compare to EVC?**

As emphasized in a previous program review, the percentages of students distributed over the day/evening sections match the college figures well, indicating that our student's profile matches that of an average EVC student, or, non STEM students.

- **c. Based on the data, would you recommend any changes?**

We initiated changes in the program by opening it up more extensively to STEM majors. Two major developments are underway:

1 - Re-launch of the AA program in spring 2023 by offering the ASTRO 014 course, followed by the ASTRO 16 course in fall 2023. It has been advertised among science majors, especially among talented high school students. We expect to increase the participation of students in the evening section since these two sections are of a hybrid modality, with an in-person component done at the Montgomery Hill Observatory, weather permitting, for data taken and imaging.

2 - Continue with efforts to promote astronomy to the community of San Jose, which in turn will bring more of its youngsters to our classrooms.

Student Demographics - Headcount

Student Demographic: Gender

- **Female: 5008 - 54.950%**
Program Headcount
137.000
Program Percentage of Total
47.330
- **Male: 4075 - 44.640%**
Program Headcount
151.000
Program Percentage of Total
52.290
- **No Value Entered: 37 - 0.410%**
Program Headcount
1.000
Program Percentage of Total
0.490

Student Demographic: Age

- **17 & Below: 486 - 5.310%**
Program Headcount
14.000
Program Percentage of Total

4.640

- **18-24: 5493 - 60.210%**

Program Headcount

225.000

Program Percentage of Total

77.850

- **25-39: 2168 - 23.800%**

Program Headcount

43.000

Program Percentage of Total

14.700

- **40 & Over: 966 - 10.600%**

Program Headcount

8.000

Program Percentage of Total

2.790

- **Unknown: 8 - 0.090%**

Program Headcount

1.000

Program Percentage of Total

0.320

Student Demographic: Race/Ethnicity (IPEDs Classification)

- **American Indian: 40 - 0.430%**

Program Headcount

1.000

Program Percentage of Total

0.450

- **Asian: 3689 - 40.480%**

Program Headcount

88.000

Program Percentage of Total

30.570

- **Black or African American: 208 - 2.290%**

Program Headcount

8.000

Program Percentage of Total

2.900

- **Hawaiian/Pacific Islander: 36 - 0.400%**

Program Headcount

2.000

Program Percentage of Total

0.720

- **Latinx: 3636 - 39.850%**

Program Headcount

140.000

Program Percentage of Total

48.490

- **Two or More Races: 248 - 2.730%**

Program Headcount

10.000

Program Percentage of Total

3.360

- **Unknown: 690 - 7.520%**

Program Headcount

19.000

Program Percentage of Total

6.360

- **White: 573 - 6.300%**

Program Headcount

21.000

Program Percentage of Total

7.330

- **a. Based on the program total headcount and percent change year to year, discuss if your program growing or declining. If so, what do you attribute these changes in enrollment to and what changes will the program implement to address them?**

The Astronomy program showed a slight increase in enrollment over the years until the pandemic hit society and student learning. It has not yet returned to its original mark. Consequently, and in response to students' interest, we opened a second asynchronous online section this fall, currently at full capacity. The next program review will provide a better understanding of where we are and where to go.

- **b. Discuss any gaps have you identified in your program. Discuss how your program enrollment is similar or different from the campus. Discuss which gender, age, and/or ethnic group are proportionally smaller than campus make up.**

The two broad ethnic groups attending the Astronomy program are Asians and Latinx, which reflect current college demographics. It is worth noting that about 10% **fewer** Asians attending EVC do not set foot in this program, but around 10% **more** Latinx do take our GE courses. These differences will

be explained more in details in the Physics Program Review where trends are reversed: more Asians seek STEM pathways than Latinx.

- **c. Discuss what interventions the program can implement to address any gaps in enrollment.**

The data suggest that decreasing enrollment is consistent with the trend observed in this and other colleges, and it is beyond our reach to reverse it. Even the intensive recruitment underway in high schools for talented students to enroll in ASTRO 014 and ASTRO 016 will, more likely, bring Asians to Astronomy, not necessarily more Latinx.

Institutional Effectiveness (6.5 year average, see Summary Tab)

EVC Capacity: 61.70% EVC Productivity: 14.43

Program Capacity

75.78%

Program Productivity

21.21

Is your capacity rate higher or lower then the campus?

higher

Is your productivity goal higher or lower than the campus?

higher

If the program capacity and/or productivity is lower than the campus, please provide rationale:

Curriculum

Related Assessments

ASTRO 010 - Introduction to Astronomy Spr 2021- Created: 10/14/2021 New Section Level SLO Assessment Report Originator: Celso Batalha (/Form/Module/Index/1552)

ASTRO 10 - SPR 22- Created: 02/27/2022 New Section Level SLO Assessment Report Originator: Celso Batalha (/Form/Module/Index/2293)

ASTRO 010 - SPR 22- Created: 02/27/2022 New Section Level SLO Assessment Report Originator: Celso Batalha (/Form/Module/Index/2294)

ASTRO 010 - Introduction to Astronomy Spr 2021- Created: 10/19/2021 New Section Level SLO Assessment Report Originator: Celso Batalha (/Form/Module/Index/1646)

Astro 10- Created: 12/31/2021 New Section Level SLO Assessment Report Originator: Michael Masuda (/Form/Module/Index/2073)

Astro 10- Created: 06/06/2022 New Section Level SLO Assessment Report Originator: Michael Masuda (/Form/Module/Index/2609)

Astro 10 (online)- Created: 06/06/2022 New Section Level SLO Assessment Report Originator: Michael Masuda (/Form/Module/Index/2610)

ASTRO 10L - SPR 22- Created: 06/09/2022 New Section Level SLO Assessment Report Originator: Celso Batalha (/Form/Module/Index/2622)

Astro 10L- Created: 12/31/2021 New Section Level SLO Assessment Report Originator: Michael Masuda (/Form/Module/Index/2075)

PHYS 4B- Created: 10/18/2021 New Section Level SLO Assessment Report Originator: Celso Batalha (/Form/Module/Index/1621)

PHYS 004B SPR 22- Created: 02/27/2022 New Section Level SLO Assessment Report Originator: Celso Batalha (/Form/Module/Index/2295)

PHYS 4B- Created: 10/16/2021 New Section Level SLO Assessment Report Originator: Celso Batalha (/Form/Module/Index/1604)

Phys 4B- Created: 01/02/2022 New Section Level SLO Assessment Report Originator: Michael Masuda (/Form/Module/Index/2079)

PHYS 4C - SPR 22- Created: 06/09/2022 New Section Level SLO Assessment Report Originator: Celso Batalha (/Form/Module/Index/2627)

PHYS 004C- Created: 10/19/2021 New Section Level SLO Assessment Report Originator: Celso Batalha (/Form/Module/Index/1654)

Courses in the program

ASTRO 010 - Introduction to Astronomy - Active. Implemented on Jan 6 2021 12:00AM (/Form/Course/index/3858)

ASTRO 010L - Introductory Astronomy Lab - Active. Implemented on Feb 24 2022 12:00AM (/Form/Course/index/3859)

PHYS 004B - General Physics - Active. Implemented on Jan 21 2021 12:00AM (/Form/Course/index/4312)

PHYS 004C - General Physics - Active. Implemented on Jan 21 2021 12:00AM (/Form/Course/index/4314)

- 1. **Identify and updates to curriculum since the last comprehensive program review, including and new programs and indicate the 6-year timeline for scheduled course outline revision. For CTE, the time line is 2 year.**

The last Program Review was in 2017, when this program was submitted along with Physics and Earth Sciences programs. There were significant changes to the AA program and courses. In response to the lack of interest in the AA - Astronomy program, we redesigned it along with some of its core courses. The SLOs have been updated in 2021 and assessed.

1 - **AA in Astronomy** - It was designed to provide a deeper understanding of Astronomy and astronomical processes for non-science majors, so ASTRO 010 and ASTRO 10L were considered the starting point for student recruitment. Given the low interest in the program, we redesigned it by recruiting students from the PHYS 07 series, which are STEM majors. In the historical version, STEM students, if interested, would have to take ASTRO 010, ASTRO 10L, ASTRO 014, and ASTRO 016 courses in addition to the physics series. In the new version, students must take only two other courses: ASTRO 014 and ASTRO 016, in addition to the PHYS 07-series.

2 - **ASTRO 014 and ASTRO 016** - These courses became hybrid with asynchronous online lectures and in-person labs at the Montgomery Hill Observatory. They were approved, and their transferability was confirmed. They are planned to be offered in 2023.

Our main course, ASTRO 010, continues to be the favorite among non-science majors.

3 - **ASTRO 010** - We opened a second section of the Asynchronous modality to attend to students' interests. We also incorporated software for student engagement and interaction during in-person sections and will try to encourage more associate faculty to use it.

4 - **ASTRO 20A and ASTRO 20B** - These are courses in an Independent Studies format designed to provide students with research skills in Astrophysics. They extensively use spectroscopy and photometry to gain knowledge about stellar properties & evolution and galaxy structure & dynamics. It

has gone through a few iterations in CurriQunet given its characteristics and format of one-on-one contact with the instructor. It is recommended not to add more than 5 students per term per instructor, and the Dean must approve research project. It is expected to be out in 2023.

- **2. Identify all the courses offered in the program and describe how these courses remain relevant in the discipline. For courses your program has not offered in the past two years, please discuss a plan on how to deal with these courses (if your program is not going to deactivate these courses, please explain why).**

ASTRO 010 - This descriptive astronomy course is one of the most sought science courses in 2 and 4-year institutions of higher learning. It is considered one of the few opportunities for students to get formal instruction on the scientific method and how it applies to producing new knowledge. Expanding it through more online sections will provide students with flexible schedules, especially for parenting.

ASTRO 10L - This laboratory course is offered to stand alone and independent from the ASTRO 010 lecture course, which is a pre-requisite course. It is challenging to find associate faculty who can help teach this course since it requires some fieldwork experience in Astronomy, which most associate faculty do not have. Yet, we manage to host three sections, one in the evening. Together with ASTRO 010, they provide our students with a 4-unit credit science course with a lab fulfilling their GE requirements.

ASTRO 014 and ASTRO 016 - These two courses are being re-launched on a hybrid modality where the 2-hour lectures are set in asynchronous mode, with a mandatory lab in-person option at the observatory in the evening. These two courses split the ASTRO 010 course content - that is broad - into two segments: the Solar System and Stars & Galaxies.

ASTRO 501 & ASTRO 502 - The courses Reaching for the Stars I & II, ASTRO 501 and ASTRO 502, respectively, are the result of a partnership with the EVC adult education to help potential 1st generation college students who are parents to set foot in college education and be familiar with STEM. It gathers parents or guardians and their K - 2 children (ASTRO 501 I) or their 3 - 5 grade level children in an 8-week fun workshop at the observatory. These courses have passed the CurriQunet pipeline and are waiting for state approval.

- **3. If you have a degree or certificate, please include a diagram of your program's guided pathways program map. (A program map indicates courses suggested for each semester, across two years, upon completion a student would qualify for a degree/certificate).**

AA Astronomy - The General Studies with Emphasis in Astronomy has been updated to attend to a population of STEM students looking for additional skills that might help them to compete in the STEM field. More particularly, learning how spectroscopy works and how data can be analyzed to produce knowledge. This new phase of the AA - degree in Astronomy will initiate in 2023. These are the recommended courses on our college map per term, not including the specifics of the students' choice GE courses:

AA - Astronomy

Term 1	Units	A.A. GE.	Notes
ENGL 001A	3	A2	
MATH 066 or MATH 071	4-5	B4	
GE	3	E	
GE	3	C1	
Physical Activity	1		
Total Units	14-15		
Term 2	Units	A.A. GE	Notes
PHYS 07A	4	B1/B3	
PATH 066 or MATH 072	4-5	B4	
GE	3	B1	
GE	3	B2	
Total Units	14-15		
Term 3	Units	A.A. GE	
PHYS 07B	4		
ASTRO 014	3		
GE	3	A3	
GE	3	D	US-1, US-2, US-3
GE	3	C2	
Total Units	16		
Term 4	Units	A.A. GE	
PHYS 07C	4		
ASTRO 016	3		
GE	3	D	US-1, US-2, US-3
GE	3	F	
GE	3	C1 or C2	
Total Units	16		

CAS - The Certificate of Achievement in STEM (CAS) has been approved, and students can start receiving such a certificate. It consists of a few core courses designed to bring high school students closer to a STEM career, with ASTRO 10 suggested as the initial course. The course map below represents one possible pathway, but student is free is to make their own choice.

Term 1	Units		NOTES
ASTRO 010	3		
Total Units	3		

Term 2	Units		NOTES
COMSC 020	3		
Total Units	3		

Term 3	Units		NOTES
ENGR 001	3		
ASTRO 014	3		Or other approved elective
Total Units	6		

Term 4	Units		NOTES
MATH 025	6		Or MATH 021 and MATH 022 or MATH 071
Total Units	6		

- **4. Identify and describe innovative strategies or pedagogy your department/program developed/offered to maximize student learning and success. How did they impact student learning and success?**

The Astronomy department has strived to implement strategies to attend to a broad range of learners. In particular:

1. **Field Trips to the observatory** - It has promoted field trips to the Montgomery Hill Observatory for students not taking one of the astronomy lab sections. Unfortunately, the observatory is not equipped with a spectrometer to demonstrate how astronomers can describe, with authority, the processes at play in regions of the universe humanity has not set foot in yet. Nor have they collected and brought a sample to a laboratory for further analysis, as in other formal sciences. In addition, astronomical objects are so remote they might not even exist anymore.
2. **Engagement in online instruction** - Pedagogies suggested for asynchronous online courses, such as essays and discussions, are ineffective for most STEM fields, particularly mathematics. We have attempted several strategies to increase student engagement in the ASTRO 010 asynchronous online course, with the latest informally termed "today's highlights." Instructors select key one-on-one responses given to students' posts daily or every other day, paste them into a summary, and share them with students through "Announcements." Students have emailed instructors with brief comments, demonstrating engagement and motivation to follow up.
3. **Certification in EDIT 022** - One instructor has completed accreditation in EDIT 022, and the department now offers two asynchronous online sections simultaneously. We state that teaching two sections of an asynchronous online astronomy course, each with 50 + learners, is a daunting task if done on the terms recommended by the DE committee. Each of the two sections is now led by a different instructor.
4. **Technology in the classroom** - Some instructors have introduced "Interactive Classroom" software to enhance student performance and success. Not all the in-person sections use it, but we have encouraged all our instructors to adopt it. In particular, we purchased a subscription to the "ClassPoint.io" software.

- **5. Discuss plans for future curricular development and/or program degrees & certificates included) modification.**

In the next two years, we will primarily offer the following courses to STEM students: ASTRO 014, ASTRO 016, ASTRO 20A, and ASTRO 20B. Two other courses we have briefly mentioned in the Program Review 2017 are Astrobiology (Life in the Universe) and Astroimaging (Astro pics).

ASTRO 018 - The recent launch of the James Webb Space Telescope has re-ignited the search for extraterrestrial life, and a GE course about life in the universe is overdue. Several community colleges, such as West Valley, have offered this course as a GE option, introducing students to this exciting frontline of possibilities and fascination. ASTRO 018 will compete with ASTRO 010 for GE students. We are looking for the best available books and ancillaries and plan to draft this course in 2023.

ASTRO 022 - We are currently developing a program on Astro-imaging using a recently donated top-of-line small telescope donated to the Montgomery Hill Observatory. We plan on acquiring more experience in Astro-imaging and developing the course outline for ASTRO 022, a non-credit course to meet the interest of visitors and our students on astronomical imaging.

- **6. Describe how your program is articulated with High School Districts, and/or other four year institutions. (Include articulation agreements, CID, ADTs...)**

1. **Transfer and Articulation** - Astro 010, ASTRO 010L, ASTRO 014, and ASTRO 016 are fully articulated with the UC and CSU systems.
2. **High School Connections** - The Astronomy department has worked closely with counselors from Accel Middle College and College Connection Academy to raise awareness of our ASTRO 010 course. It has partnered with the Dual Enrollment coordination on several initiatives to facilitate student access to the ASTRO 010 course, making it an important gateway from high school to college.
3. **Middle School Connections** - The Astronomy department has invested several years in the building and championing the EVC-CSI (Citizen Science Initiatives) project to connect middle school students to the college environment. It has given scholarships (\$500 / year) to participant students, 36 as in the academic year 2021-2022, and is seeking college or district support to become institutionalized. It has submitted NSF grants intending to gather funds for hiring a permanent manager and counselors (NSF-INCLUDES and NSF- INCLUDES Planning Grant). In the 2021-2022 academic year, we implemented major changes using the scholarship funds to purchase equipment for the participant children: Arduino kits, LEGO robots, and Google Python computers, providing these children with the advanced technology they don't have in their schools. So, instead of giving out \$500 scholarships to each student, we invested in equipment. The results were disappointing as we saw students not committing to attending the weekly planned instructions. According to a few parents, their children were too busy with homework and not interested in another zoom gathering. We kept the momentum with a smaller group and are planning on re-igniting this branch of the EVC-CSI project in February 2023, this time with the help of a few school teachers who vouch to support this project until it becomes part of an official EVC or district program. ... and, the scholarships are

back! We learn that the monetary incentive of an award or scholarship is an important factor contributing to student retention, and we are bringing it back in 2023.

4. **University Connections** - The Astronomy department has partnered with professors from several universities to help create a pipeline from community colleges to 4-year institutions supporting undergraduate research. To that end, we submitted two NSF - S STEM grant proposals (2020 and 2022), partnering with SJSU, SAC, UCSC, Cal-Bridge consortium (CSU and UC), Stanford, and NASA. Unfortunately, we did not get the award, but we intend to carry on the ideas suggested in the S STEM submission beginning in the fall of 2023, and they are:
 - Promote undergraduate research on courses such as ASTRO 020A and 020B
 - Initiate online talks on the "Virtual Cafe Lounge," an every-other-month online talk given by university professors and their students, scientists from NASA and SETI Institute, and others.
 - Promote more internships and scholarships among our STEM students. In particular, SETI Institute will fund two EVC interns beginning in 2023.
 - Expand the robotic program and make it independent from the CaSGC funds. For example, we could not launch the cohort this year due to their lack of funding.
 - Create an EVC-STEM webpage loading all information regarding job and research opportunities.
5. **Research Institutes** - The department has established partnerships with NASA, SETI Institute, and California Space Grant Consortium (CaSGC) where these centers are either offering paid internships to selected low-income EVC students who are interested in advancing a career in space sciences (NASA and SETI) or in robotic (CaSGC).

Items 2 - 5 are an attempt to build a pipeline connecting low-income middle schools with universities, filling the gap in higher education commonly found in the household of a future 1st generation college student. It is a vision cherished by the department since it got involved with the Cal-Bridge program, which attempts to bring 1st generation college students to a Ph.D in STEM areas.

- **7. If external accreditation or certification is required, please state the certifying agency and status of the program.**

NA

Student Learning Outcome and Assessment

Related Assessments

ASTRO 010 - Introduction to Astronomy Spr 2021- Created: 10/14/2021 New Section Level SLO Assessment Report Originator: Celso Batalha (/Form/Module/Index/1552)

ASTRO 10 - SPR 22- Created: 02/27/2022 New Section Level SLO Assessment Report Originator: Celso Batalha (/Form/Module/Index/2293)

ASTRO 010 - SPR 22- Created: 02/27/2022 New Section Level SLO Assessment Report Originator: Celso Batalha (/Form/Module/Index/2294)

ASTRO 010 - Introduction to Astronomy Spr 2021- Created: 10/19/2021 New Section Level SLO Assessment Report Originator: Celso Batalha (/Form/Module/Index/1646)

Astro 10- Created: 12/31/2021 New Section Level SLO Assessment Report Originator: Michael Masuda (/Form/Module/Index/2073)

Astro 10- Created: 06/06/2022 New Section Level SLO Assessment Report Originator: Michael Masuda (/Form/Module/Index/2609)

Astro 10 (online)- Created: 06/06/2022 New Section Level SLO Assessment Report Originator: Michael Masuda (/Form/Module/Index/2610)

ASTRO 10L - SPR 22- Created: 06/09/2022 New Section Level SLO Assessment Report Originator: Celso Batalha (/Form/Module/Index/2622)

Astro 10L- Created: 12/31/2021 New Section Level SLO Assessment Report Originator: Michael Masuda (/Form/Module/Index/2075)

PHYS 4B- Created: 10/18/2021 New Section Level SLO Assessment Report Originator: Celso Batalha (/Form/Module/Index/1621)

PHYS 004B SPR 22- Created: 02/27/2022 New Section Level SLO Assessment Report Originator: Celso Batalha (/Form/Module/Index/2295)

PHYS 4B- Created: 10/16/2021 New Section Level SLO Assessment Report Originator: Celso Batalha (/Form/Module/Index/1604)

Phys 4B- Created: 01/02/2022 New Section Level SLO Assessment Report Originator: Michael Masuda (/Form/Module/Index/2079)

PHYS 4C - SPR 22- Created: 06/09/2022 New Section Level SLO Assessment Report Originator: Celso Batalha (/Form/Module/Index/2627)

PHYS 004C- Created: 10/19/2021 New Section Level SLO Assessment Report Originator: Celso Batalha (/Form/Module/Index/1654)

Student Learning Outcomes

ASTRO 010 - Introduction to Astronomy - Describe the fundamentals of spectroscopy and photometry, the basic techniques employed in retrieving physical properties of celestial objects. (Historical)

ASTRO 010 - Introduction to Astronomy - Describe the fundamentals of spectroscopy and photometry, the basic techniques employed in retrieving physical properties of celestial objects. (Active)

ASTRO 010 - Introduction to Astronomy - Describe the fundamentals of spectroscopy and photometry, the basic techniques employed in retrieving physical properties of celestial objects. (Active)

ASTRO 010 - Introduction to Astronomy - Describe the fundamentals of spectroscopy and photometry, the basic techniques employed in retrieving physical properties of celestial objects. (Active)

ASTRO 010 - Introduction to Astronomy - Describe the fundamentals of spectroscopy and photometry, the basic techniques employed in retrieving physical properties of celestial objects. (Active)

ASTRO 010 - Introduction to Astronomy - Explain the causes of astronomical cycles such as eclipses, seasons, phases of the moon, sunspots, stellar evolution, and others. (Active)

ASTRO 010 - Introduction to Astronomy - Explain the causes of astronomical cycles such as eclipses, seasons, phases of the moon, sunspots, stellar evolution, and others. (Active)

ASTRO 010 - Introduction to Astronomy - Explain the causes of astronomical cycles such as eclipses, seasons, phases of the moon, sunspots, stellar evolution, and others. (Active)

ASTRO 010 - Introduction to Astronomy - Explain the causes of astronomical cycles such as eclipses, seasons, phases of the moon, sunspots, stellar evolution, and others. (Active)

ASTRO 010 - Introduction to Astronomy - Explain the causes of astronomical cycles such as eclipses, seasons, phases of the moon, sunspots, stellar evolution, and others. (Historical)

ASTRO 010 - Introduction to Astronomy - Describe the physical processes underlying the properties of light such as reflection, refraction, diffraction, and scattering. (Historical)

ASTRO 010 - Introduction to Astronomy - Describe the physical processes underlying the properties of light such as reflection, refraction, diffraction, and scattering. (Active)

ASTRO 010 - Introduction to Astronomy - Describe the physical processes underlying the properties of light such as reflection, refraction, diffraction, and scattering. (Active)

ASTRO 010 - Introduction to Astronomy - Describe the physical processes underlying the properties of light such as reflection, refraction, diffraction, and scattering. (Active)

ASTRO 010 - Introduction to Astronomy - Describe the physical processes underlying the properties of light such as reflection, refraction, diffraction, and scattering. (Active)

ASTRO 010 - Introduction to Astronomy - Describe the main physical processes driving the evolution of low and high mass stars and their relation to the increasing metallicity in the universe. (Active)

ASTRO 010 - Introduction to Astronomy - Describe the main physical processes driving the evolution of low and high mass stars and their relation to the increasing metallicity in the universe. (Historical)

ASTRO 010 - Introduction to Astronomy - Describe the main physical processes driving the evolution of low and high mass stars and their relation to the increasing metallicity in the universe. (Active)

ASTRO 010 - Introduction to Astronomy - Describe the main physical processes driving the evolution of low and high mass stars and their relation to the increasing metallicity in the universe. (Active)

ASTRO 010 - Introduction to Astronomy - Describe the main physical processes driving the evolution of low and high mass stars and their relation to the increasing metallicity in the universe. (Active)

ASTRO 010 - Introduction to Astronomy - Describe the origin of the universe as suggested by the Big Bang theory, along with the supporting evidence collected by astronomers since the early 20th Century. (Active)

ASTRO 010 - Introduction to Astronomy - Describe the origin of the universe as suggested by the Big Bang theory, along with the supporting evidence collected by astronomers since the early 20th Century. (Active)

ASTRO 010 - Introduction to Astronomy - Describe the origin of the universe as suggested by the Big Bang theory, along with the supporting evidence collected by astronomers since the early 20th Century. (Historical)

ASTRO 010 - Introduction to Astronomy - Describe the origin of the universe as suggested by the Big Bang theory, along with the supporting evidence collected by astronomers since the early 20th Century. (Active)

ASTRO 010 - Introduction to Astronomy - Describe the origin of the universe as suggested by the Big Bang theory, along with the supporting evidence collected by astronomers since the early 20th Century. (Active)

PHYS 004B - General Physics - Solve real world problems involving electricity and magnetism. (Active)

PHYS 004B - General Physics - Solve real world problems involving electricity and magnetism. (Historical)

PHYS 004B - General Physics - Solve real world problems involving electricity and magnetism. (Rejected)

PHYS 004B - General Physics - Solve real world problems involving electricity and magnetism. (Active)

PHYS 004B - General Physics - Solve real world problems involving electricity and magnetism. (Active)

PHYS 004B - General Physics - Calculate electric fields and electric potentials produced by simple charge distributions. (Active)

PHYS 004B - General Physics - Calculate electric fields and electric potentials produced by simple charge distributions. (Active)

PHYS 004B - General Physics - Calculate electric fields and electric potentials produced by simple charge distributions. (Rejected)

PHYS 004B - General Physics - Calculate electric fields and electric potentials produced by simple charge distributions. (Historical)

PHYS 004B - General Physics - Calculate electric fields and electric potentials produced by simple charge distributions. (Active)

PHYS 004B - General Physics - Apply the principle of conservation of energy to determine the trajectory of a charge moving in an electric and magnetic fields. (Active)

PHYS 004B - General Physics - Apply the principle of conservation of energy to determine the trajectory of a charge moving in an electric and magnetic fields. (Historical)

PHYS 004B - General Physics - Apply the principle of conservation of energy to determine the trajectory of a charge moving in an electric and magnetic fields. (Rejected)

PHYS 004B - General Physics - Apply the principle of conservation of energy to determine the trajectory of a charge moving in an electric and magnetic fields. (Active)

PHYS 004B - General Physics - Apply the principle of conservation of energy to determine the trajectory of a charge moving in an electric and magnetic fields. (Active)

PHYS 004B - General Physics - Determine voltages, currents, and power dissipated in different components of an AC/DC circuit. (Active)

PHYS 004B - General Physics - Determine voltages, currents, and power dissipated in different components of an AC/DC circuit. (Active)

PHYS 004B - General Physics - Determine voltages, currents, and power dissipated in different components of an AC/DC circuit. (Rejected)

PHYS 004B - General Physics - Determine voltages, currents, and power dissipated in different components of an AC/DC circuit. (Historical)

PHYS 004B - General Physics - Determine voltages, currents, and power dissipated in different components of an AC/DC circuit. (Active)

PHYS 004B - General Physics - Calculate the induced voltage generated by simple distributions of varying currents and moving magnets. (Active)

PHYS 004B - General Physics - Calculate the induced voltage generated by simple distributions of varying currents and moving magnets. (Historical)

PHYS 004B - General Physics - Calculate the induced voltage generated by simple distributions of varying currents and moving magnets. (Rejected)

PHYS 004B - General Physics - Calculate the induced voltage generated by simple distributions of varying currents and moving magnets. (Active)

PHYS 004B - General Physics - Calculate the induced voltage generated by simple distributions of varying currents and moving magnets. (Active)

PHYS 004C - General Physics - Solve real world problems involving propagation of light and heat. C-ID # 1; Lab #1 (Active)

PHYS 004C - General Physics - Solve real world problems involving propagation of light and heat. C-ID # 1; Lab #1 (Active)

PHYS 004C - General Physics - Predict the transfer of heat among materials. C-ID Lab # 2 (Active)

PHYS 004C - General Physics - Predict the transfer of heat among materials. C-ID Lab # 2 (Active)

PHYS 004C - General Physics - Analyze the physical propagation of light through different media, by drawing light ray diagrams characteristics of reflection and refraction. C-ID # 1; Lab #1 (Active)

PHYS 004C - General Physics - Analyze the physical propagation of light through different media, by drawing light ray diagrams characteristics of reflection and refraction. C-ID # 1; Lab #1 (Active)

PHYS 004C - General Physics - Analyze the phenomena of interference and diffraction in optics, predicting patterns produced by narrow slits: single, double and multiple. C-ID # 2; Lab #1 (Active)

PHYS 004C - General Physics - Analyze the phenomena of interference and diffraction in optics, predicting patterns produced by narrow slits: single, double and multiple. C-ID # 2; Lab #1 (Active)

PHYS 004C - General Physics - Explain how Relativity and Quantum Mechanics changed our view of the physical world. C-ID # 3, 4 (Active)

PHYS 004C - General Physics - Explain how Relativity and Quantum Mechanics changed our view of the physical world. C-ID # 3, 4 (Active)

Program Learning Outcomes

General Studies with Emphasis in Astronomy - Associate in Arts: Associate in Arts - Analyze data collected in laboratory experimentation and formulate predictions using computer technology, mathematics, and consistent significant figures ()

General Studies with Emphasis in Astronomy - Associate in Arts: Associate in Arts - Solve problems representing real world situations using classical and/or modern physics ()

General Studies with Emphasis in Astronomy - Associate in Arts: Associate in Arts - Demonstrate understanding of the scientific method, by clearly identifying its use in current scientific developments, and in historical scientific revolutions ()

General Studies with Emphasis in Astronomy - Associate in Arts: Associate in Arts - Show personal responsibility and social awareness by exercising ethical leadership and balanced critique of new scientific developments and public affairs ()

General Studies with Emphasis in Astronomy - Associate in Arts: Associate in Arts - Demonstrate effective use of the language when communicating scientific information, using methodological skepticism to scrutinize knowledge and to formulate opinions about world situations ()

- **1. On the program level, defined as a course of study leading to degree or certificate, list the Program Learning Outcomes (PLOs), and how they relate to the GE/ILOs. Please also indicate how the course SLOs have been mapped to the PLOs. If you are completing this program review as a department or discipline and do not offer any degrees or certificates, please write N/A in this space.**

The AA program in Astronomy was initially conceived for non-science majors who wanted to extend their learning in Astronomy. However, we modified the program to incorporate scientific techniques, such as spectroscopy and photometry, and promoted it among STEM majors, and we are currently transitioning to this new setting. The PLOs of the Astronomy AA program are listed as follows:

Demonstrate effective use of the language when communicating scientific information, using methodological skepticism to scrutinize knowledge and formulate opinions about world situations

ILO mapping: Communication, Inquiry, and Reasoning

Analyze data collected in laboratory experimentation and formulate predictions using computer technology, mathematics, and a consistent number of significant figures

ILO mapping: Communication, Inquiry, and Reasoning

Solve problems representing real-world situations using classical and modern physics

ILO mapping: Inquiry and reasoning

Demonstrate understanding of the scientific method by clearly identifying its use in current scientific developments and historical, scientific revolutions

ILO mapping: Inquiry and reasoning

Show personal responsibility and social awareness by exercising ethical leadership and balanced critique of new scientific developments and public affairs

ILO mapping: Communication, Inquiry, and Reasoning

These PLOs depend on assessments done on the PHYS 07-series, ASTRO 014, and ASTRO 016, which have been reformulated for STEM students and not SLOs assessed. We expect a first program assessment by 2024 once the last cohort of students entering the 7-series and astronomy hybrid courses have completed these courses.

- **2. Since your last program review, summarize SLO assessment activities and results at the course and program level. Please include dialogue regarding SLO Assessment results with division/department/college colleagues and/or GE areas. Provide evidence of the dialogue (i.e. department meeting minutes or division meeting minutes, etc.) List any SLOs or PLOs that have not been assessed in the last two years and provide an explanation of why they have not been assessed. This will be reviewed by the IEC to determine if your Program Review is approved or not.**

SLO assessed - All course-level SLOs for ASTRO 010 and ASTRO 10L have been assessed and recycled.

SLO not assessed - ASTRO 014 and ASTRO 014 have undergone a major structural transformation and are planned to be re-launched in spring 2023. They stopped being offered, causing the lack of data in SLO assessments.

AA Program not assessed - We noticed in the previous program review that we should make our AA astronomy program tailored to STEM majors, and we went on to change the program AND redesign ASTRO 014 and ASTRO 016. As a result, ASTRO 010 and ASTRO 10L are not part of the program anymore. We will start assessing the AA program in 2023.

As of today, given the dormant phase of ASTRO 014 and ASTRO 016, we expect 100% SLO survey completion for these two courses by the end of 2023 after their re-launching. We are uploading communication exchange with the SLOAC coordinator and other documents relevant to this issue.

- **3. What plans for improvement have been implemented to your courses or program as a result of SLO assessment? Please share one or two success stories about the impacts of SLO assessment on student learning.**

The full-time faculty teaching astronomy takes a load with all physics courses and Earth Sciences (PHYSC 012), now called an independent program. The current FTEF rounds to 35%, which makes it a daunting task to implement SLO surveys and collect them promptly. The two full-timers take most of their load in Astronomy, so data has been collected nicely in this department and consistent through the last program review in 2017. In the past study, we wrote the following concerning the type of assessment implemented:

"We created a survey of one or two questions per SLO and gave to students along with their final exam. Questions based on the tools astronomers use to retrieve physical properties of celestial objects (spectroscopy, and atomic absorption, emission and scattering), and to the large scale processes such as those related to galaxies and clusters of galaxies returned few "rights". We intended to implement visualizations such as those available in PHET Colorado, exercises given in ComPADRE, and NAAP astronomy class actions, but were unable to coordinate this with our adjuncts. We are planning on assessing the students again in spring 2017, and attempt to introduce these measures in the fall 2017."

Since this last program review, we noticed that spectroscopy was a significant challenge for students unfamiliar with the scientific method and advanced physics. By then, we encouraged instructors to use simulations in class and bring as many demos as possible to illustrate how spectroscopy works and how it allows astronomers to uncover unseen aspects of matter and identify unknown

substances. When the pandemic forced the courses to be taught online, it significantly increased the lack of overall understanding of how spectroscopy operates. We used this narrative when we analyzed SLO results during the pandemic.

“Astronomy was taught primarily remotely this spring. Although online, we have included different interventions to keep students engaged. “Discussions” were one. As a GE course, our goal is to explain how the scientific method is employed to build knowledge on objects that are not within reach and demonstrate how spectroscopy and photometry are used as tools to reveal that knowledge. Therefore, we must explain light- a complex subject in physics - to nonscience majors. In particular, it is quite a challenge to demonstrate and make students learn the operation of a spectrometer. This requires technology and preparation on the part of the instructor. There are no significant changes from the last report. Breaking down data from asynchronous to in-person sections indicates consistent low scores for fully online students.”

Further down, we summarize:

“The department needs a full-time faculty given the large ratio between adjuncts (6 or more) and full-timers (2). We also urgently need to purchase a spectrometer. It has been indicated in our previous program review and will be reiterated in our next.”

What makes science unique is its hands-on counterpart necessary to complement different learning modalities. We can get by with simulations and videos explaining to non-science majors how a spectrometer operates and how knowledge is derived from such an instrument. On the contrary, we cannot provide an honest learning environment for students on track to an advanced STEM career simulating the specifics of the operation of a spectrometer. We need them to actually collect data and analyse.

To summarize, we do not have a success story to share when assessing SLOs and promoting interventions. Scores continue to be lower than desirable in themes related to spectroscopy, and simulations do not seem to be effective in explaining spectroscopy. SLOs that cover other themes indicate student mastery of the subjects.

Faculty and Staff

Part D: Faculty and Staff

- **1. List current faculty and staff members in the program, areas of expertise, and describe how their positions contribute to the success of the program.**

Staff and faculty at the astronomy department work as a team to better serve students and support the college mission.

1. **Batalha, Celso** – He has worked with Mike Masuda updating course outlines, SLOs, and PLOs, overseeing SLO assessments and their analytics, and introducing a variety of teaching modalities to attend to different students' learning skills. Still, with Mike Masuda, they visited instructors' classrooms and submitted student evaluations for Dean's consideration. Celso has introduced significant modifications to his online asynchronous course to improve students' browsing and communication. In addition, he has attempted to initiate several out-of-classroom activities, including undergraduate research with community college students, which has led

to independent study types of courses, ASTRO 20A & 20B, currently in CurriQunet pipeline. Most of his drive is directed toward connecting low-income middle-schoolers from underserved school systems to an environment that is college-oriented. As a result, he has worked with community members organizing a branch of the EVC-CSI project that bridges EVC faculty and students to these middle schoolers. Lastly, he has engaged with faculty and the EVC Academic Senate to create a science museum on the "27 acres" of land belonging to the district.

2. **Duong, Van** - Instructional Laboratory Technician III at Evergreen Valley College (2007 – present) for two departments, Physics (50%) and Chemistry (50%). Her position contributes to program success in the Physics department as follows: She has primary responsibility for ensuring that laboratories run smoothly and safely. Determine, prepare, and provide materials for laboratory experiments and instructor demonstrations. Assist instructors as problems arise. Familiarize new instructors with our facilities and procedures. Oversee lab safety and security. Manage hazardous waste disposal. Help maintain equipment. Support faculties with promoting our programs, including STEM program, Summer Reach, and California Space Grant. Purchase materials, supplies and equipment; deal closely with the Business Office and the Purchasing departments. She maintains department supply budgets and grant budgets. Join the Hiring committee to hire new staff and faculty. She is also a member of the Classified Senate Committee.
3. **Francisco, Ricardo** - The Astronomy program has been successful in its student-centered and outreach initiatives due to the dedicated work of Mr. Ricardo Francisco, currently supported by a grant. Rick is an Instructional Laboratory Technician III, Evergreen Valley College (2017-present), and a former volunteer at the Astronomy department (2015-2017). Assist instructors in planning and setting up laboratories and demonstration equipment for the instructors. Perform annual maintenance of the MHO two observatory buildings, Dome, and Roll of Roof mechanical and electrical systems. Assemble instruments on telescopes and service them, clean and sanitize all used optical eyepieces and hand control pads. He also oversees software updates on all astronomical applications controlling the mounts. Host and support MHO/EVC Astronomy outreach program, and schedule monthly public stargazing events via our Meetup website. We have over 1,500+ members. Support the special faculty programs, California Space Grant, Summer Outreach, STEM, and special Astronomical events and talks. He is a member of the MS3 Emergency Floor Captain team and performs an annual inventory of all astronomy equipment, notifying all instructors of new equipment or software.
4. **Masuda, Michael** - Professor Masuda (MS Physics, BS Physics: Lasers & Optics, BS: Condensed Matter Physics) is a physics and astronomy instructor whose expertise is in utilizing physical demonstrations whenever possible to help students visualize concepts in physics and astronomy. During the 2020 pandemic and lockdown, he spent a few months outside of class recording video footage of lab equipment to be used as video data for the student analysis in physics and astronomy labs. He was also the first to suggest using an inexpensive diffraction grating filter to use the telescopes as astrometric spectrometers in lieu of the availability of funds for the desired \$30,000 spectrometer--a filter that can be used to produce the visible absorption spectrum of stars and galaxies towards the development of future astronomy course labs. He has also become proficient with a digital telescope called the Unistellar EVscope--which he has successfully utilized at the Observatory with a large screen monitor to show local visitors a host of deep sky objects too faint to be seen with normal optical telescopes. In the past, Mike has served as faculty advisor for the EVC Physical Science Club--whose members have volunteered alongside him at the campus Montgomery Hill Observatory during their monthly public Night Sky viewing events. He is also hoping to develop in the near future a zero-credit course for senior members of the local community who are interested in

amateur astronomy and telescopes. In regards to the future EVC STEAM museum (originally just a natural science museum but has evolved to include other disciplines and interests in STEAM), he has proposed a novel approach to the proposed planetarium--a PROJECTORLESS planetarium, where the walls, floor, and ceiling have flexible UHD 8K LED screens, similar to the ones used by Lucasfilm for their backdrops in their TV shows. This virtual reality room may serve as a multipurpose system where lecturers of other disciplines can also come in and use the room to dynamically float through an excavation site, fly over a natural biome, rotate the night sky (planetarium), or some other scenic vista footage for educational purposes. It will not have a projector in the center of the room--allowing more flexibility in use. It could also be used by art students to create their own virtual realities, by performing arts faculty to provide realistic moving stage backdrops--the uses are endless, and he is hoping to ask for more than one of these rooms so that a single room will not be overlooked!

In addition to fulfilling their contract jobs, this team of physics and astronomy departments has invested significant time and energy in partnering with the community of residents to create the EVC - Citizen Science Initiatives, intending to connect middle schools in low-income areas to college grounds. We are listing some of their achievements so far.

The EVC Citizen Science Initiatives, Bridging Middle School and College -This crew, making up the core personnel of the Astronomy and Physics departments, have invested intense efforts over the years to help tackle the equity gap in education, leading to a society where different racial groups have a share of the wealth of this nation representative of their population. Elementary and secondary education in science and math serve as a basis for student entry into STEM majors at the college level. However, racial and ethnic disparities in access to upper-level math and science courses and student achievement in STEM are persistent barriers contributing to the small number of underrepresented minorities in STEM. In April 2018, James Lick High School (JLHS), a feeder school for EVC, in which 97% of the student body is a minority and 84% is economically disadvantaged, proposed cutting the school's physics program for the upcoming academic year. Consequently, parents would be faced with the choice of enrolling their child in a further out "wealthier" school or jeopardizing their child's acceptance into college as all University of California campuses recommend students have three core years of science, one of which is traditionally physics. The school leadership's decision to cut physics brought to light an alarming equity issue in the otherwise vibrant and wealthy Silicon Valley. The northern California chapter of the American Association of Physics Teachers intervened by writing petitions against the decision and coordinated a transitional stage where EVC would provide laboratory classes and oversee instruction. Due to the collaboration and activism of a caring community, the school's decision was reversed, and a substitute teacher was hired to lead the program. While the initial aim was to save physics classes at JLHS, a core group of educators, parents, and community members have continued to work to reduce the STEM achievement gap by creating programs that will ensure students have equal access and outcomes in STEM. Moreover, through a shared vision and partnership, we saw how a small group of people could spur significant and ongoing change.

Researchers suggest that a child's decision to enter a specific career or field of study happens in middle school, thereby highlighting the need for effective interventions at an early age to reverse negative perceptions about STEM in general and math in particular. The EVC-CSI program was designed to 1) engage minority and low-income children in STEM at an early age, 2) provide mentorship and weekly interactions designed to expose the participant to the joys of science, math, and technology supervised by college professors, and 3) establish a familial relationship with the children, following their academic development throughout the years up to college.

The establishment of bridges linking middle school to college is considered fundamental to bringing equity to education and promoting changes in the demographics we currently observe in our calculus-based physics courses, gateways to advanced STEM programs.

The California Space Grant Consortium - As a measure to improve student success and retention at EVC, we applied for several grants, with the CaSGC resulting in a positive outcome. It is a consortium between NASA and UCSD, providing cohorts of twelve EVC low-income students with the opportunity to learn robotics and exercise teamwork to produce results. We were awarded on three consecutive terms and await to begin on the next cohort in spring 2023.

Department members have received awards in recognition for the efforts done towards equity in education:

- "Bridges to Diversity and Equity." Award in 2021 by Dr. Byron Breland, the former San Jose Evergreen Community College District Chancellor.
 - "Multicultural Astronomy: Stars of Many Colors." Award in 2021 from Dr. T. Gilkerson, EVC President Humanizing Curriculum and Instruction
- **2. In addition to major professional development activities completed by faculty and staff in the past, in particular with regards to students' success, equity, distance education, SLO assessment, guided pathways and/or innovative teaching/learning strategies, are there any additional professional development needs of your department in the future? What are they? Please provide details about a timeline.**

Faculty Hire Prioritization - The Astronomy and Physics departments are in dire need of a full-time faculty that can promote growth in the physics department, create out-of-classroom activities, improve course content and its delivery, and outreach to underserved K12. Currently, we run at 35% FTEF demanding constant support from associate faculty, who are not directly participating in the day-by-day decisions impacting physics, the gateway to any career in STEM.

Classified Hire Prioritization - We currently count on the 50% allocated time of a Science Lab Technician III overseeing the entire Physics, Astronomy, and Earth Science labs. A grant was funneled to the Division of MSE to support another full-time Lab Technician to oversee the Astronomy program alone. Thanks to the dedicated work of this lab technician, we have successfully initiated the test and implementation of astronomical cameras (CCD) at the observatory, to be employed on a future course on Astro-imaging, tentatively named ASTR0 022.

Budget Planning

Part E: Budget Planning

- **1. With your Dean, review the department Fund 10 budget (operational budget) and discuss the adequacy of the budget in meeting the program's needs.**

Three programs share one single budget, and we request these departments to be divided, given that we are currently writing three independent Program Reviews. Physics provides STEM core courses, Astronomy provides GE courses primarily, and Physical Sciences is just one course. If divided, each department's leading faculty would have an independent budget to better plan their department's future growth. As of 2022, these are the funds allocated to the three programs:

2021-2022 operation budget for Physics, Astronomy, and Earth Science:

Physics, Astronomy & Earth Science (1902)

<u>GL Account</u>	<u>Description</u>	<u>Budget</u>
17-21-1902-22500-54100	Supplies Instruction	\$4,315.00 (\$2,873.00 – Physics; \$1,442.00: Astronomy).
10-21-1902-00000-55200	Conference	\$120 (Transferred to Supplies non-instruction and Postage for Physics needs)

- **2. List all external funds, i.e. fund 17, the department/program receives, and describe their primary use.**

10-25-1902-00000-55620	Repair	\$500	(to send broken function generators to vendor to be repaired)
17-25-1902-10506-56411	HERRF Fund	\$3,923.23	(Use all for Physics)

External funds have been received from small grants such as California Space Grant Consortium, Synopsys Foundation, and scattered donations used to support our growing out-of-classroom and K12 projects. Total deposits made on an SJECCD Foundation account are uploaded at the end of this report.

Technology and Equipment

Part F: Technology and Equipment

- **Review the current department technology and equipment needed and assess program adequacy. List and changes to technology or equipment since the last program review. If changes were made please indicate how the change impacted student success.**

The Astronomy department has an extensive collection of portable telescopes used by ASTRO 010 and ASTRO 10L students. These portable telescopes are set for visual inspection alone: to look at a given sky object and enjoy it. It is a perfect technology for public stargazing and field trips, but it offers limited learning capabilities even for the non-science majors attending ASTRO 010. With that in mind, we requested two instruments in our previous program review to bring the data-taking aspect of science to our astronomy students: a new telescope, a spectrometer of adequate spectral resolution, cameras, and a new telescope mount.

Technology requested and received - Since the last program review, the department has invested funds to acquire modern CCD cameras to enable astrophotography courses and workshops. For these cameras to operate desirably, a new mount for the telescope had to be purchased for stability and precision. Thanks to Lab Technician III's constant diligence, supported by a grant, several successful tests have been made at the observatory yielding "astro_pics" of excellent quality, some of which have been adorning division flyers and college posters. The department is now ready to organize the ASTRO 022 course outline. In addition, we received the donation of an eVscope through our partnership with the SETI Institute.

In summary, we have requested and received cameras and a new mount.

Technology requested and not received – Spectroscopy is the essential tool astronomers use to gather data and build knowledge. We do not have one for the Astronomy program. The College of San Mateo has two and has created a program that funnels STEM students to their facility and other programs. The last program review identified the Shelyak ESHEL Complete Spectrograph System # SKU SL-ES0007 at \$19,005.00. The spectrometer requires a dedicated camera to store data, and we identified the SBIG STXL-16200 Ultimate Package # SKU: STXL16200-Ultimate, at \$13,541.00

In addition, our telescopes need to be upgraded. Access to quality instruction for our STEM students will be significantly improved once a new telescope is in place. In astronomy, the bigger is better, and we aim at a 20" telescope to replace our existing 14". The last program review identified the ALLUNA RC20 Ritchey-Chretien Telescope 510mm f/8.0 system at \$47,206.00, mounted on a PARALLAX HD300C GEM Weight load Max.300lbs at \$25,000.

- *Use of resources, IF allocated I* – The spectrograph will enhance the capability of the ASTRO 20A & 20B independent studies, providing students with a unique capacity not only to understand spectroscopy but to be trained on this technique before transferring to a 4-years institute. Its use can also directly impact the quality of upcoming redesigned courses, ASTRO 014 and ASTRO 016, allowing students to derive properties of planetary objects (ASTRO 014) and stellar or galactic sources (ASTRO 016).
- *Use of resources, IF allocated II* – The new 20" telescope will attract visitors to our stargazing as never before, bringing a new wave of potential students to EVC, especially from low-income areas, if persistent efforts from the EVC-CSI project remain in operation. It can be combined with the new spectrograph to further extend our undergraduate research courses – ASTRO 20A & ASTRO 20B.

Additional Information

Part G: Additional Information

- **Please provide any other pertinent information about the program that these questions did not give you an opportunity to answer.**

The Astronomy program has been supporting our non-science major students and is currently transitioning to supporting STEM majors. However, we noticed a low representation of Latinx and female students in calculus-based physics courses that are gateways to careers in science and technology. Why aren't they represented in our advanced classrooms? Is it our (EVC) fault, or is it a systemic issue? Today's students were populating the K-8 education system years ago, formulating perceptions about themselves and science in response to what they experienced in classrooms and their homes as future 1st generation college students. Given the low quality of science and math programs in underserved schools, the outcome of a bad start in these areas is the consequent distancing of these students from STEM at an older age.

We have resources allocated to support existing students, not K-8 students. Therefore, out-of-the-box solutions must be envisioned to tackle systemic-driven equity gaps in achievement for those people of color attending underserved schools. The K-12 branch of the EVC-CSI represents an alternative solution to the problem, although it is struggling to find its identity and get support from the institution it represents. Another avenue explored is expanding the community reach of our Astronomy program.

In the last program review, we wrote:

*"A planetarium in a community college is the most efficient tool for teaching astronomy, whereas an observatory is the required tool for research. The STA (it now became one of the branches of the EVC-CSI) is being developed to make full use of the Montgomery Hill Observatory as an asset of our local community of residents and students, capable of enriching their minds and extend their horizons. A state-of-art planetarium, such as the one in use at the College of San Mateo, constitute the most advanced tool to deliver astronomic visuals and knowledge, and will integrate EVC with Eastside school district, establishing a first contact of these students with college life at an early age. It will fulfill the ultimate goal of the STA project, which is to increase the percentage of underrepresented minorities in the pool of PhD awardees in the US, as identified in part. The **Evergreen Planetarium** is a natural outcome of the STA proposed goals, and conceived as an asset of the entire division and not only used by astronomers like an observatory. Each department of the MSE division will have its own room to showcase their instruments and demonstrations, decorated to fit its specific science. It will be a mandatory stopping point for schools, counselors, and businesses visiting our campus."*

This idea was circulated among parents of our K12 participant children and community activists supporting the EVC-CSI community college-middle school bridging project. The community of residents embraced the idea of a planetarium on the 27 acres of land, and senior administrators oriented us toward engaging the EVC Academic Senate and more faculty. Today, the planetarium grew to become an overarching academic museum. Faculty from our and other divisions have joined efforts to write a draft of a resolution adopted by the Academic Senate in support of a Museum of Science, Technology, and Arts on our land, attending and serving our future college students who are presently attending K12.

In the previous program review, we emphasized that our Astronomy department would profit if the investment in a planetarium were made. We close this program review by affirming that investments in a Museum on our land will promote the growth of our college, effectively extending its reach to underserved areas in East Side San Jose.

Future Needs and Resource Allocation Request

Based on the areas noted below, please indicate any unmet needs for the program to maintain or build over the next Comprehensive Review. Please provide rationale on how the request connects back to SLO/PLO assessment, strategic initiatives or student success. If no additional requests are needed in any of the areas, put N/A.

1. **Classified Professional Request**

Ongoing Budget Needs

\$66,000- Instructional Laboratory Technician III for Astronomy, Physics, and Earth Sciences to oversee the Montgomery Hill Observatory and assist with three courses with laboratory done at this facility.

One-Time Expenditure

\$105,680.99 - Instructional Lab + benefits.

Total Expenses (Staffing and Faculty Requests include Salary and Benefits)

105680.990

Request linked to SLO/PLO #

AA - PLO # 1, 2 - Improve scientific communication; Collect and analyse data

Strategic Initiatives (student centered, organizational transformation, community engagement)

Yes

Improving student success rates

Yes

Achievement of program set standard for student success

Yes

2. Equipment/Supplies**Ongoing Budget Needs**

1800

One-Time Expenditure

95645

Request linked to SLO/PLO #

PLO # 1, 2, 3, 4 - Improve scientific communication; Collect and analyse data; Solve real world problems using a hands-on approach; Master the scientific method.

Strategic Initiatives (student centered, organizational transformation, community engagement)

Yes

Improving student success rates

Yes

Achievement of program set standard for student success

Yes

3. Technology**Ongoing Budget Needs**

Hardware and software - The Montgomery Hill Observatory requires constant upgrade of equipment, some expensive. such as CCD cameras and operating software.

One-Time Expenditure

2000

Request linked to SLO/PLO #

PLO # 1, 2, 3, 4 - Improve scientific communication; Collect and analyse data; Solve real world problems using a hands-on approach; Master the scientific method.

Strategic Initiatives (student centered, organizational transformation, community engagement)

Yes

Improving student success rates

Yes

Achievement of program set standard for student success

Yes

4. **Technology****Ongoing Budget Needs**

Shelyak ESHEL Complete Spectrograph System # SKU SL-ES0007 at \$19,005.00. The spectrometer requires a dedicated camera to store data, and we identified the SBIG STXL-16200 Ultimate Package # SKU: STXL16200-Ultimate, at \$13,541.00

One-Time Expenditure

\$32546

Request linked to SLO/PLO #

PLO # 1, 2, 3, 4 - Improve scientific communication; Collect and analyse data; Solve real world problems using a hands-on approach; Master the scientific method.

Strategic Initiatives (student centered, organizational transformation, community engagement)

Yes

Improving student success rates

Yes

Achievement of program set standard for student success

Yes

5. **Technology****Ongoing Budget Needs**

We request a 20" telescope to replace our existing 14". The last program review identified the ALLUNA RC20 Ritchey-Chretien Telescope 510mm f/8.0 system at \$47,206.00, mounted on a PARALLAX HD300C GEM Weight load Max.300lbs at \$25,000.

One-Time Expenditure

\$72206

Request linked to SLO/PLO #

AA - PLO # 1, 2, 3, 4 - Improve scientific communication; Collect and analyse data; Solve real world problems using a hands-on approach; Master the scientific method.

Strategic Initiatives (student centered, organizational transformation, community engagement)

Yes

Improving student success rates

Yes

Achievement of program set standard for student success

Yes

6. **Classified Professional Request****Ongoing Budget Needs**

\$62500 base salary - Ricardo Francisco is working under a grant that is expiring in June 2023 -

One-Time Expenditure

108577 - Ricardo Francisco's salary + benefits

Total Expenses (Staffing and Faculty Requests include Salary and Benefits)

108577.000

Request linked to SLO/PLO #

AA - PLO # 1, 2, 3, 4 - Improve scientific communication; Collect and analyse data; Solve real world problems using a hands-on approach; Master the scientific method.

Strategic Initiatives (student centered, organizational transformation, community engagement)

Yes

Improving student success rates

Yes

Achievement of program set standard for student success

Yes

Total CostClassified Professional Request

Ongoing Budget Needs: \$66,000- Instructional Laboratory Technician III for Astronomy, Physics, and Earth Sciences to oversee the Montgomery Hill Observatory and assist with three courses with laboratory done at this facility.

One-Time Expenditure: \$105,680.99 - Instructional Lab + benefits.

Total Expenses (Staffing and Faculty Requests include Salary and Benefits): 105680.990

Equipment/Supplies

Ongoing Budget Needs: 1800

One-Time Expenditure: 95645

Total Expenses (Staffing and Faculty Requests include Salary and Benefits):

Technology

Ongoing Budget Needs: Hardware and software - The Montgomery Hill Observatory requires constant upgrade of equipment, some expensive. such as CCD cameras and operating software.

One-Time Expenditure: 2000

Total Expenses (Staffing and Faculty Requests include Salary and Benefits):

Technology

Ongoing Budget Needs: Shelyak ESHEL Complete Spectrograph System # SKU SL-ES0007 at \$19,005.00.

The spectrometer requires a dedicated camera to store data, and we identified the SBIG STXL-16200

Ultimate Package # SKU: STXL16200-Ultimate, at \$13,541.00

One-Time Expenditure: \$32546

Total Expenses (Staffing and Faculty Requests include Salary and Benefits):

Technology

Ongoing Budget Needs: We request a 20" telescope to replace our existing 14". The last program review identified the ALLUNA RC20 Ritchey-Chretien Telescope 510mm f/8.0 system at \$47,206.00, mounted on a PARALLAX HD300C GEM Weight load Max.300lbs at \$25,000.

One-Time Expenditure: \$72206

Total Expenses (Staffing and Faculty Requests include Salary and Benefits):

Classified Professional Request

Ongoing Budget Needs: \$62500 base salary - Ricardo Francisco is working under a grant that is expiring in June 2023 -

One-Time Expenditure: 108577 - Ricardo Francisco's salary + benefits

Total Expenses (Staffing and Faculty Requests include Salary and Benefits): 108577.000

Attach Files

Attached File

EVC Account 198880. pdf.pdf (/Form/Module/_DownloadFile/2775/43425?fileId=291)

Copy of SLO Status for ASTRO PHYS and PHYSC 29Nov2022.xlsx

(/Form/Module/_DownloadFile/2775/43425?fileId=292)

IEC Reviewers

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