EVERGREEN VALLEY COLLEGE

DIVISION OF MATH, SCIENCE & ENGINEERING

Physics

Program Review Self-Study

2016 – 2017

…A mind once stretched by a new idea never regains its original dimensions…

Program Review

Physics, Physical Science, and Astronomy
Academic Year 2016-2017

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Department/Program Name: Physical Sciences

Last Review: 2011

Current Year: 2017

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Overview of the Department/Program ("Program")

1. Provide a brief summary of your program. Assume the reader does not know anything about it. Your explanation should include a brief history and a discussion of any factors that have been important to the program's development. Please explain the purpose of your program, what students you serve, what services you provide, and why these services are valuable.

The Physical Sciences Program encompasses a diverse field of courses sharing the unique Evergreen Valley College (EVC) mission: "With equity, opportunity and social justice as our guiding principles, Evergreen Valley College's mission is to empower and prepare students from diverse backgrounds to succeed academically and to be civically responsible global citizens." It includes all fields of natural sciences, excepting the branches of Biology, and maintains a diverse range of courses grouped under the subject areas of astronomy, chemistry, earth science and physics. These courses have been submitted to constant review and upgrades, incorporating new instructional methods and technologies as delivered by the ever growing Silicon Valley high tech industry. The list of courses includes introductory astronomy courses (Introduction to Astronomy; Introduction to Astronomy — Lab; Solar System; and Stars, Galaxies, and the Origin of the Universe), foundational chemistry courses (Fundamental of Chemistry and the two-semester Introduction to Chemistry), chemistry majors sequence (the two-semester General Chemistry and two-semester Organic Chemistry), introductory physics course (Introductory Physics), algebra-trigonometry based physics sequence (the two-semester General Physics), calculus-based physics sequence (the three-semester General Physics), and introductory earth science course.

Guided by the college's Commitments to Action and focusing on Student Centeredness, Community Engagement, and Organizational Transformation, the Physical Science program is committed to providing education to students of all ages and backgrounds, preparing them to succeed in a global and multicultural society. The program primarily offers general education and university transfer courses supporting the following degrees: General Studies with Emphasis in Astronomy, Associate in Science for Transfer in Physics and Chemistry. Courses are scheduled around student availability and schedule, providing state-of-the-art equipment and facilities, while delivering methods and supplemental learning opportunities off-classroom, textbook price reduction, and others. In addition, the program has committed to hire new faculty, continued staff professional development, creating campus activities, creating and expanding a modern physics lab to attend courses such as PHYS004C and PHYS002B, and performing outreach functions.

2. Please state at least three recent accomplishments for your program which show how it contributes to the College's success.

Student retention and success rate — According to data showed in Part A, the Physical Sciences programs have maintained a consistent trend on student enrollment, which is a positive landmark. Physics and Astronomy offer degrees that are not the top choices of students entering community colleges. However, students take our courses as part of their requirement for graduation in other majors: Chemistry, Biology, Computer Sciences, or Engineering. We plan on reversing this trend by strengthening our ties with Universities and stretching our reach to middle and high schools. This action is fully explained in the outline of the Space and Technology Academy (STA). We suggest that formalizing the STA in our Division will promote an extra flow of students to our AS-T in Physics and General Studies in Astronomy.

SLO Implementation and SLO Assessment: In the previous program review, our Physics labs were reported outdated and in need of major improvements. In particular, several SLO's could not be assessed for lacking of equipment needed to train students, and evaluate them on skills required for their majors. As shown Part F- 1 and on the display of investment done in the last five years, we initiated a reformulation of key Physics labs and purchased new telescopes to better prepare our students increase the visibility of our Division in the community. As a result, all listed SLO's have been updated and assessed in fall 2016. In particular, we were able to coordinate a single procedure to execute SLO assessments as follows: all sections of a course have assessments in the last week of classes with a series of multiple choice questions reflecting contracted SLO's (one or two questions per course SLO). Professors are left to include or not those questions on their final exams. In addition, and to reflect a spirit of partnership and cooperation, all professors were invited to create the questions. In 2017, we will improve on this by having all professors submitting questions on the first week of classes, revisiting those in the last week of classes. We think this is a better policy then assessing students after delivering the course content.

Increase visibility of EVC in its neighborhood: In 2014, a project named ***Space and Technology Academy (STA)*** was initiated with the main focus of promoting research in community colleges using the Montgomery Hill Observatory to attract visitors. The underlying goal is to hook up our physics and astronomy departments to high and middle school groups, especially those traditionally populated by under-representative minorities, creating a culture of science and research since early age. As of January 2017, and with time volunteered by full timers, adjuncts, and visitors, the STA became a reality and has attracted a wave of at least 100 visitors every month to public talks and stargazing events (see Part C — 3). Astronomy clubs in high schools have been organized and a few students are currently receiving direct training under EVC professor's supervision.

Creation of Space Technology Academy with Volunteering Time From Faculties and Staff — This program review intends to formalize the existence of the Space and Science Academy, a project faculty-driven designed to implement scientific research among college and high school students. Project goals, landmarks already achieved, budget needs, and potential outcome in students enrollment at EVC are indicated throughout the review.

Regular Department Meetings — We maintained regular monthly meetings when all adjuncts, lab supporting crew, and full timers were invited. These meetings were made available in an online platform, videotaped, and circulated for further scrutiny. They helped us to coordinate labs and equipment purchasing, implement SLO's assessments and data analysis, while giving voice to our robust supporting crew of adjuncts. Minutes of these meetings are available in the Math and Science T-Drive.

GAVART — The Goldstone Apple Valley Radio Telescope (GAVRT) is a radio antenna maintained by NASA and remotely used by students all over the world. As recommended by EVC President Henry Yong, the Astronomy Department established a partnership with the Lewis Center for Education that runs antenna, opening a valuable opportunity for our Astro 10L students to collect real astronomical data and participate in long-term campaigns, monitoring Black Holes in galaxies or following the changes in signatures of Jupiter strong magnetic field.

High School student participants in the Space Technology Academy project during the 2016 academic year. Here, they just finished observing a Black Hole with the GAVRT 34-m radio antenna located in the Mojave Desert. These observations were done remotely, and are now incorporated into our Astro 10L course.

3. Where would you like your program to be three years from now?

As we pass in review of the last three years of our department, our primary goal for the following triennium is to move the Space and Technology Academy from the status of a project set by a few professors and an enthusiastic Dean, to the status of a formal EVC program. In addition, we plan on improving on what we have achieved so far, such as in the implementation of SLO's, modernizations of our labs, adoption of different teaching techniques, and improving students' success in our online offering. These can be summarized as follows:

1 — Update and Creation of Course Outlines

The enrollment trends of our Astronomy courses correlates with the College FTES, whereas Physics enrollment is proportional to FTES in Engineering, Chemistry, and Computer Sciences programs all together. Students have not enrolled in EVC to take Physics or Astronomy courses as a career of choice, but as a requirement for some other majors. We would like to change this scenario observing an increase in FTES attending our Physics courses because they are better structured than in other colleges. For that, we would like to make the following changes in our programs and courses in the next 5 years:

- Update Astro 014 and Astro 016 course outlines, combining each of these courses with specific labs while keeping the same 3 credit units. This can be achieved by reducing lecture hours from 3.0 to 2.0 hours and adding 3 hours/week of lab instruction.
- Update the PHYSC 012 course outline and petition a C-ID status for this course.
- Develop course outlines for the following new courses: Introduction to Astrobiology, Astro-image Techniques, Elements of Research I, and Elements of Research II. We would also redesign the General Studies with Emphasis in Astronomy to include these new courses.
- Investigate the impacts of reducing the number of credits (5 to 4) in each of the Physics 4-series courses. Other community college already offer these courses with less weekly load, being fully transferrable to CSU. Perhaps some adjustments must be introduced to satisfy UC transfer requirements. By doing so, we predict that more students will seek our sections without affecting the rigorous academic standards we have set.
- Investigate the impacts of changing the MATH 013 pre-requisites for the PHYS 002-series to a more rigorous college — algebra based course. MATH 013 is not college algebra. Students currently enrolling in PHYS 002A/002B do not have, in general, the math skills required to be successful in these courses. Without compromising the SLO's, we are forced to eliminate lecture hours in important course content, substituting the time spent on those by delivering math instruction instead of physics topics.

2 — Creation of Space and Technology Academy (STA)

Objectives and Expected Significance: The Space and Technology Academy (STA) was conceived by a group of EVC professors as an alternative project to bring diversity to the STEM workforce, and contains elements that will set an underrepresented minority person — women, African Americans, Hispanics, and people with disabilities — on a track to a PhD. The keystone here, holding the two ascending arcs of K-12 academic preparation and specialized instructions received at the university prior to a PhD award, will be carved with the tools of advanced scientific research initiated during high school. It will also introduce children to existing mentoring and academic programs to improve retention and success. The STA connects K-14 students to forefront scientific knowledge using a collective impact framework composed of nonprofits, community college professors, academic and student programs, high school and middle school teachers, university professors, private labs, engineers and graduate students.

When fully implemented, this program will increase the number of underrepresented minorities interested in STEM fields at the middle school level, and several avenues are being conceived to ensure its success. Our program is illustrated in Figure 1.

STA Outcome 1 — Bridge to High Schools: Participating High School students at the Junior (grade 11) level will:

- Enroll in two semester-long courses at the community college to a) learn research skills and b) conduct their own unique, cutting-edge research project using public domain data.
- Receive mentoring from community college professors.
- Provide academic support to Middle School students via a partnership with online-based tutoring projects, such as the "Learn to Be Foundation".
- Help host engagement events for Middle School students, including delivering of curricula designed for middle schools.

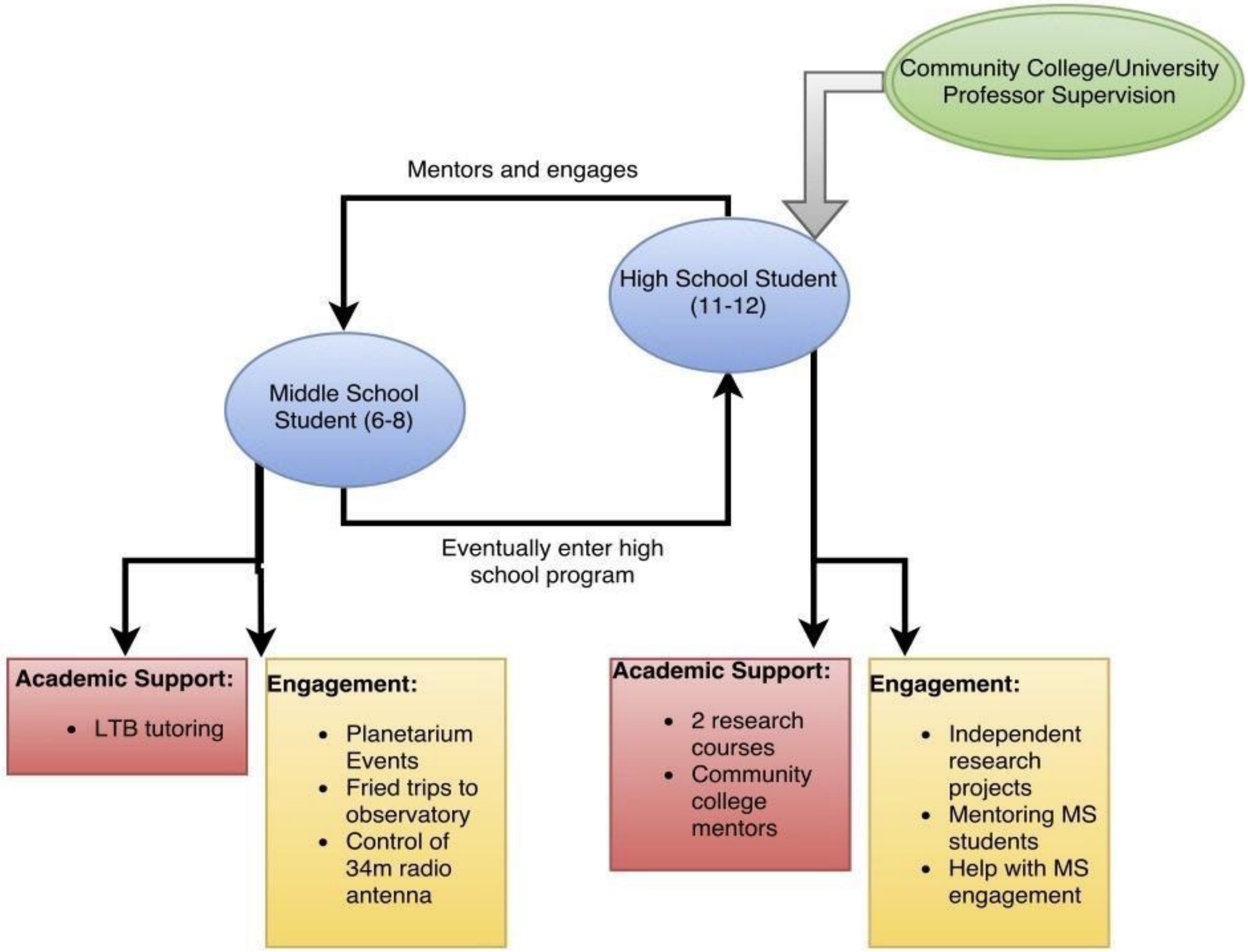


Figure 1. Schematic of academic support and engagement activities done by either high school or middle school students. Illustrates the connectivity of the middle school students, the high school students, and the community college professors.

STA Outcome 2 — Bridge to Middle Schools: Participating Middle School students will:

- Attend middle school curricula in development.
- Attend field trips to Montgomery Hill Observatory.
- Control the 34 m radio antenna (GAVRT) in group workshops.
- Receive academic tutoring by High School Students via online based mentoring projects.
- Enroll in the High School (STA) level program when in the High School.

This academic web of students, ruled by the single interest of producing pristine scientific knowledge, will set young minds from underrepresented minorities on track to completing their high education requirements. This should lead to a measurable increase in the number of PhD awards of females and underrepresented minorities as discussed next.

STA Outcome 3 — Increase PhD's Representation of Underrepresented Minorities: According to the NSF — National Center for Science and Engineering Statistic — 2014, the balance of awarded doctorate in all areas show a slight tilt of 8.0% on the male side over female recipients. Furthermore, the Physical Sciences and Engineering (PSE) fields together, scored 36% of the total PhD graduates, 27% being males, indicating a modest representation of females in these two major areas. The data is staggering when Hispanic-Latino and black students are surveyed in these two areas. African Americans, Hispanic Americans and Native Americans amounts 30% of the U.S. population, but only 1.6% of the awarded PhD's in the Physical Sciences and Engineering belong to these ethnic groups, with African Americans lagging the Hispanics in 0.4%. Several programs have sought to tackle this issue. The "Bridge Program", for example is a partnership between Vanderbilt University in Tennessee and a nearby, historically black university, Fisk. In the program, students earn a master's degree at Fisk and then are put on fast-track admission to one of the participating Vanderbilt PhD programs. A similar bridge program at Columbia University brings students into the university as research assistants for up to two years and places them in research groups in the natural sciences. Recently, similar programs have started popping up in several universities: The Ohio State University, University of South Florida, MIT, and University of Michigan. Although all of these programs have been wildly successful at putting university level students into PhD programs, they all, of course, assume that the student has already made it to their top ranking institutions. But at that level, the pool of STEM minorities has already shrunk dramatically considering that out of the 160,000 African-American students who graduate high school each year, fewer than half apply to a four-year school [2].

As indicated below, we will integrate the STA actions with existing EVC academic and students programs, which will provide the required know-how to outreach target students, especially at the middle school level. Conversations have already been initiated with EVC Upward bound and DSP programs.

STA Outcome 4 — Integrating Students and Academic Services: Community colleges, on the other hand, are gateways to higher education for several low income, first-generation postsecondary education and minority groups. According to the American Association of Community Colleges, and since 1985, more than half of all community college students have been women, and majority of Black and Hispanic undergraduates study at these colleges. In particular, the 2016 Evergreen Valley College commencement ceremony handed out diplomas to a pool of 64% females with a predominance of Hispanic and Asian Americans awardees. Several initiatives such as the "InTeGrate", Cal-Bridge, California Minority Partnership for Astronomy Research and Education (CAMPARE), the Lamat Program at UCSC and others have turned their attention to the diversity ground community colleges offer, and the need of providing students with better tools to help them to succeed in the upcoming years in the university. The STA will not compete with these programs, but complement them by opening a wing towards middle schools in underrepresented and economically disadvantaged areas. Bringing students to advanced technology, organizing summer workshop for school teachers, planning field trips for middle school science parties, are some of the activities on schedule to allow the beauty of STEM fields to touch some of these students for good, initiating the slow process of mentoring and nurturing that are needed to bring a new wave of better prepared future community college students or university freshmen. All too often though, community college professors see highly motivated and passionate students lose interest in STEM fields because they lack a solid foundation on the basic principles of mathematics and physical sciences which are taught at the high school and even middle school. Therefore, the chances of success of such a program increases significantly if an academically aggressive outpost is established at the middle school, or, at the very latest, high school level.

Community Colleges are traditionally equipped with tools and mechanisms to support a diverse population of students. The participant school partners are located in areas populated by underserved families, and are quite familiar with their students facing the daily struggles of poverty, teen pregnancy, family disruption, and crime. All partners share the common vision that education is an unequivocal right of the individual, and must be nurtured and made available to all, especially those living under unfavorable conditions.

The broadening participation challenge of increasing the number of underrepresented minorities and females into the pool of STEM PhDs in the US can be addressed by establishing alliances with already existing programs. These are: foster care associations, programs supporting the disabled, student services and programs to increase access of underrepresented to quality education, citizen science groups, parents organizations and many others. The STA project brings all of these partners together, and uses their unique characteristics and resources to establish a secure pathway to a science career. The STA will spice up what they already do by activating child skepticism, critical thinking, scientific curiosity, and care for one another through the tutoring program, and most of all, academic discipline, without which science cannot be produced.

The STA project will organize and maintain students' academics and socio-economic records. It begins, at the earliest, during a middle school intervention, continues when student is ready to apply for internships at the Universities or private labs, and ends when student finally completes her/his sophomore academic year at a chosen University.

EVC and other community college students participating on a field trip visit to IBM Laboratories. The Space Technology Academy will organize similar visits to university conference series, advanced labs, field trips, observatories, and others.

Participant students will be supported by existing programs and services since at from a young age, which will bring two important points into perspectives: a) the roadmap to a STEM PhD will be on view since middle school when students are forming self-identification and establishing their particular worldview. b) The STA will establish an official alliance in the otherwise segregated and somewhat disconnected parts of middle/high school systems — community colleges — universities, and existing supporting programs. An underrepresented minority participant will not arrive at the end of his/her sophomore year clueless about research opportunities, without formal training in STEM research, and unaware of how the academic system works. The STA will lead the participant student after transfer day — if community college — or after graduation — if high school, to the doorsteps of an upper division setting fully aware of her/his objectives and goals.

STA Outcome 5 — Advanced Laboratory: Several students seek orientation from Physics and Astronomy professors to receive honors credit. The creation of an advanced lab in Physics and Astronomy under the umbrella of the STA would funnel students to a state-of-art lab to complete work at a level above what is usually required in regular lab settings. Although students seeking honors' credit should be considered the primary users of such advanced lab, this setting would also serve as an extension to the current "research groups". Creativity and initiative are thought out as essential to the full development of a STEM-oriented mind, and groups developing side projects in Physics and Astronomy courses will use the advanced lab to expand on their ideas and projects. Another aspect of "Advanced Labs in Physics and Astronomy" is to promote and organize field trips of our students to businesses and research institutes in the highly tech Silicon Valley.

Therefore, personnel must be hired with the duties of overseeing the implementation of this lab and manage activities related such as coordinating field trips to private research centers, partner universities, and professional observatories. These field trips enrich our students and extend their horizons and dreams. The figure above is our last field trip organized with our physics fall students to IBM labs. A cosmic ray lab has the advantage of being within our college budget, and we recommend this as a starting landmark. On the Astronomy front, this advanced lab could foster long term research campaign using the access EVC has gained to the Goldstone Apple Valley Radio Telescope (GAVRT). We could participate in the collection and data-sharing with professional astronomers, using the always renewed wave of students to secure new data for long-term campaigns.

STA Outcome 6 — Citizen Science Center at EVC: The STA has the ability of providing a suitable setting for citizen-led research groups, taking advantage of the highly technical community of retirees living in the vicinity of our campus. We initiated in 2017 a community research theme named "Build a Stonehenge in your Backyard", which integrate basic knowledge of positioning astronomy, ethno-astronomy, moon-sun-earth configurations, and application of horizon coordinate system. This will be launched in January 2017, and will run for at least one year.

The STA can also provide the means to foster "informal research" in community colleges, since young adjunct professors are more likely trained in the ways of "formal" research. In fact, this initiative can be reproduced in other departments, helping straightening the ties between our crew of professors and high school students. We are currently collaborating with the organization "YouResearch" (http://www.youresearch.org/), which is partnering a senior of Yerba Buena High School with one of our full timers on a project of T-Tauri Stars. Others will follow.

Landmarks to be achieved: Measuring Success: The STA project brings an innovative strategy to the table conceived to awake and retain underserved students to STEM fields. It is founded on the idea that initiating scientific research after junior high school will bring students closer to a pathway leading to a PhD. But the turning point towards science isn't in the high school. By this time, students have already established their own identity, with an underrepresented minority probably setting its own self-image as one of "a non-science" person simply because he or she flunked middle school algebra, or could not follow properly the intricacies of middle school biology, or the lack of an academic role model in the family.

The STA wants to push the STEM "on/off" button in early middle school years employing tools that will bring sophisticated technology and aggressive tutoring to children at this age. A detailed socio-economical mapping of children in the area, associated with a robust mentoring strategy set in place by organizations such as the Learn to Be Foundation, participant high school students, and an alliance of teachers and professors, will bring some of these student closer to the gateway to a STEM PhD. Here are some indicators of program success:

a) Underrepresented minorities enrolled in ASTRO 020 — Elements of Research I. The utmost success-indicator of this project is the rate in which underserved students enroll in the ASTRO 020 and ASTRO 022 courses during its first 5 years. It is expected from the get-go that the large majority of enrolled students will originate from families academically inclined and economically stable. At the same time, the bulk of these "academically fit" children would advance towards their chosen fields and universities past high school quite independently from this project. In fact, unless economic struggles hit the family, these kids would cruise straight to the Universities after graduation, never detouring through a community college campus. But a critical mass of these students are essential for the sustainability of this project within the community college system.

The crude reality is that programs exist to serve students in community colleges, and students are needed to sustain courses. Without students, courses are cancelled or frozen. Therefore, although keeping track of underserved students from the middle school years will be a routine data mining process, several of the STA clients will be wealthy students. This should be seen as an ok follow up of the project development, and not as a sign of failure. Unless this project is expected to be funded by external grants forever, all students interested in enrolling in ASTRO 020 and ASTRO 022 should be equally embraced, even the wealthier students. Self-motivated and family supported kids are of an invaluable support for the success of this project targeting underserved children. One of our clubs (Evergreen High) was formed by self-motivated children (wealthy district) and the other (Overfelt High), by a self-motivated teacher (underserved district). In the eyes of a community college system, students enrolled in a class are translated in FTES, which ensures revenues for the course survival. To summarize, it is expected that a small percentage of minority representatives will be initially enrolled in the ASTRO 020 and ASTRO 022 courses during piloting phase and beyond, but success in the STA organizational strategy should be highlighted by a sensible growth in the number of minority enrollees. Wealthier students from economically supported districts are welcome to the project, as they provide the critical mass needed to achieve sustainability within the community college system.

During summer/fall 2016 (August and September), a total of fourteen high school club members were invited to pilot ideas that would be further incorporated into the ASTRO 020 course. Most of the students were from Evergreen High School, which is a school with strong parent commitment and support, students are self-motivated and engaged in academic Olympics and science fair. A couple students from Overfelt High School also volunteered, but they needed the time for summer jobs! Overfelt serves a community of primarily underserved students. We developed web-based discussions on star formation, students performed presentations and, for the most part, showed up consistently to the meetings. In August/September 2017 we will implement research with few of these students with the scope of providing us a baseline upon which the course ASTRO 022 can be developed. Currently, we are supervising two students using the web-based platform zoom.us.

The EVC Upward Bound Program has already mapped local high and middle schools, and has data on where the largest percentage of first generation of potential college students are located. The EVC Upward Bound program has already set foot in these school premises, which will facilitate the export of project ideals through a network of underserved children.

b) Exporting the project to another community colleges will provide enough ammunition to convince neighboring community colleges of the feasibility of this project. One of our faculty is already working with several other community colleges in a project sustaining similar goals (Cal-Bridge), and the momentum has already been built. Each CC has its own talents and strengths, but the basic structure of courses such as Elements of Research 10 and Elements of Research 20 can be transported to other STEM fields, as long as there are full time faculty energetic enough to carry on an emulation of the STA project.

c) Number of official partnerships with community groups: Although of a minor range, the STA is open to establish partnerships with STEM amateur associations and science citizen groups.

d) Number of official partnerships with universities and private firms: In the piloting phase, internships, REU opportunities, and special programs such as LAMAT, SIP, and SPHERE originated in UCSC, will be mapped and made available to participant students. The course ER10 will be a natural feeding ground to these programs, providing students with better skill to succeed academically.

e) Successful attendance of summer workshop for science teachers: Teachers will have an opportunity to learn a technical subject matter from specialists, but will also learn innovative curricula, and update in current STEM events.

3 — Creation of an EVC Science Club

In 1997, The EVC MASTEP Math & Science Club was chartered; the club was initiated to meet the social demands of students interested in the math and sciences. Activities included forums on teaching, whale watching expeditions, monarch butterfly tours, camping trips, and a tour of Ames Research Center. In December 1999, there were 49 student members and was one of the largest student organizations on campus. The original advisor (now a full-time faculty member) is spearheading a rebirth of the student organization as the EVC Science Club.

This new student organization will serve to meet the demands of students interested in the sciences (physics, astronomy, chemistry, Earth science, etc.) by:

- providing a safe and secure environment for science students to socialize on campus,
- allowing interaction and networking possibilities for club members with prospective employers in the science fields,
- increasing on-campus presence to perpetuate student interest in science courses,
- providing chaperoned outings for club members to local science museums, local science and tech facilities, and science departments at local university campuses,
- training interested club members in science demonstrations to showcase them at local middle and high schools—for the purpose of OUTREACH--generating interest of future college students specifically to our campus,
- training interested and dedicated club members for on-campus star-gazing activities with telescopes,
- awarding scholarships to outstanding science students in the club, and
- Inviting notable local speakers in the fields of science and technology to come give informative and provocative talks on campus.

Funding for the club's various activities will come from student organized fundraisers, online fundraising, donations from local businesses, and prospective grants from local science and tech facilities. Although not its primary focus, the club will be guided towards the latest environmentally-conscious efforts in the fields of energy science and technology.

4 — Implementation of a State-of-Art Planetarium at EVC: The Evergreen Planetarium.

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 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-or-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.

Contacts with the Dean of College of San Mateo and the faculties in charge of the planetarium granted us the following information

- ***Planetarium Director —*** Large part of the planetarium work at the College of San Mateo is carried out by volunteer time of their full timers. However, we foresee a center promoting not only shows once a week, but actively recruiting schools to participate on several shows and hands-on labs, disseminating not only astronomic materials but also content of other STEM fields currently under the umbrella of our division of MSE. In addition to a building capable of hosting 150 visitors — the current number of visitors in our public talks — it should contain adjacent rooms for experiments and demonstrations in biology, chemistry, earth sciences, engineering, and robotic. This requires a full time manager familiar with the advances of modern science. We conceive the future Evergreen Planetarium as a miniature version of the Chabot Space and Science Center with classrooms designed to showcase advanced aspects of each EVC-STEM department. It will also host the "Advanced Physical Sciences Laboratory".
- ***Astrotechnician*** — s/he would assist the delivery of shows during day time and assist students and professors at the Montgomery Hill Observatory. This staff will have skills to de-bug tech issues with the projector and telescopes.

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.

The official establishment of the STA in 2017, will integrate more efficiently the outreach efforts of our Division with students and academic programs already in place in EVC, as the STA aims specific at the East-Side School District.

PART A: Program Effectiveness and student success

1. State the goals and focus of this department/program and explain how the program contributes to the mission, strategic initiatives, comprehensive academic offerings, and priorities of the College and District.

Astronomy Department: Courses and Program

The department currently holds 4 courses (3 lectures and one lab) and the program "General Studies with Emphasis in Astronomy". During the period, the program has had 1 graduate.

Astronomy has this unique capacity of sparking people's imagination, which makes an attractive subject for students looking forward to enroll in an interesting GE course. The district has ASTRO 010 as one of the most popular courses, and we created an accompanying lab in early 2000's — the ASTRO 010L course — to help fulfilling the GE requirements for non-science majors. Since ASTRO 010 deals with a broad range of topics, covering not only Earth's processes but every other process acting on stars, galaxies and in the Universe in large scale, we decided to split the course into two separate unities named ASTRO 014: Solar System and ASTRO 016: Stars, Galaxies, and the Universe. The college ILO's "Communication" and "Inquiry and Reasoning" constitute major learning outcomes of these courses. Due to demand, the courses ASTRO 014 and ASTRO 016 never got the student enrollment needed to make these courses "successful", perhaps in part for not having an attached "ASTRO 014L" and "ASTRO 016L" laboratories. We plan on redesigning these two courses by including specific lab modules, making them more appealing to students. Once completed, we will redesign the General Studies with Emphasis in Astronomy Program.

Physics Department: Courses and Program

The Physics Program has traditionally existed to support Engineering, Chemistry, Biology and Computer Sciences. It is rare to find students embracing our physics courses with the intention of becoming Physics graduates. As a result, absolute enrollment in physics courses has been governed by the absolute number of students enrolled in other STEM courses. With the creation of an AS-T in Physics, we expect to change this trend by attracting students who might perceive our AS-T degree as a quick pathway to a B.S in Physics in a 4-years institute. We set as a major goal to publicize our program to local high schools, while launching several research avenues within the Space and Technology Academy, which has been highlighted in this program review.

2. (Data) What is your program set standard (baseline standard that you don't fall below) for successful course completion to measure effectiveness? (Please use program 5 year average success rate and review 5 year state average to set the program set standard).How did your program do against this program set standard?

The Physical Science Program rests upon student success, implying that academic settings such as laboratories, office hours, out-of-classroom events and academic activities, are all designed to ensure acceptable retention rate and the implementation of institutional ILO's.

The program defines effectiveness if:

- The proposed courses promote students goals of improving themselves as educated citizens in the community, while expanding their world-view by state-of-art pedagogical materials.
- The courses and degrees offered show a significant rate of student's retention, leading to comfortable rates of graduation and transfer to 4-years institutions.
- The efforts of establishing partnership with local educational centers must be met with visits of EVC professors to high and middle schools, creation of STEM oriented clubs in local schools, increase enrollment of high school students in courses of a major or GE.
- The faculties and supporting staff must be constantly aware of modern trends in educational technologies and laboratory equipment, being fully engaged in exposing students to innovative technologies and academic challenges.

According to data provided by the California Community Colleges Chancellor's Office, the EVC course success rate for the Astronomy department shows an average success rate of 63.7% ± 8.3% when computed over the 2010 and 2014 years. In the same source, the correspondent figure for the State indicates an average success rate of 66.6% ± 1.3%, which provide us with elements to interpret averages and correspondent dispersions.

The EVC year-by-year performance points to a larger deviation from its average when compared to that of the State: 8.3% and 1.3% respectively. We interpret this as reflecting our much smaller student population, forcing its overall performance to resonate more dramatically with yearly seasonal changes in the economy, high school graduation rate, etc. A fiducial critical-red line of student success rate - below which the department should trigger direct interventions - can be established after comparing EVC overall performance with that of the State. We noticed that EVC average success rate is 95.0% of the State average. However, due to our larger seasonal changes, it is a safer procedure to set this fiducial line at the 92.0%, which lead us to a "floor standard" of success rate (completion with "C" or better) at the 61.3% level. In reviewing our past success rates, the years 2010 and 2013 indicate achievements below this standard: 51.7% and 59.8% respectively.

We interpret the low success rate in Astronomy, both of the State and EVC, as being indicative of the course content and clientele it serves. The Astronomy department offers four courses for non-science majors, requiring from students a commitment to learn in a short period of time methods, procedures, and language used in scientific environment. In addition, students are exposed to a large volume of data, background history, and an always evolving outcome of facts and new evidences following advances in new technologies and practices.

The Physics department offers a variety of courses serving non-science majors (PHYS 001), as well as courses feeding a diverse population of students majoring on various STEM fields. Data provided by the Chancellor's Office indicates success rate of Physics courses for the State at the 70.9% ± 0.7% level, whereas EVC lies at the 67.8% ± 2.1% level. As noted previously in Astronomy courses, EVC's figures indicate a standard deviation (2.1%) larger than that of the State (0.7%), which we interpret as being indicative of its significantly smaller student population. It also shows that our success rate lies above the fiducial critical-red line of interventions set previously for the Astronomy courses - 92.0% of the State average - or 63.8%. This “floor-standard” fiducial line was never trespassed in the past five years. Due to our improving lab equipment and lab practices, we expect a growth in student success rate in the next 5 years.

Data also indicate a student population (age, ethnicity, and gender) consistent with previous program review, with a slight increase of enrollment of high school students. We project an increase of this younger cohort in our classrooms, as outreach projects with high schools tend to gain more attention on EVC.

We also identified a 12% gap in gender enrollment favoring male students, and an even a smaller percentage of African American enrollees. This is an important issue that has been tackled on different fronts at federal and state levels. In search of solutions, the Space and Technology Academy (STA) submitted an NSF grant proposal (INCLUDES 2016) with the main goal of promoting scientific research among pre-collegiate students, as a tool to engage and retain underrepresented minorities and female students in STEM fields. The project envision reducing the disparity on the percentages of PhD’s awards achieved by African Americans and Hispanics when compared to their Caucasians and Asians peers. In the following 5 years, the STA plan on partnering with student programs at EVC (AFFIRM and ENLACE in particular), visiting high schools and creating measures to spark science in these young student’s minds.

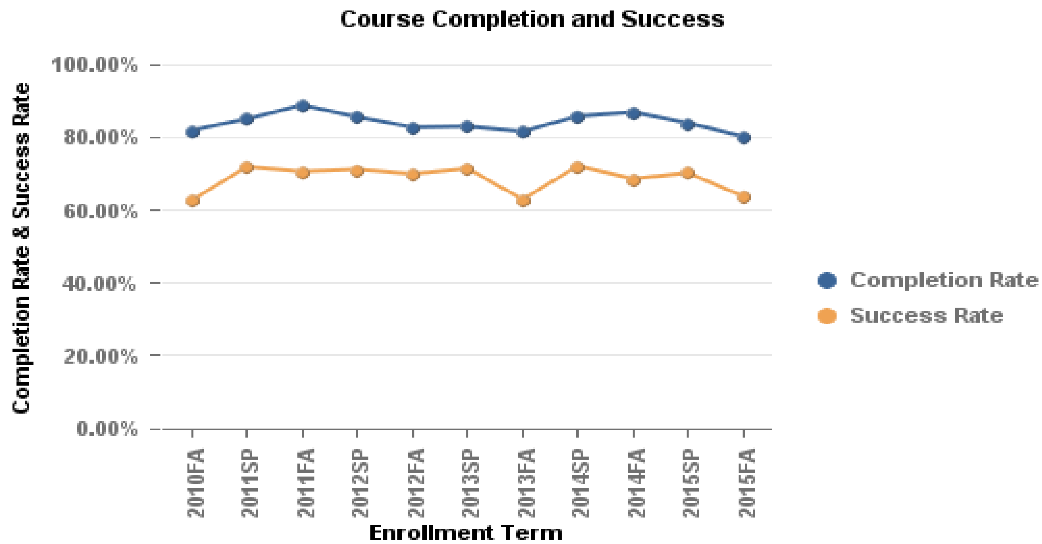
3. (data) Identify student success rate and patterns within the department/program and compare your results to the overall college institutional set standard of 64% successful course completion with “c” or better and your program set standard (questions 2)?

Listed below are the measures used in assessing performance of the Physical Science program:

- Headcount
- Seat Count
- Capacity Percentage
- Persistence Headcount
- Persistence Rate
- Full Time Equivalent Students

Course Completion and Success Rate:

The average success rate of all Physics and Astronomy courses over the five year period was 69%, with a standard deviation of less than 4%. The small deviation suggests that our course offerings are not subject to seasonal changes, which gives students confidence and assurance that their academic goals will be met. The average of 69% over the 5 years period indicates that we have met the 64% success rate college landmark. As we improve our lab offerings, participate more effectively in early alert efforts, support students with efficient academic tutoring, and strengthen our partnership with local high schools, we expect this level to be maintained — or perhaps increased — in the next period.



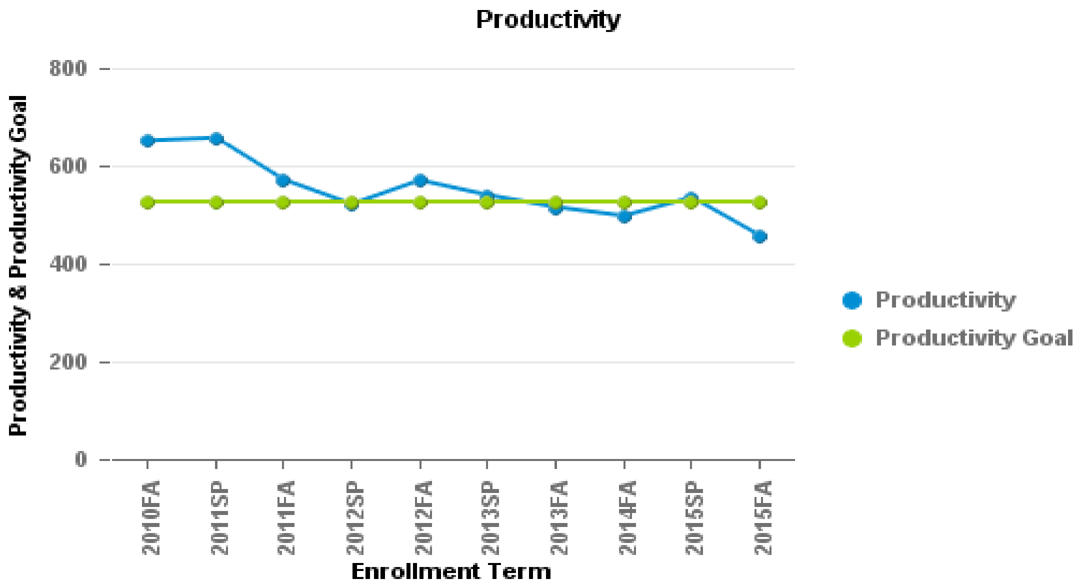
Development of course completion and success rates for the past 5 — year period

The completion rate during the same period yields an average of 85% with standard deviation of 2.3%, which is a good result considering the technical characteristic of the program. To ensure we achieve the same high percentage level during the next period, we plan on creating an "early alert" within the physics department, guiding students at risk of failing to online tutoring videos we create focusing on subject matter extensively discussed in class. This idea will be explored in future meetings of our department.

An outcome of these good results in success and completion rate is that our physics students will be positively impacting the Engineering, Chemistry, Computer Sciences and Biology programs.

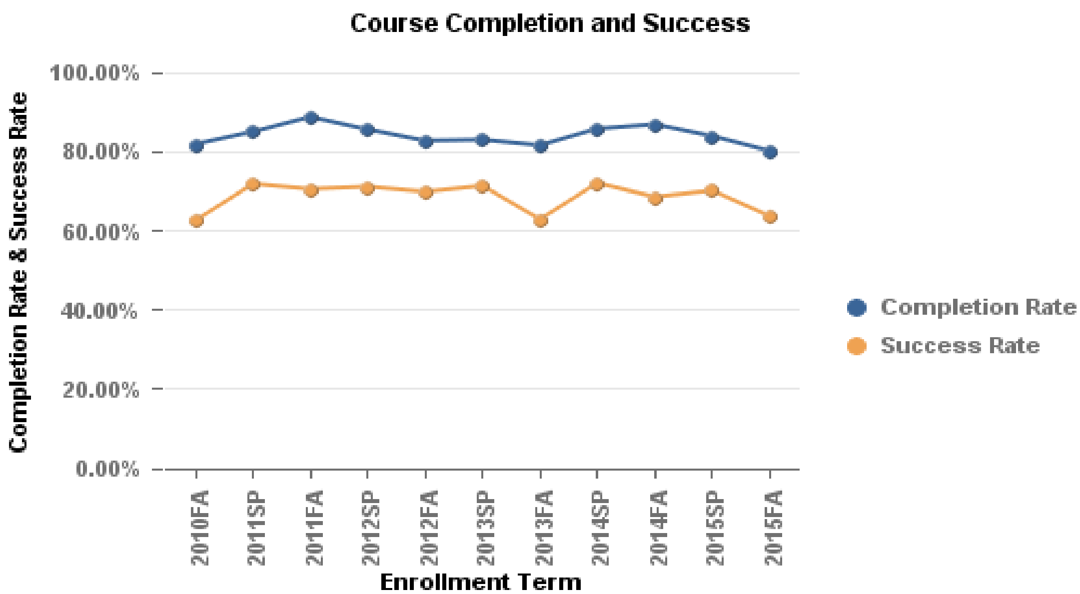
Productivity:

The figure below shows 5 years of productivity for the entire program, suggesting a steady decline in productivity since 2010, reaching below standard goals in 2013 and onward. The high productivity levels observed in 2011 can be explained by a combination of executive actions done in the aftermath of the 2008 economic crisis. Low enrollment sections were terminated, while highly demanded classes were offered on competitive time slots. As a result, community colleges went on reducing their operational costs while inconveniencing students who attempted to enroll in sections with seat counts at or below suggested cap limits. In addition to this administrative austere move, it is well known that student enrollment in community colleges negatively correlates with the health of the local economy. The urgency for re-training and gaining new working skills, in addition to attractive financial aids, serve as a safe haven to overcome harsh economic times, explaining the high productivity achieved in 2010. Once the economy initiated its recovery, more sections were made available to a reduced number of students who decided to attend college instead of joining the workforce, resulting in "unproductive" results.



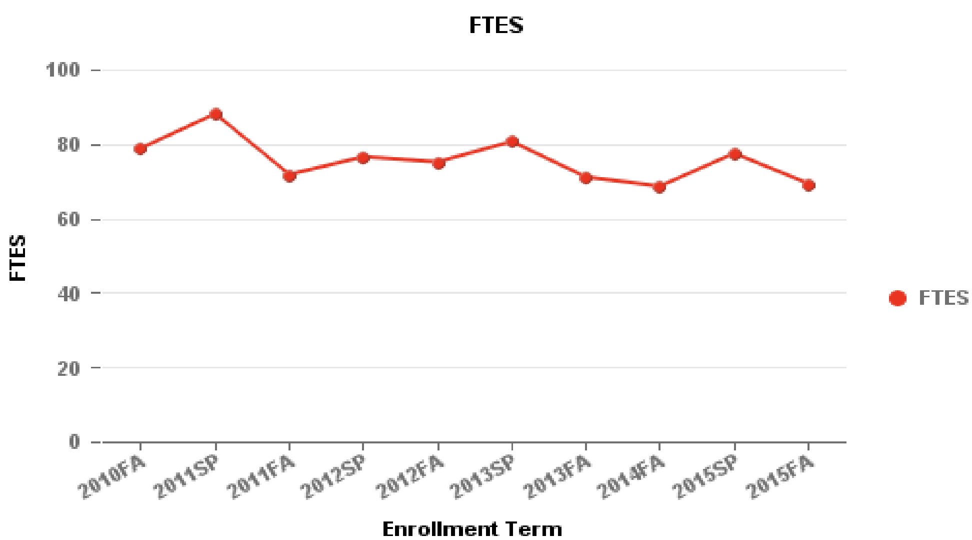
Productivity has shown a slight decline over the last 5 years, passing the threshold of 500 in fall 2015

FTES and Course Completion



Our program success rate has been constant over at the last 5 years.

The FTES has been kept constant at around 75 (± 6).

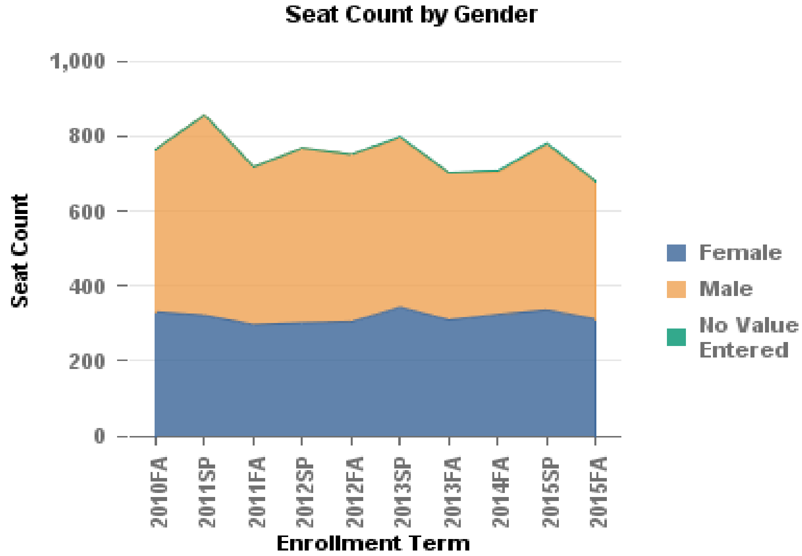


The FTES has been maintained at a relatively constant level during the last 5 years.

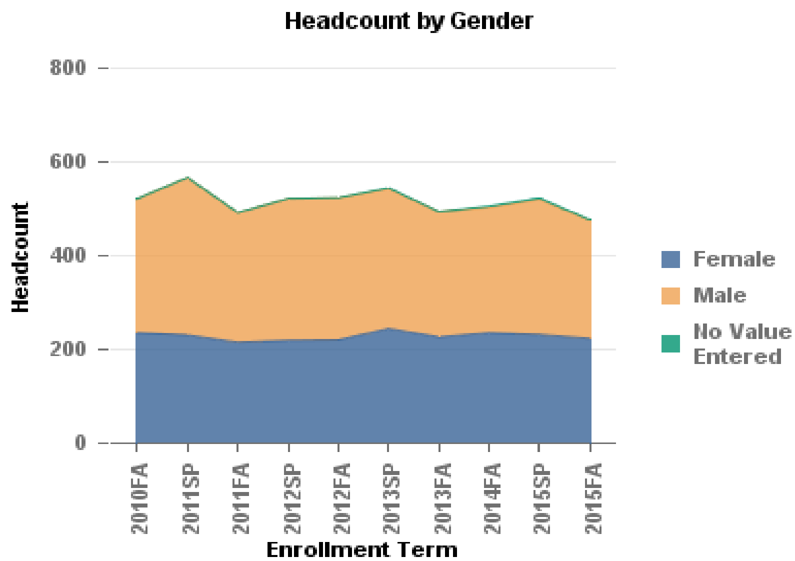
Completion rate has been reported at the 84.5% ± 2.3% level, while success rate is at the 69.0 % ± 3.5 % level. The reported success rate matches similar figures presented by the Engineering Department (70%), indicating an equivalency between our two departments. In other words, our Physics 4-series serves students majoring in Computer Sciences and Engineering, and the directions we envision to our program will directly impact these departments.

4. (data) Identify current student demographics. If there are recent changes in student Demographics, explain how the program is addressing these changes

Seat Count and Headcount by Gender



Male enrollment is still predominant in our program



Headcount by gender shows similar trends as the seat count by gender data.

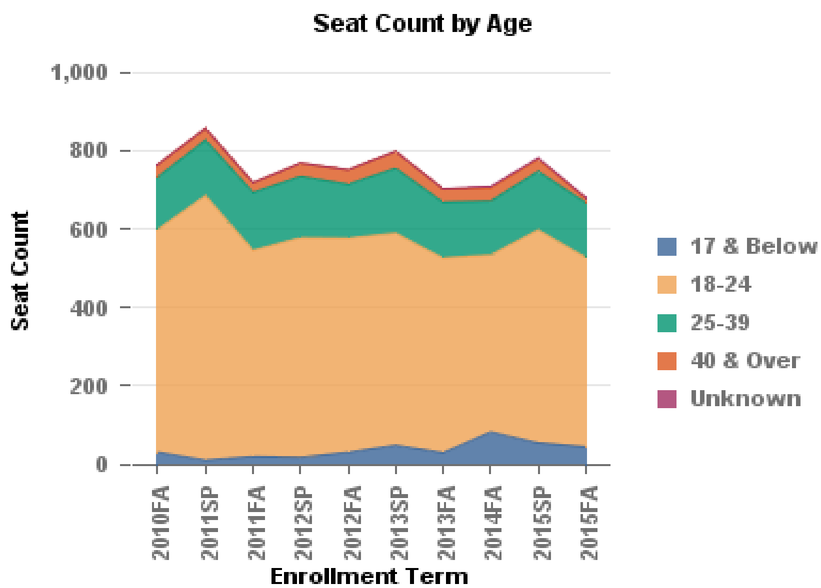
The last 5 years have observed very little change in this category, and we report the traditional predominance of males (12%) above female students. The STA has attempted to meliorate these ratings by attracting high school female students to advanced research, having so far obtained modest results. In the 2016 academic year, the STA mentored high school students of Evergreen and Overfelt High Schools. The pool had 23 % female students (see GAVRT picture above: 3 female and 10 male students). Out of these, we currently orient three students; two are female.

Once we include the STA in our college budget, we expect to formalize the “Advanced Lab in Physics and Astronomy” and promote field trips to advanced and technical laboratories in the Bay Area, recruiting students from local high school, particularly female students.

Seat and Headcount by Age Groups

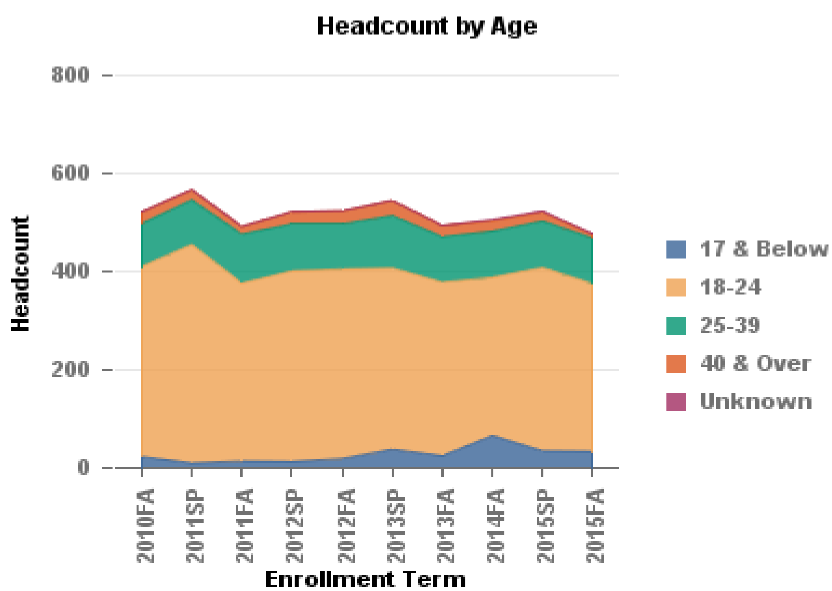
During the last 5 years very little has changed in this category. Between spring and fall 2015 there was a slight decrease in all age groups, except in the high school cohort. This can be explained in terms of more job opportunities in an improved economy, affecting more directly the older student population, in addition to efforts done by the college and our Space Technology Academy to attract high school students to our program.

The graphs also indicate interesting figures to dive in. Student headcount indicate a 56% ± 2.3% of males versus 44% ± 2.1% of females (similar percentages in seat count). Asian-Vietnamese students represent the majority of our enrollees, 20.6% ± 2.3%, followed by Hispanic at the 10.7% ± 2.2% level.



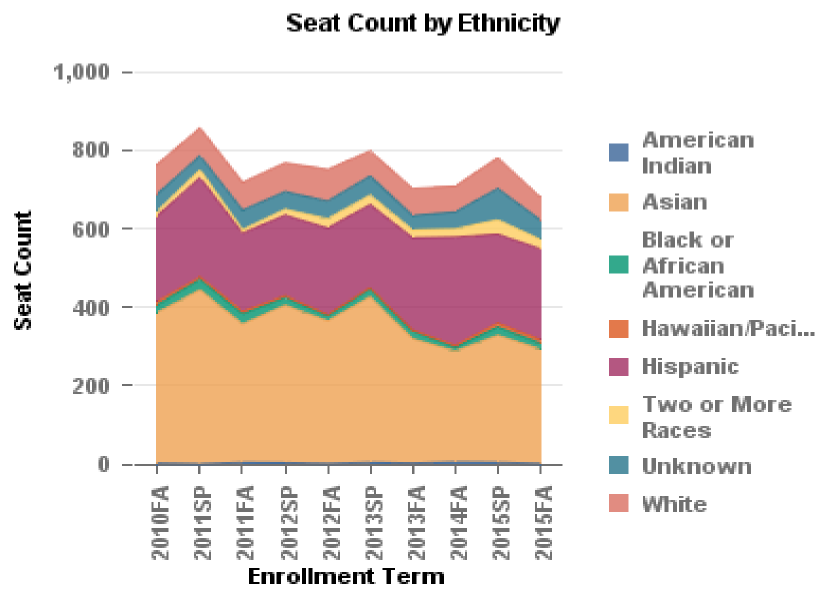
Seat count indicates a majority of young adults, as expected in a community college population.

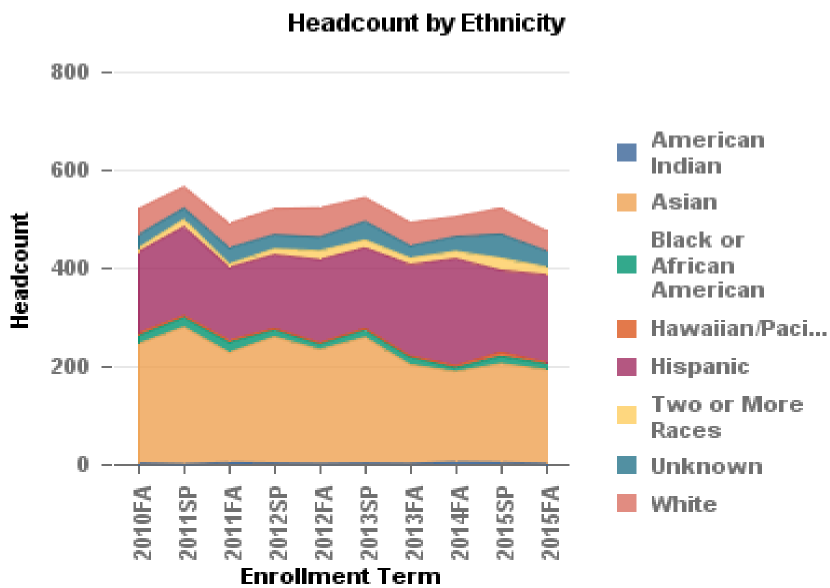
We commented on the decline of the success rate observed in fall 2015, which is here illustrated in seat and headcount drops. It is significant though, to notice the slight increase in high school enrollment, indicating the importance of keeping communications with high schools open via methods such as "Academy Connection" and others.



A similar increase in high school enrollees is observed in headcount by age, indicating the positive outcome of outreaching to talented high school students.

Seat Count and Headcount by Ethnic Groups





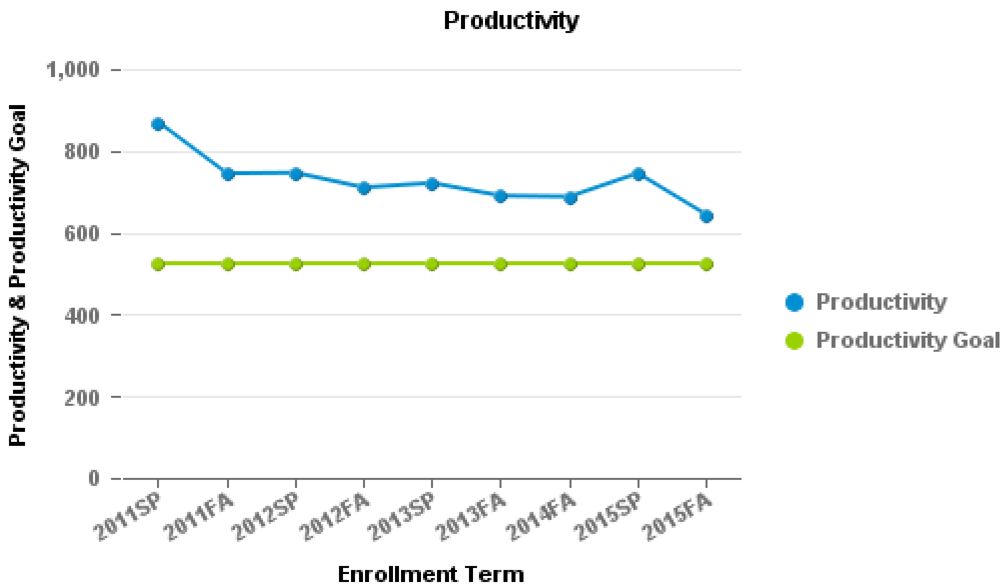
Seat Count and Headcount by ethnic groups reports no major changes as in previous reports. Efforts should be implement to increase the population of African American in our courses.

We do not report major changes in seat and headcount enrollment of different ethnic groups with respect to previous reviews. We do emphasize the negligible enrollment of African Americans in our courses, which demands special attention. The STA is partnering with AFFIRM at EVC on a project to reach out to African American high school students who might get their interests in science sparked by Astronomy or Physics. We plan on creating an “early alert” program within the Physics Department and, if possible, follow closely the academic progress of students in this ethnic group.

6. Identify department/program productivity (WSCH/FTEF).

Department Productivity

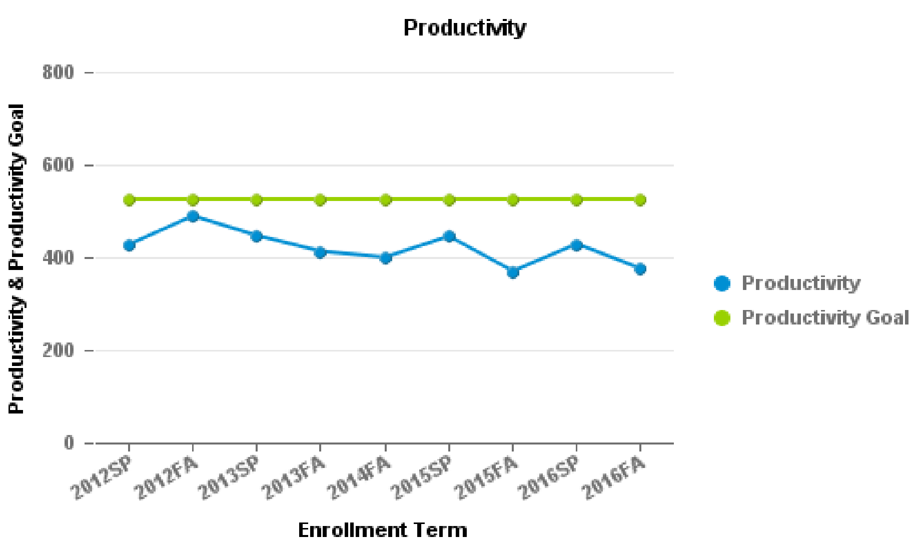
Astronomy Productivity



Astronomy productivity is above the college threshold.

Enrollment in Astronomy courses has been steady over the past 5 years, with only a slight decline in the fall 2015 semester. Even so, the productivity is well above EVC goals, and should remain so in the coming years.

Physics Productivity



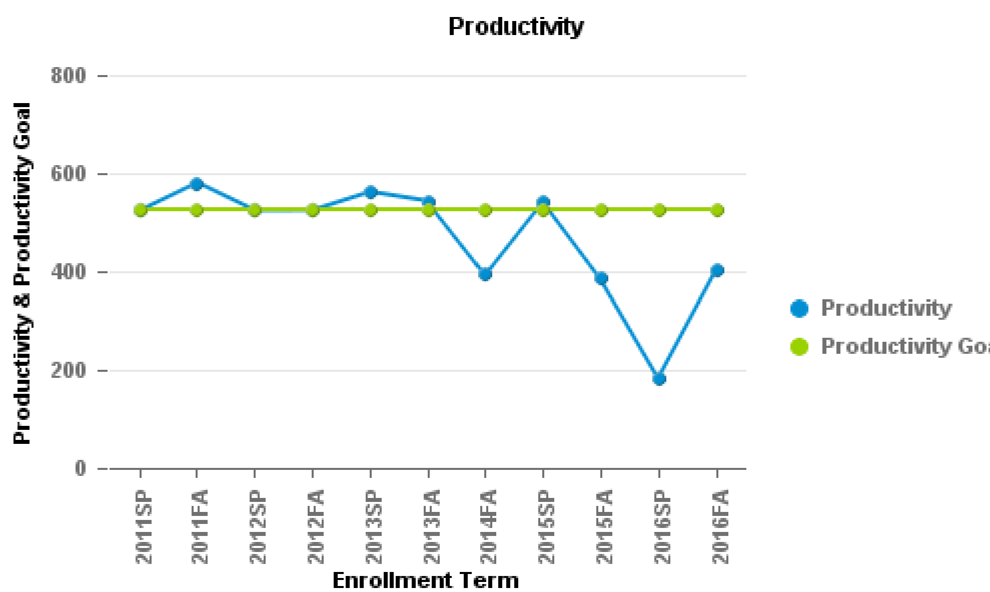
Trend of physics productivity.

Physics courses have the reputation for being among the most challenging courses in college, and even math majors often find their grades plummeting from A's to C's. As a result, the productivity of physics courses falls short of the college goal. It could be argued that the college goal is unrealistic for courses such as these. The trend also contrasts with the Astronomy trend which is well above the college goals.

The trend of our physics courses has been on a downward mode since the “highs” observed in fall 2012, partly due to the recovering economy. Even as the enrollment fell, the department did its best to maintain sections in an effort to meet different schedules. The department works with the understanding that the AS-T degree will draw more graduates into our courses. We will introduce two measures to help reversing the trend of low productivity by boosting student performance. They are:

- Initiate early-alert initiatives in physics – this will be done in addition to the college “early-alert” program, and will require the participation of all our adjuncts. We plan on discussing this issue in 2017 department meetings, and establish an action plan for the 2018 academic year.
- Create academic online tutoring modules that can be used by students in risk of failing. These are YouTube videos with specific instructions complementing work done in class. We plan on discussing this issue in 2017 department meetings, and establish an action plan for the 2018 academic year.

Earth Sciences Productivity



Productivity of Earth Sciences

The course Earth Sciences PHYSC 012 was consistently within college productivity levels until we changed its load in 2014 to a 3.0 hours lecture a week, in lieu of 2.0 hours. There is a noticeable fall in productivity after. We suspect the increasing load has driven the fall, as the course shifted from its original hands-on profile to a more physical sciences oriented course. We will monitor this trend in productivity, and maybe re-evaluate our prior decision, re-instating the original load.

7. If the program utilizes advisory boards and/or professional organizations, describe their roles.

This is not applicable to Physical Science Programs.

PART B: Curriculum

1. Identify all courses offered in the program and describe how the courses offered in the program meet the needs of the students and the relevant discipline(s).

The Astronomy program offers two descriptive GE courses — ASTRO 010 and ASTRO 010L — designed to explain the workings of science and the scientific method. They are complemented by the courses ASTRO 014 and ASTRO 016, both extending the reach of ASTRO 10 into Solar System, and Stars, Galaxies and the Universe respectively. In part because of their GE status, they are heavily sought by non-science majors to fulfill their requirements. They meet the mission college of providing students with skills to communicate and exercise reasoning when dealing with real world processes.

The Physics program centers in two broad groups with a trigonometry-algebra based sequence consisting of PHYS 002A and PHYS 002B, and a calculus based sequence consisting of PHYS 004A, PHYS 004B, and PHYS 004C. Bio students, such as those on track in Kinesiology and Nursing, will enroll in the algebra-trig sequence, whereas engineers, computer scientists, medical doctors, microbiologists will choose the calculus sequence. Students completing these courses will develop skills enabling them to communicate technical information in a reasonable and logical way, and to exercise critical thinking when facing situations.

These two sequences are complemented by an introductory conceptual physics course PHYS 0001 and earth sciences PHYSC 012. As introductory courses and serving primarily the students needing a science-based course with lab, they are structured to provide students with skills to communicate science and use the scientific method when dealing with real world situations.

Listed below are contracted courses SLO's as in 2017 for Physics and Astronomy:

With the exception of ASTRO 014 and ASTRO 016 courses, all Physics and Astronomy courses have updated SLO's, and here they are listed below. As explained in Part B — 4, ASTRO 014 and ASTRO 016 will be updated in 2017, and submitted to the EVC curriculum committee in Fall 2017.

<u>Astro 10</u>

a. Effectively communicate astronomical concepts such as the Big Bang Theory, evolution of the universe, the laws of physics, the relationship of astronomy to civilization, and techniques employed in retrieving physical properties of celestial systems.
b. Analyze astronomic processes and use evidence, sound reasoning, and the scientific method to analyze astronomic problems.
c. Explain astronomic processes including processes related to apparent shift of constellations, telescopes and light detection, astronomical cycles, comparative planetology, stellar variability, and interaction of galaxies.
d. Describe the major components of the solar system, the Milky Way Galaxy, and their interactions with each other.
e. Explain the evolution of an astronomical system, such as the formation and evolution of star systems

Astro 10L

a. Use astronomical instruments to measure stellar properties and planetary motion, employing mathematical analysis and graphics to explain phenomena (CLC all).
b. Describe how knowledge derived from modern astronomy has positively impacted society and changed people's view of the Universe and life (CLC 2a/2e/3b/3c/3d/3e)
c. Explain the origins of atoms — the building blocks of nature — by listing the cosmological, stellar, or artificial processes responsible for their formation (CLC 3b/3c/3e)
d. Explain the three major cyclic motions Earth is subject to, and identify all forces governing these motions (CLC 1a/1c/2a/2f).
e. Apply the scientific method to explain situations developed in the laboratory, such as the interaction of light with matter, or production of images with different arrangements of lenses, or interpretation of light fluctuation from celestial sources (CLC all).
f. Identify the evolutionary phase of a star using its location on a Hertzsprung-Russel diagram (CLC 3a/3b/3c).

Two Astro 10L sections participated in the SLO assessment with a total of 32 students. SLO grading can be summarized as follows:

a. Distinguish between linear, rotational, and wave motions
b. Explain Newton's laws of motion
c. Formulate the principles of conservation of momentum and of energy
d. Describe the law of universal gravitation and the motion of satellites
e. Relate the properties of matter to their physical states
f. Describe temperature, heat, heat transfer and phase change
g. Apply descriptively the laws of thermodynamics
h. Explain the properties of waves, including sound and light waves
i. Apply the basic principles of electrostatics, electric current, and electromagnetism to everyday phenomena
j. Explain the reflection and refraction of light
k. Discuss the origin of radioactivity, radioisotope dating, and half-life
l. Implement the scientific method towards the design of scientific experiments and towards solving everyday practical problems relating to physics

PHYS 002A

a. Apply kinematic equations to predict the motion of a uniformly accelerated object. (C-ID 1)
b. Apply Newton's laws of motion to solve problems involving multiple forces acting on an object. (C-ID 2)
c. Formulate and solve mechanics and thermodynamics problems using the law of conservation of energy. (C-ID 3)
d. Present experimental findings in a scientific manner, using critical thinking and logic. (all C-ID)
e. Analyze static and rotating systems using concepts of torque and angular acceleration. (C-ID 4)
f. Collect, and analyze experimental data using appropriate units, significant figures, and estimating error propagation. (all C-ID)

PHYS 2B

a. Calculate the electric field and electric potential produced by a simple charge distribution.
b. Calculate magnetic fields produced by simple current distributions, and predict electric potential induced by varying magnetic flux.
c. Determine the trajectory of a charged particle moving in a region permeated by electric and magnetic fields.
d. Calculate voltages, currents, and power dissipated in different components of an AC/DC circuit.
e. Calculate location and size of images formed by mirrors and lenses.
f. Analyze the phenomena of interference and diffraction in optics, predicting patterns produced by different types of slits.
g. Discuss how Quantum Mechanics and Relativity changed our views of the natural world.

PHYS 4A

a. Solve problems involving accelerated motion using equations of kinematics. (EVC all)
b. Predict the position and velocity of an object if all external forces acting on it are known. (EVC 1,2,3,4,8)
c. Predict the position and speed of an object subjected to conservative and non-conservative forces. (EVC 4)
d. Analyze the motion of rolling and spinning masses. (EVC 6,8)
e. Employ the principle of the harmonic oscillator to solve more complex systems such as vibrating molecules. (EVC 7)
f. Apply the concepts of gravitational force and potential energy to predict the trajectory of objects. (EVC 8)
g. Apply Archimedes law to calculate the fraction of a floating object partially submerged. (EVC

PHYS 4B

a. Solve real world problems involving electricity and magnetism.
b. Calculate electric fields and electric potentials produced by simple charge distributions.
c. Apply the principle of conservation of energy to determine the trajectory of a charge moving in an electric and magnetic fields.
d. Determine voltages, currents, and power dissipated in different components of an AC/DC circuit.
e. Calculate the induced voltage generated by simple distributions of varying currents and moving magnets.

PHYS 4C

a. Solve real world problems involving propagation of light and heat. C-ID # 1; Lab #1
b. Predict the transfer of heat among materials. C-ID Lab # 2
c. Analyze the physical propagation of light through different media, by drawing light ray diagrams characteristics of reflection and refraction. C-ID # 1; Lab #1
d. Analyze the phenomena of interference and diffraction in optics, predicting patterns produced by narrow slits: single, double and multiple. C-ID # 2; Lab #1
e. Explain how Relativity and Quantum Mechanics changed our view of the physical world. C-ID # 3, 4

PHYSC 012

a. Apply the scientific method to formulate solutions to real world situations, using critical thinking and logical reasoning (C-ID lec 1; C-ID lab 1,4,5)
b. Describe direct and alternate pathways within the rock cycle (C-ID lec 2,3; C-ID lab 1,2,5)
c. Explain the main tenets of the Plate Tectonics Theory, indicating the variety of geologic features arising from plates interactions (C- ID lec 2,4; C-ID lab 1, 3,4)
d. Explain the workings of Earth's major cycles such as the rock, carbon, hydrologic, and salt cycles, listing examples of their interactions and interdependencies (C-ID lec 1,2; C-ID lab 1,3,5)
e. Explain the differences between weather and climate, and formulate scientific explanations to data indicating changes in the climate and weather systems (C-ID lec 1,3,4,5; C-ID lab 1,3,4,5)
f. Use scientific language and mathematical tools to express physical quantities, increment rates, and extrapolations (C-ID lec 5; C-ID lab 1,5)
g. Explain how Solar System objects such as the Sun, Moon, asteroids and others affect the Earth's biosphere and its climate (C-ID lec 1; C-ID lab 1)

We are currently revising the ASTRO 014 and ASTRO 016 course outlines to incorporate laboratory activities while maintaining the same credit units (3) as required in the General Studies degree with emphasis in Astronomy.

2. All course outlines in this program should be reviewed and revised every six years. If this has not occurred, please list the courses and present a plan for completing the process, including timelines and dates for each course.

- A Physics 004A revision is awaiting approval by the state.
- The courses ASTR 0014 and ASTRO 0016 will be revised and upgraded with the inclusion of a lab component. New course outlines are currently under development, and we plan submission in fall 17.
- The course PHYS 001 has too many SLO's and need to be revised. A new course outline is currently under development, with submission in fall 17.
- The course PHYSC 0012 needs revision in its structure and petition to a C-ID number. A series of recommendations were passed by the referee, and are being implemented for a final submission to the college curriculum committee in fall 2017. We noticed a fall in productivity after increasing the course weekly load to 3 hours, which might lead us to revise our decision to raise the weekly course load.
- All other physics and physical science courses have been updated based upon the schedule maintained by the EVC Curriculum Specialist.

3. 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?

Students' open-ended science projects — We introduced group open-ended science projects in our physics courses to give students the ability of exercising their curiosity and creativity designing experiments that would explore how forces act, how light interact with matter, how different forms of energy propagates in different media — all real world situations occurring outside the laboratory walls. This enterprise is still in baby phase, but we think it will became an integral part of learning physics in the future, when professors will recycle themselves by participating in the unfolding of students ideas. Part of this initiative is based on ideas explained in the STA project: real understanding of science processes can only be achieved when the individual — after acquiring core learning from books and professors — is left free to exercise their right to innovation and creation.

Video Capturing the Real World with Cell Phones — Some of the current physics labs such as free-fall, projectile motion, conservation of momentum and energy are being developed with student mobile devices capturing the action of falling, or throwing objects up in the air, and others. Our participation in a workshop for Physics teachers in Arizona, opened a new door for student learning as they develop physics experiments using their mobile devices. While some professors are trying to promote a ban on the use of cell phones during class hours, we say: “Don’t forget to bring them next time!”… No need to purchase expensive cameras and software: students of all economic status have them. The results have been amazing and the students love to see them on action during experiments.

Free Text Books for Students — The physics and astronomy departments are currently adopting fantastic instructional books, but they are expensive. Although some students receive book vouchers while others easily try downloading an entire ebook for free, there are always a small percentage of students requesting extensions of homework deadlines as they struggle to finalize their book order. This uncertainty is fatal in the short term summer section when missing two weeks of interaction with adopted book is translated into failure in the first midterm. The Openstax initiative (https://openstax.org/subjects/science) is led by Rice University and supported by various foundations. Openstax has produced quality college books for free, and has released an Astronomy book and a calculus-based sequence in fall 2016. We already adopted their algebra-based college physics a couple of years ago. We will be adopting these books beginning in fall 2017, saving the students big cash, but more importantly, allowing them to get ready for college on the very first week of classes without infringing any copyrights agreements. It is true that we, professors, will be forced to adapt to a new book and do some background prep work. Since the book is online and free, we will investigate if this format can be incorporated into our Canvas course management.

4. Discuss plans for future curricular development and/or program (degrees & certificates included) modification. Use a Curriculum Mapping form as needed.

The formalization of the STA will integrate STEM research in the community colleges curricula, which will impact the General Studies with Emphasis in Astronomy degree after new courses are implemented. In particular the Elements of Research I and Elements of Research II (ER 20 and ER 22, respectively) will receive incoming high school students once they have completed recommended courses at EVC. Currently, the required 20 hours are distributed as follows:

Major Area of Emphasis: Credit Hours: (20 Required)

ASTRO 010	Introduction to Astronomy	3.0
ASTRO 010L	Introductory Astronomy Lab	1.0
ASTRO 014	Solar System Astronomy	3.0
ASTRO 016	Stars, Galaxies, and the Origin of the Universe	3.0
PHYS 004B	General Physics	5.0
PHYS 004C	General Physics	5.0

We will incorporate the ER 20 (1 credit hour), two semesters of ER 22 (1 each), and Introduction to Astrobiology (3) into this degree, and redesign Astro 014 (3) and Astro 016 (3) with the introduction of labs. Remove ASTRO 010 and ASTRO 10L, which will still serve for the non-science-major GE clientele.

This degree requires students passing the entire calculus-based series although there are only two courses listed in the major: PHYS 004B and PHYS 004C (PHYS 004A is pre-req of both). As in 2017, the district calculus based sequence carry 5 credit units, but an investigation on the reduction of each of these courses to a 4 credit units is underway. A quick survey among neighboring community college districts holding transfer agreements with CSU and UC, show that a reduction in hours/week is totally feasible. Below is an excerpt from the College of San Mateo physics catalogue outlining the requirements of its sequence for beginners:

> *Physics 250-260-270 constitute a three-semester program designed to give student majoring in Engineering, Physics or Chemistry a thorough foundation in the fundamentals of physics. Students in other majors should consider Physics 210-211-220-221 sequence.*
> *PHYS 250 Physics with Calculus I (4 units)*
> *PHYS 260 Physics with Calculus II (4 units)*
> *PHYS 270 Physics with Calculus III (4 units)*

Some tweaks might need to be executed for students transferring to UC, perhaps developing a math prep course designed specifically for students transferring to UC.

After these changes are introduced in current course outlines, the new major area of emphasis will be:

ASTRO 014	Solar System Astronomy	3.0
ASTRO 016	Stars, Galaxies, and the Origin of the Universe	3.0
ASTRO 018	Introduction to Astrobiology	3.0
ASTRO 020	Elements of Research I	1.0
ASTRO 022	Elements of Research II (2x)	2.0
PHYS 004B	General Physics	4.0
PHYS 004C	General Physics	4.0
	Total Credit Units	20.0

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

Official articulation with high schools and universities are not formalized yet within the STA, but initial contacts have been established with several institutes. The piloting phase of the STA once implemented, will establish an ensemble of landmarks forming the supporting nodes of a major network that includes district middle and high schools, community-driven children groups, citizen science associations, astronomy amateur clubs, home schooling, county foster care, and others. Some of these external partners have already been contacted and they have demonstrated interest in supporting the initiative, and they are:

1) District school system: The following school Principals or Vice — Principals were contacted in 2015-2016 academic year, showing interest in partnering with the STA project: Overfelt High School, Evergreen High School, Mount Pleasant High School, Yerba Buena High School, Jose Hernandez Middle School, Alvarado Blanca Middle School, Chaboya Middle School, and Ocala Middle School. With the participant high schools, we will consolidate astronomy and physics clubs and pre-screen students to attend or to pilot courses we are in the process of developing, engaging the in actual research.

With participant middle schools, we will introduce innovative STEM curricula (NASA Educational Resources — example: The Space Math — I), use NASA astronomy curricula as a tool to expose science to middle schoolers, and partnering them with high school mentors. Allow the children to control the GAVRT radio antenna and participate on regular field trips to the Montgomery Hill Observatory. Online-based mentoring organizations such as the "Learn to be Foundation" will monitor the tutoring of underrepresented middle school children.

2*) Various community groups:* several communicating avenues can be open such as: a) Astronomy Amateur clubs and science citizen associations: These are the natural partners of STA, and the San Jose Astronomical Association is one of the largest. b) Foster care organizations: We contacted the Santa Clara KAFPA (Kinship, Adoptive & Foster Parent Association) to initiate partnership once the grant is approved. c) One-on-one mentoring through the Learn to Be Foundation, and participation of the child in field trips and inflatable planetarium curricula might lead to a new career option to some of these youngsters.

The recruiting work and mentoring done along the K-14 school years have the unique goal of equipping undeserved minors with science skills that will help keeping them to pathways leading to a PhD in a STEM field, once completing their sophomore academic year, or when finalizing transfer from a community college. Astronomy departments of several Universities have been contacted, and one of their professors is a Co-PI in this endeavor. These universities and respective chairs have provided encouragement, ideas, and interest in seeing this project launched: UC-Santa Cruz (Dr, Enrico Ramirez-Ruiz), Cal-Poly (Dr. Alex Rudolph), SJSU (Dr. Michael Kaufman), and EBSU (Dr. Amy Furniss), SSU (Dr. Vera Margoniner) and UC Davis (Dr. David Wittman). We carry a formal letter of support of Dr. Enrico Ramirez-Ruiz, chair of the Astronomy Department of UC Santa Cruz. e) Private Tech Firms or Labs — EVC is located in San Jose, which lies in the core of Silicon Valley and access to private firms is a must.

Among the partnerships already in place, online based tutoring projects such as the Learn to be Foundation will provide the necessary academic support and incentive usually lacking for underrepresented population. Children served by the foundation must have access to a computer and internet, unless after school programs can be structured. Once some of these children reach the junior level in high school, they will be direct to academic programs already in place in most of the community colleges, and for that, they need to be community college students, and for that, we tailored the courses Elements of Research I, and Elements of Research II (ASTRO 020 and ASTRO 022 respectively).

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

This section is not applicable to the Physical Science program.

PART C: Student Learning Outcomes and Assessment

1. On the program level, defined as a course of study leading to a degree or certificate, list the Program Learning Outcomes (PLO), and how they relate to the GE/ILOs (link to ILOs). If you are completing this program review as a department or discipline and do not offer any degrees or certificates, please disregard this question.

The Astronomy and Physics departments hold a General Studies with Emphasis in Astronomy degree and an Associate in Science for Transfer degree in Physics. Below is listed their respective program learning outcomes and assessment criteria.

General Studies degree in Astronomy PLO's:

- Demonstrate effective use of the language when communicating scientific information, using methodological skepticism to scrutinize knowledge and to formulate opinions about world situations
- Analyze data collected in laboratory experimentation and formulate predictions using computer technology, mathematics, and consistent significant figures
- Solve problems representing real world situations using classical and/or modern physics
- Demonstrate understanding of the scientific method, by clearly identifying its use in current scientific developments, and in historical scientific revolutions
- Show personal responsibility and social awareness by exercising ethical leadership and balanced critique of new scientific developments and public affairs

Results of the 2016 assessments are given in the table below and on the following pages

Program: General Studies with Emphasis in Astronomy

Date: March 23, 2012

		Program SLOs	Assessment Plan for each Program SLO	Program Courses									Analysis/Action Plan and Timeline
				Course	Course	Course	Etc.						
Add	SLO #1	Demonstrate effective use of the language when communicating scientific information, using methodological skepticism to scrutinize knowledge and to formulate opinions about world situations ILO: Communication	In 2014 we implemented a comprehensive use of scientific notation, proper count of significant figures, and simple data processing during laboratory time. Laboratory modules were changed to allow direct grading	Astro 016 I	PHYS 00 M	PHYS 00 M	PHYS 00 M	Astro 10 D	Astro 10L D	Astro 14 I			This PLO was introduced in 2014, assessed in fall 2015 in Physics courses listed, and routine assessment became incorporated into all physics labs. Use of scientific language and communication skills were done in all lab section s of Physics 4A/4B/4C in fall 2015, with a total of 53 students scoring 87%. Lab equipments were updated in spring 2016, and critical thinking assessments consisting of video analysis and group project development were introduced, allowing professors measuring this PLO routinely. It will be reassessed in fall 2016. All four listed courses had course outline updated. Astro 14 and Astro 16 courses are being revised to include a lab component to the lecture setting, and reducing the number of lecture hours from 3 to 2 hours. This change aims at facilitating interactions between Astronomy majors and professors at Montgomery Hill Observatory. Astro 10 and Astro 10L courses have been routinely assessed, and will be reassessed in fall 2016
Add	SLO #2	Analyze data collected in laboratory experimentation and formulate predictions using computer technology, mathematics, and consistent significant figures ILO: Communication ILO: Inquiry and Reasoning	Laboratory work is completed during scheduled lab using computer and software for data analysis. Students are required to present results in scientific format and are graded with a rubric scale (0-5)	ASTRO 0 I	PHYS 00 M	PHYS 00 M	PHYS 00 M	Astro 10 D	Astro 10L D	Astro 14 I			This PLO was introduced in 2014, assessed in fall 2015 in Physics courses listed, and routine assessment became incorporated into all physics labs. Lab equipments were updated in spring 2015, and critical thinking assessments consisting of video analysis and group project development were introduced, allowing professors measuring this PLO routinely. All four listed courses had course outline updated. Students in PHYSC 012 are not science majors, and have hard time mastering the language and ways of science, specially when presenting lab results formally. Inquiry and Reasoning was assessed with a grading scale (0-5) based on answer students provided on lab handouts. ILO Communication was assessed on project reports completed at the end of semester and presented to the class. Last assessment delivered in fall 2015 gave group scorings above 84% class average (24 students). Astro 14 and Astro 16 courses are being revised to include a lab

Program: General Studies with Emphasis in Astronomy

		Program SLOs	Assessment Plan for each Program SLO	Program Courses: Course	Course	Course	Etc.						Analysis/Action Plan and Timeline
													component to the lecture setting, reducing thereby the number of lecture hours from 3 to 2 hours. This change aims at facilitating interactions between Astronomy majors and professors at Montgomery Hill Observatory. Astro 10 and Astro 10L courses have been routinely assessed.
Add	SLO #3	Solve problems representing real world situations using classical and/or modern physics ILO: Inquiry and Reasoning	Laboratory work is completed during scheduled lab using computer and software for data analysis. Students are required to present results in scientific format and are graded with a rubric scale (0-5)	PHYS 00 M	PHYS 04B M	PHYS 04C M							This PLO was introduced in 2014, assessed in fall 2015 in Physics courses listed, and routine assessment became incorporated into all physics labs. Use of scientific language and communication skills were done in all lab section s of Physics 4A/4B/4C in fall 2015, with a total of 53 students scoring 87%. Lab equipments were updated in spring 2016, and critical thinking assessments consisting of video analysis and group project development were introduced, allowing professors measuring this PLO routinely. It will be reassessed in fall 2016. All four listed courses had course outline updated. Astro 14 and Astro 16 courses are being revised to include a lab component to the lecture setting, and reducing the number of lecture hours from 3 to 2 hours. This change aims at facilitating interactions between Astronomy majors and professors at Montgomery Hill Observatory. Astro 10 and Astro 10L courses have been routinely assessed, and will be reassessed in fall 2016
Add	SLO #4	Demonstrate understanding of the scientific method, by clearly identifying its use in current scientific developments, and in historical scientific revolutions ILO: Comunication ILO: Inquire and Reasoning	Laboratory work is completed during scheduled lab using computer and software for data analysis. Students are required to present results in scientific format and are graded with a rubric scale (0-5)	PHYS 00 M	PHYS 04B M	PHYS 04C M	Astro 10 D	Astro 10L D	Astro 14 I	Astro 16 I			This PLO was introduced in 2014, assessed in fall 2015 in Physics courses listed, and routine assessment became incorporated into all physics labs. Use of scientific language and communication skills were done in all lab section s of Physics 4A/4B/4C in fall 2015, with a total of 53 students scoring 87%. Lab equipments were updated in spring 2016, and critical thinking assessments consisting of video analysis and group project development were introduced, allowing professors measuring this PLO routinely. It will be reassessed in fall 2016. All four listed courses had course outline updated. Astro 14 and Astro 16 courses are being revised to include a lab component to the lecture setting, and reducing the number of lecture hours from 3 to 2 hours. This change aims at facilitating interactions between Astronomy majors and professors at Montgomery Hill Observatory. Astro 10 and Astro 10L courses have been routinely assessed, and will be reassessed in fall 2016

Program: General Studies with Emphasis in Astronomy

Add	SLO #5	Show personal responsibility and social awareness by exercising ethical leadership and balanced critique of new scientific developments and public affairs ILO: Inquiry and Reasoning ILO: Social Responsibility	Laboratory work is completed during scheduled lab using computer and software for data analysis. Students are required to present results in scientific format and are graded with a rubric scale (0-5)	ASTRO 1 I									Project developed by ASTRO 10L students on Climate Change (greenhouse effect) bring students to question core values of our society, bringing awareness on social issues. Grades received by students at the end of the semester will be based on project report and project presentation. Our action plan is to introduce this SLO in spring 2017, exploring similar greenhouse effects in other planets such as Venus and Mars. Re-assessment is scheduled on fall 2017.

(Click the Add button to continue grid for each Program SLO)

This PLO was introduced in 2014, assessed in fall 2015 in all calculus-based Physics courses, and routine assessment became incorporated into our physics labs, in the subject of error propagation. Use of scientific language was reinforced in all calculus-based physics lab sections in fall 2015, with a total of 53 students scoring 87%. Lab equipment was updated in spring 2016, and critical thinking assessments consisting of video analysis and group project development were introduced, allowing professors to measure this PLO routinely. It was reassessed in fall 2016 but results were biased, and therefore disregarded. Student participants in the assessment did not receive “incentives to do well”, and performed poorly with averaged near guess work. PLO’s will be reassessed in spring 2017 and intervention attempted in fall 2017.

Astro 10, and PHYS 4A/B/C courses have course outline updated. Astro 14 and Astro 16 courses are being revised to include a lab component to the lecture setting, reducing the number of lecture hours from 3 to 2 hours. This change aims to facilitate interactions between Astronomy majors and professors at Montgomery Hill Observatory.

AS-T degree in physics PLO's

- Identify all of the physical quantities in a problem, and define the steps to model and solve real world problems
- Use inductive and deductive reasoning to analyze evidence to arrive at logical conclusions
- Demonstrate proficiency in assembly of experimental apparatuses to conduct and analyze measurements of physical phenomena
- Assess experimental uncertainty to aid in making meaningful comparisons between experiment and theory

Results of the 2016 assessments are given in the table below and on the following page:

Program: AS-T Physics

Date: 11/20/2015

	Program SLOs	Assessment Plan for each Program SLO	Program Courses: Course	Course	Course	Etc.					Analysis/Action Plan and Timeline
Add SLO #1	Identify all of the physical quantities in a problem, and define the steps to model and solve real world problems ILO: Inquiry & Reasoning	In spring 2016, we made an effort bringing all physics professors to agree in creating a common assessment tool consisting of three multiple choice questions for each of the courses SLO's. For instance, PHYS 4A has 21 questions, and PHYS 4B and 4C have 15 questions each. These questions will be embedded in these courses final exam at the end of fall 2016, when data will be collected.	PHYS 00 D	PHYS 00 M	PHYS 00 M						Following up on data from SLO#1 data published in Fall 2015, the MSE Division made major effort to modernize equipments for the Physics lab, as this modernization was urgently requested in previous Program Review - Physical Sciences published in 2011. In spring 2016, we redesigned most of the PHYS 4A/4C labs, making them more inquire-based than previously conceived, re-wrote course SLO's, and hired a new full time faculty for the Physics Department. Several labs modules are now using video analysis, and students are required to create and present an independent project where SLO's #2,3,4 will be assessed for the first time in fall 2016. In addition, a series of conceptual multiple choice questions were developed by course professors - an assessment similar to the "Force Concept Inventory" or "Energy Inventory". Those questions will be incorporated into all sections of these courses final exams.

Program: AS-T Physics

	Program SLOs	Assessment Plan for each Program SLO	Program Courses: Course	Course	Course	Etc.					Analysis/Action Plan and Timeline
Add SLO #2	Use inductive and deductive reasoning to analyze evidence and arrive at logical conclusions ILO: Inquire and Reasoning	In spring 2016, we made an effort bringing all physics professors to agree in creating a common assessment tool consisting of three multiple choice questions for each of the courses SLO's. For instance, PHYS 4A has 21 questions, and PHYS 4B and 4C have 15 questions each. These questions will be embedded in these courses final exam at the end of fall 2016, when data will be collected.	PHYS 00 D	PHYS 00 M	PHYS 00 M						Following up on data from SLO#1 data published in Fall 2015, the MSE Division made major effort to modernize equipments for the Physics lab, as this modernization was urgently requested in previous Program Review - Physical Sciences published in 2011. In spring 2016, we redesigned most of the PHYS 4A/4C labs, making them more inquire-based than previously conceived, re-wrote course SLO's, and hired a new full time faculty for the Physics Department. Several labs modules are now using video analysis, and students are required to create and present an independent project where SLO's #2,3,4 will be assessed for the first time in fall 2016. In addition, a series of conceptual multiple choice questions were developed by course professors - an assessment similar to the "Force Concept Inventory" or "Energy Inventory". Those questions will be incorporated into all sections of these courses final exams.
Add SLO #3	Demonstrate proficiency in assembly of experimental apparatuses to conduct and analyze measurements of physical phenomena ILO: Inquire and Reasoning	In spring 2016, we made an effort bringing all physics professors to agree in creating a common assessment tool consisting of three multiple choice questions for each of the courses SLO's. For instance, PHYS 4A has 21 questions, and PHYS 4B and 4C have 15 questions each. These questions will be embedded in these courses final exam at the end of fall 2016, when data will be collected.	PHYS 00 D	PHYS 00 M	PHYS 00 M						Following up on data from SLO#1 data published in Fall 2015, the MSE Division made major effort to modernize equipments for the Physics lab, as this modernization was urgently requested in previous Program Review - Physical Sciences published in 2011. In spring 2016, we redesigned most of the PHYS 4A/4C labs, making them more inquire-based than previously conceived, re-wrote course SLO's, and hired a new full time faculty for the Physics Department. Several labs modules are now using video analysis, and students are required to create and present an independent project where SLO's #2,3,4 will be assessed for the first time in fall 2016. In addition, a series of conceptual multiple choice questions were developed by course professors - an assessment similar to the "Force Concept Inventory" or "Energy Inventory". Those questions will be incorporated into all sections of these courses final exams.

Add	SLO #4	Assess experimental uncertainty to aid in making meaningful comparisons between experiment and theory ILO: Inquire and Reasoning	In spring 2016, we made an effort bringing all physics professors to agree in creating a common assessment tool consisting of three multiple choice questions for each of the courses SLO's. For instance, PHYS 4A has 21 questions, and PHYS 4B and 4C have 15 questions each. These questions will be embedded in these courses final exam at the end of fall 2016, when data will be collected.	PHYS 00	PHYS 00	PHYS 00							Following up on data from SLO#1 data published in Fall 2015, the MSE Division made major effort to modernize equipments for the Physics lab, as this modernization was urgently requested in previous Program Review - Physical Sciences published in 2011. In spring 2016, we redesigned most of the PHYS 4A/4C labs, making them more inquire-based than previously conceived, re-wrote course SLO's, and hired a new full time faculty for the Physics Department. Several labs modules are now using video analysis, and students are required to create and present an independent project where SLO's #2,3,4 will be assessed for the first time in fall 2016. In addition, a series of conceptual multiple choice questions were developed by course professors - an assessment similar to the "Force Concept Inventory" or "Energy Inventory". Those questions will be incorporated into all sections of these courses final exams.
				D	M	M							

(Click the Add button to continue grid for each Program SLO)

Following up on data regarding the ILO: "Identify all of the physical quantities in a problem, and define the steps to model and solve real world problems" published in Fall 2015 (see description of each course below), the MSE Division made a major effort in modernizing equipment for all physics labs, as this modernization was urgently requested in a previous Program Review. In spring 2016, we redesigned most of the PHYS 4A/4B/4C labs, making them more inquiry-based than previously conceived, and hired a new full time instructor for the Physics Department. Several lab modules are now incorporating video analysis with specific content to help in assessing each of the remaining PLO's in fall 2016. A series of conceptual multiple choice questions were developed by course professors, as we had planned to incorporate these questions in all sections' final exams. We did not coordinate well with adjuncts, and students responded to the assessment without putting in the required effort. The results reflected guesswork, and were disregarded. As indicated previously, we will submit a new series of PLO/SLO questions in 2017.

2. Since your last program review, summarize SLO assessment results at the course and program level (if this is your first program review, please summarize your SLO assessment results over the past 6 years). 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…)

SLO Implementation and Assessment

A major effort in 2013 was established within the division to tag C-ID numbers to articulated courses, and physics was not immune to this effort. We went on redesigning the SLO's in 2014/2015 periods but their assessments were done sporadically. In addition, the creation in this period of an AS-T degree in Physics led us to revise course contents and adopted SLO's of our Physics 4-series, especially complying with the explicit demands of emphasizing modern physics. In astronomy, the courses ASTRO 014 and ASTRO 016 were not offered and assessment could not be completed. As explained elsewhere, both courses are being revised to incorporate a lab. In the realm of ASTRO 010, we modified an assessment inventory name TOAST: Test of Astronomy Standards Survey with questions addressing all of contracted SLO's.

Here are the results of the last reported assessment:

Program level — General Studies with Emphasis in Astronomy Degree

The General Studies with Emphasis in Astronomy Program was designed with the scope of identifying students inclined to embrace physics or astronomy related careers, providing them with a clear gateway for transfer. So far, only one student has graduated from the program and is now at the UCSC Astronomy Department. Although we have an observatory on campus dedicated for education, the Montgomery Hill Observatory lacks basic equipment for astronomy research such as spectrometers and fast detectors (CCD's) to accommodate photometric campaigns. The majority of students taking our popular Astro 10 course are not science majors, and therefore not necessarily interested in diving into a particular STEM field.

We created the ASTRO 14 (Solar System) and ASTRO 16 (Stars and Galaxies) courses to deepen the subject level taught in our ASTRO 10 sections, including specific technicalities related to data taken and data analysis (photometry and spectroscopy). The result was sections offered in danger of being cancelled as the number of students laid below minimum threshold. The courses ASTRO 14 and ASTRO 16 start being offered less frequently, and temporally discontinued. They are now being reformulated to include a laboratory segment, and we expect to relaunch them in the 2018 academic year. We also initiated an update of our lab equipment, including the purchasing of new telescopes, and are now requesting a state-of-the-art spectrometer and CCD. These new instruments, in addition to the opening of "Advanced Labs in Physics and Astronomy" through the Space and Technology Academy, and the formalization of astronomical research with high school students, are expected to create a critical mass of students interested in Astronomy, increasing the number of graduates from this program.

The Matrix so far indicates that students who took the Physics 4-sequence have mastered the ILO's.

Program level — Associate of Science — Transfer (AS-T) Degree

The AS-T Physics Matrix was updated in 2016. We decided to implement all courses SLO's at the end of academic semester, in all sections of a given course, introducing SLO's questions as part of final exam. Low scores in PHYS 4C achieved in May 2015 assessments were interpreted as being governed by the lacking of suitable equipment in optics and thermo-physics. These were purchased, lab modules were created in 2016 and perfected this spring, and a final round of assessments will delivered and analyzed in late spring. All our physics courses were submitted to major upgrades and revision they will be all re-assessed at the end of spring 2017.

Course Level

We decided to measure student learning outcomes by creating two or three multiple choice questions per SLO of a given course, submit this assessment during the first and last week of instructions, and measure success as a positive trend from initial assessment. The basic idea is that the first evaluation would result in scores slightly better than guess work, while the second evaluation would measure student learning if punctuated above the 60% fiducial line. Following suggestions made in a workshop of the "American Association of Physics Teachers", we did not provide student any incentive to perform well in the assessment, no extra credits or grades added to course overall grade. Students did guess work on both assessments and we could not evaluate interventions suggested in previous analysis. We are zeroing our procedures, and establishing a new baseline of SLO assessments in spring 2017, but at this time incorporating the questions on the final exam. Analysis will lead to suggested interventions in the fall 2017 semester, and attempting at closing the loop will be made in spring 2018. Most of the discussion submitted below are based on our last assessment.

Introduction to Physics — PHYS 001

The course is conceptual, and designed to give students an understanding of the workings of science and its modern outcomes. Although we plan on revising this course outline reducing the number of contracted SLO's, the course was assessed in fall 2016 using a survey of 9 questions, one per each SLO. The results are given in the table below:

Course: Phys 001

	Student Learning Outcomes (SLOs) As listed on EVC ACCC Course Outline *"On completion of this course, the student will..."*	Assessment Tool List the tools to assess each SLO (such as rubrics, projects, assignment, survey, etc.)	Evaluation Timeline When will the SLO be assessed?	Assessment Results Summarize collected data including how data were collected and number of students.	Analysis/Action Plan and Timeline What, if any, changes will be made to instruction, or the SLO and when?
Add	SLO #1 Distinguish between linear, rotational, and wave motions ILO - Inquiry and Reasoning	Class received a comprehensive SLO assessment consisting of multiple choice questions designed to assess each of the course SLO's.	Fall 2016	14 students took the survey with class average of 46%. In this SLO, class average was 29%, with is below target goals of 55% +- 5%	Three SLO's in our survey were not assessed and will be revisited in 2017. With respect to the positive assessments - those with data above the fiducial 55% level line - we note that they were performed on subjects extensively demonstrated in laboratory (collisions and momentum - energy conservation, and others), which emphasize the importance of up-to-date lab settings to instruct students . The "guess work" results of SLO # 1 and 10 must be addressed, as they deal with different types of motion and interaction of light and transparent media. There were no specific laboratory exercises developed in class, and this is being fixed in spring 2017. Our understanding is that introductory courses such as PHYS 001 with 2 hours/week of lecture and lab component must be delivered almost entirely out of lab exercises, and assessments and evaluations should be done as a natural outcome of implemented exercises. This course is being revised, number of SLO will be reduced, and the course philosophy will be redesigned.

Course: Phys 001 — Page 3 of 9

		Student Learning Outcomes (SLOs) As listed on EVC ACCC Course Outline *"On completion of this course, the student will..."*	Assessment Tool List the tools to assess each SLO (such as rubrics, projects, assignment, survey, etc.)	Evaluation Timeline When will the SLO be assessed?	Assessment Results Summarize collected data including how data were collected and number of students.	Analysis/Action Plan and Timeline What, if any, changes will be made to instruction, or the SLO and when?
Add	SLO #2	Explain Newton's laws of motion ILO - Inquiry and Reasoning	Class received a comprehensive SLO assessment consisting of multiple choice questions designed to assess each of the course SLO's.	Fall 2016	14 students took the survey with class average of 46%. In this SLO, class average was 52%, with is within the target goals of 55% +- 5%	Three SLO's in our survey were not assessed and will be revisited in 2017. With respect to the positive assessments - those with data above the fiducial 55% level line - we note that they were performed on subjects extensively demonstrated in laboratory (collisions and momentum - energy conservation, and others), which emphasize the importance of up-to-date lab settings to instruct students . The "guess work" results of SLO # 1 and 10 must be addressed, as they deal with different types of motion and interaction of light and transparent media. There were no specific laboratory exercises developed in class, and this is being fixed in spring 2017. Our understanding is that introductory courses such as PHYS 001 with 2 hours/week of lecture and lab component must be delivered almost entirely out of lab exercises, and assessments and evaluations should be done as a natural outcome of implemented exercises. This course is being revised, number of SLO will be reduced, and the course philosophy will be redesigned.
Add	SLO #3	Formulate the principles of conservation of momentum and of energy ILO- Communication ILO- Inquiry and Reasoning	Class received a comprehensive SLO assessment consisting of multiple choice questions designed to assess each of the course SLO's.	Fall 2016	14 students took the survey with class average of 52%. In this SLO, class average was 84%, with is above the target goals of 55% +- 5%	Three SLO's in our survey were not assessed and will be revisited in 2017. With respect to the positive assessments - those with data above the fiducial 55% level line - we note that they were performed on subjects extensively demonstrated in laboratory (collisions and momentum - energy conservation, and others), which emphasize the importance of up-to-date lab settings to instruct students . The "guess work" results of SLO # 1 and 10 must be addressed, as they deal with different types of motion and interaction of light and transparent media. There were no specific laboratory exercises developed in class, and this is being fixed in spring 2017. Our understanding is that introductory courses such as PHYS 001 with 2

Course: Phys 001 — Page 4 of 9

						hours/week of lecture and lab component must be delivered almost entirely out of lab exercises, and assessments and evaluations should be done as a natural outcome of implemented exercises. This course is being revised, number of SLO will be reduced, and the course philosophy will be redesigned.
Add	SLO #4	Describe the law of universal gravitation and the motion of satellites ILO- Communication	Class received a comprehensive SLO assessment consisting of multiple choice questions designed to assess each of the course SLO's.	Fall 2016	14 students took the survey with class average of 46%. In this SLO, class average was 0 %, This SLO and the next (5) where questions 11 and 12 on the survey and students did not mark. SO this SLO was not assessed yet.	Three SLO's in our survey were not assessed and will be revisited in 2017. With respect to the positive assessments - those with data above the fiducial 55% level line - we note that they were performed on subjects extensively demonstrated in laboratory (collisions and momentum - energy conservation, and others), which emphasize the importance of up-to-date lab settings to instruct students . The "guess work" results of SLO # 1 and 10 must be addressed, as they deal with different types of motion and interaction of light and transparent media. There were no specific laboratory exercises developed in class, and this is being fixed in spring 2017. Our understanding is that introductory courses such as PHYS 001 with 2 hours/week of lecture and lab component must be delivered almost entirely out of lab exercises, and assessments and evaluations should be done as a natural outcome of implemented exercises. This course is being revised, number of SLO will be reduced, and the course philosophy will be redesigned.
Add	SLO #5	Relate the properties of matter to their physical states ILO - Inquiry and Reasoning	Class received a comprehensive SLO assessment consisting of multiple choice questions designed to assess each of the course SLO's.	Fall 2016	14 students took the survey with class average of 46%. In this SLO, class average was 0 %, This SLO and the previous (4) where questions 11 and 12 on the survey and students did not mark. So, this SLO was not assessed yet.	Three SLO's in our survey were not assessed and will be revisited in 2017. With respect to the positive assessments - those with data above the fiducial 55% level line - we note that they were performed on subjects extensively demonstrated in laboratory (collisions and momentum - energy conservation, and others), which emphasize the importance of up-to-date lab settings to instruct students . The "guess work" results of SLO # 1 and 10 must be addressed, as they deal with different types of motion and interaction of light and transparent media. There were no specific laboratory exercises developed in class, and this is being fixed in spring 2017. Our understanding is that

						introductory courses such as PHYS 001 with 2 hours/week of lecture and lab component must be delivered almost entirely out of lab exercises, and assessments and evaluations should be done as a natural outcome of implemented exercises. This course is being revised, number of SLO will be reduced, and the course philosophy will be redesigned.This class is conceptual and
Add	SLO #6	Describe temperature, heat, heat transfer and phase change ILO - Inquiry and Reasoning	Class received a comprehensive SLO assessment consisting of multiple choice questions designed to assess each of the course SLO's.	Fall 2016	14 students took the survey with class average of 46%. In this SLO, class average was 0 %, This question assess equaly SLO 6 and SLO 5, and students did not mark it. Therefore, this SLO has not been assessed.	Three SLO's in our survey were not assessed and will be revisited in 2017. With respect to the positive assessments - those with data above the fiducial 55% level line - we note that they were performed on subjects extensively demonstrated in laboratory (collisions and momentum - energy conservation, and others), which emphasize the importance of up-to-date lab settings to instruct students . The "guess work" results of SLO # 1 and 10 must be addressed, as they deal with different types of motion and interaction of light and transparent media. There were no specific laboratory exercises developed in class, and this is being fixed in spring 2017. Our understanding is that introductory courses such as PHYS 001 with 2 hours/week of lecture and lab component must be delivered almost entirely out of lab exercises, and assessments and evaluations should be done as a natural outcome of implemented exercises. This course is being revised, number of SLO will be reduced, and the course philosophy will be redesigned.
Add	SLO #7	Apply descriptively the laws of thermodynamics ILO- Inquiry and Reasoning ILO - Communication	Class received a comprehensive SLO assessment consisting of multiple choice questions designed to assess each of the course SLO's.	Fall 2016	14 students took the survey with class average of 46%. In this SLO, class average was 93%, with is above the target goals of 55% +- 5%	Three SLO's in our survey were not assessed and will be revisited in 2017. With respect to the positive assessments - those with data above the fiducial 55% level line - we note that they were performed on subjects extensively demonstrated in laboratory (collisions and momentum - energy conservation, and others), which emphasize the importance of up-to-date lab settings to instruct students . The "guess work" results of SLO # 1 and 10 must be addressed, as they deal with different types of motion and interaction of light and transparent media. There were no specific laboratory

						exercises developed in class, and this is being fixed in spring 2017. Our understanding is that introductory courses such as PHYS 001 with 2 hours/week of lecture and lab component must be delivered almost entirely out of lab exercises, and assessments and evaluations should be done as a natural outcome of implemented exercises. This course is being revised, number of SLO will be reduced, and the course philosophy will be redesigned.
Add	SLO #8	Explain the properties of waves, including sound and light waves ILO - Inquiry and Reasoning	Class received a comprehensive SLO assessment consisting of multiple choice questions designed to assess each of the course SLO's.	Fall 2016	14 students took the survey with class average of 46%. In this SLO, class average was 64%, with is above the target goals of 55% +- 5%	Three SLO's in our survey were not assessed and will be revisited in 2017. With respect to the positive assessments - those with data above the fiducial 55% level line - we note that they were performed on subjects extensively demonstrated in laboratory (collisions and momentum - energy conservation, and others), which emphasize the importance of up-to-date lab settings to instruct students . The "guess work" results of SLO # 1 and 10 must be addressed, as they deal with different types of motion and interaction of light and transparent media. There were no specific laboratory exercises developed in class, and this is being fixed in spring 2017. Our understanding is that introductory courses such as PHYS 001 with 2 hours/week of lecture and lab component must be delivered almost entirely out of lab exercises, and assessments and evaluations should be done as a natural outcome of implemented exercises. This course is being revised, number of SLO will be reduced, and the course philosophy will be redesigned.
Add	SLO #9	Apply the basic principles of electrostatics, electric current, and electromagnetism to everyday phenomena ILO - Communication ILO - Inquiry and Reasoning	Class received a comprehensive SLO assessment consisting of multiple choice questions designed to assess each of the course SLO's.	Fall 2016	14 students took the survey with class average of 46%. In this SLO, class average was 57%, with is within the target goals of 55% +- 5%	Three SLO's in our survey were not assessed and will be revisited in 2017. With respect to the positive assessments - those with data above the fiducial 55% level line - we note that they were performed on subjects extensively demonstrated in laboratory (collisions and momentum - energy conservation, and others), which emphasize the importance of up-to-date lab settings to instruct students . The "guess work" results of SLO # 1 and 10 must be addressed, as they deal with different types of motion and interaction of light and transparent

						media. There were no specific laboratory exercises developed in class, and this is being fixed in spring 2017. Our understanding is that introductory courses such as PHYS 001 with 2 hours/week of lecture and lab component must be delivered almost entirely out of lab exercises, and assessments and evaluations should be done as a natural outcome of implemented exercises. This course is being revised, number of SLO will be reduced, and the course philosophy will be redesigned.
Add	SLO #10	Explain the reflection and refraction of light IILO - Inquiry and Reasoning	Class received a comprehensive SLO assessment consisting of multiple choice questions designed to assess each of the course SLO's.	Fall 2016	14 students took the survey with class average of 46%. In this SLO, class average was 21%, with is guess work.	Three SLO's in our survey were not assessed and will be revisited in 2017. With respect to the positive assessments - those with data above the fiducial 55% level line - we note that they were performed on subjects extensively demonstrated in laboratory (collisions and momentum - energy conservation, and others), which emphasize the importance of up-to-date lab settings to instruct students . The "guess work" results of SLO # 1 and 10 must be addressed, as they deal with different types of motion and interaction of light and transparent media. There were no specific laboratory exercises developed in class, and this is being fixed in spring 2017. Our understanding is that introductory courses such as PHYS 001 with 2 hours/week of lecture and lab component must be delivered almost entirely out of lab exercises, and assessments and evaluations should be done as a natural outcome of implemented exercises. This course is being revised, number of SLO will be reduced, and the course philosophy will be redesigned.

Add	SLO #11	Discuss the origin of radioactivity, radioisotope dating, and half-life ILO - Inquiry and Reasoning	Class received a comprehensive SLO assessment consisting of multiple choice questions designed to assess each of the course SLO's.	Fall 2016	14 students took the survey with class average of 46%. In this SLO, class average was 93%, with is above the target goals of 55% +- 5%	Three SLO's in our survey were not assessed and will be revisited in 2017. With respect to the positive assessments - those with data above the fiducial 55% level line - we note that they were performed on subjects extensively demonstrated in laboratory (collisions and momentum - energy conservation, and others), which emphasize the importance of up-to-date lab settings to instruct students . The "guess work" results of SLO # 1 and 10 must be addressed, as they deal with different types of motion and interaction of light and transparent media. There were no specific laboratory exercises developed in class, and this is being fixed in spring 2017. Our understanding is that introductory courses such as PHYS 001 with 2 hours/week of lecture and lab component must be delivered almost entirely out of lab exercises, and assessments and evaluations should be done as a natural outcome of implemented exercises. This course is being revised, number of SLO will be reduced, and the course philosophy will be redesigned.
Add	SLO #12					

We created a survey of 3 questions per SLO. Three SLO's in our survey were not assessed and will be revisited in fall 2017. With respect to positive outcomes — those with data above the fiducial 55% level line — we noticed they were performed on subjects extensively demonstrated in laboratory (collisions and momentum — energy conservation, and others), which emphasize the importance of up-to-date lab settings to instruct students. The "guess work" results of SLO # 1 and 10 must be addressed, as they deal with different types of motion and interaction of light and transparent media. There were no specific laboratory exercises developed in class, and this is being fixed in spring 2017. Our understanding is that introductory courses such as PHYS 001 with 2 hours/week of lecture and lab component must be delivered almost entirely out of lab exercises, and assessments and evaluations should be done as a natural outcome of implemented exercises. This course is being revised, number of SLO will be reduced, and the course philosophy will be redesigned.

Introduction to Astronomy — ASTRO 010

Course: Astro 10

		Student Learning Outcomes (SLOs) As listed on EVC ACCC Course Outline *"On completion of this course, the student will..."*	Assessment Tool List the tools to assess each SLO (such as rubrics, projects, assignment, survey, etc.)	Evaluation Timeline When will the SLO be assessed?	Assessment Results Summarize collected data including how data were collected and number of students.	Analysis/Action Plan and Timeline What, if any, changes will be made to instruction, or the SLO and when?
Add	SLO #1	1. Effectively communicate astronomical concepts such as the Big Bang Theory, evolution of the universe, the laws of physics, the relationship of astronomy to civilization, and techniques employed in retrieving physical properties of celestial systems. ILO - Information Competency ILO - Inquiry and Reasoning	We use an adaptation of Concept Inventory for Astronomy 101 courses (ASP), consisting of multiple choice questions delivered to students in the week prior to finals. This concept inventory has been adapted to fit current EVC SLO's and has 19 multiple choice questions designed to assess at each SLO at least once. Students were not warned about assessment, nor given incentives to do well such as extra credits, "buddy work", or having grades reflected in the course grade sheet.	Last Week May 2015	61 students total of different classes were assessed and SLO#1 yield 62%	Questions based on the tools astronomers use to retrieve physical properties of celestial objects (spectroscopy, and atomic absorption, emission and scattering) came with few right answers, and I suspect those were guessed. We will implement visualizations such as those available in PHET Colorado or exercises given in ComPADRE, and assess students with short quizzes in moodle. This will be discussed with Astro professors in future meetings of our Physics and Astronomy Department, and implemented in Spring 2016
Add	SLO #2	Analyze astronomic processes and use evidence, sound reasoning, and the scientific method to analyze astronomic problems. ILO - Inquire and Reasoning	We use an adaptation of Concept Inventory for Astronomy 101 courses (ASP), consisting of multiple choice questions delivered to students in the week prior to finals. This concept inventory has been adapted to fit current EVC SLO's and has 19 multiple choice questions designed to assess at each SLO at least once. Students were not warned about assessment, nor given incentives to do well such as extra credits, "buddy work", or having grades reflected in the course grade sheet.	First Week May 2015	61 students total of different classes were assessed and SLO#2 yield 40%	Questions based on astronomical cycles came with fewer right answers. We will implement visualizations such as those available in PHET Colorado or exercises given in ComPADRE, and assess students with short quizzes in moodle. This will be discussed with Astro professors in future meetings of our Physics and Astronomy Department, and implemented in Spring 2016

Course: Astro 10

		Student Learning Outcomes (SLOs) As listed on EVC ACCC Course Outline *"On completion of this course, the student will..."*	Assessment Tool List the tools to assess each SLO (such as rubrics, projects, assignment, survey, etc.)	Evaluation Timeline When will the SLO be assessed?	Assessment Results Summarize collected data including how data were collected and number of students.	Analysis/Action Plan and Timeline What, if any, changes will be made to instruction, or the SLO and when?
Add	SLO #3	Explain astronomic processes including processes related to apparent shift of constellations, telescopes and light detection, astronomical cycles, comparative planetology, stellar variability, and interaction of galaxies. ILO - Communication	We use an adaptation of Concept Inventory for Astronomy 101 courses (ASP), consisting of multiple choice questions delivered to students in the week prior to finals. This concept inventory has been adapted to fit current EVC SLO's and has 19 multiple choice questions designed to assess at each SLO at least once. Students were not warned about assessment, nor given incentives to do well such as extra credits, "buddy work", or having grades reflected in the course grade sheet.	First Week May 2015	61 students total of different classes were assessed and SLO#3 yield 55%	Questions based on the tools astronomers use to retrieve physical properties of celestial objects (spectroscopy, and atomic absorption, emission and scattering), large scale processes such as those related to galaxies and clusters of galaxies showed few "rights". We will implement visualizations such as those available in PHET Colorado or exercises given in ComPADRE, and assess students with short quizzes in moodle. This will be discussed with Astro professors in future meetings of our Physics and Astronomy Department, and implemented in Spring 2016
Add	SLO #4	Describe the major components of the solar system, the Milky Way Galaxy, and their interactions with each other. ILO - Communication	We use an adaptation of Concept Inventory for Astronomy 101 courses (ASP), consisting of multiple choice questions delivered to students in the week prior to finals. This concept inventory has been adapted to fit current EVC SLO's and has 19 multiple choice questions designed to assess at each SLO at least once. Students were not warned about assessment, nor given incentives to do well such as extra credits, "buddy work", or having grades reflected in the course grade sheet.	First Week May 2015	61 students total of different classes were assessed and SLO#4 yield 34%y.	Questions based on the tools astronomers use to retrieve physical properties of celestial objects (spectroscopy, and atomic absorption, emission and scattering) and scale of celestial groups were not well understood by students. We will implement visualizations such as those available in PHET Colorado or exercises given in ComPADRE, and assess students with short quizzes in moodle. This will be discussed with Astro professors in future meetings of our Physics and Astronomy Department, and implemented in Spring 2016
Add	SLO #5	Explain the evolution of an astronomical system, such as the formation and evolution of star systems. ILO - Inquiry and Reasoning	We use an adaptation of Concept Inventory for Astronomy 101 courses (ASP), consisting of multiple choice questions delivered to students in the week prior to finals. This concept inventory has been adapted to fit current EVC SLO's and has 19 multiple choice questions designed to assess at each SLO at least once. Students were not warned about assessment, nor given incentives to do well such as extra credits, "buddy work", or having grades reflected in the course grade sheet.	First Week May 2015	61 students total of different classes were assessed and SLO#5 yield 27%	Results based on the tools astronomers use to retrieve physical properties of celestial objects (spectroscopy, and atomic absorption, emission and scattering), stellar evolution, and specifics of HR diagram indicate that students have a low perception of these processes. We will implement visualizations such as those available in PHET Colorado or exercises given in ComPADRE, and assess students with short quizzes in moodle. This will be discussed with Astro professors in future meetings of our Physics and Astronomy Department, and implemented in Spring 2016

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.

Introduction to Astronomy Lab — ASTRO 010L

Course: Astro 10L

	Student Learning Outcomes (SLOs) As listed on EVC ACCC Course Outline *"On completion of this course, the student will..."*	Assessment Tool List the tools to assess each SLO (such as rubrics, projects, assignment, survey, etc.)	Evaluation Timeline When will the SLO be assessed?	Assessment Results Summarize collected data including how data were collected and number of students.	Analysis/Action Plan and Timeline What, if any, changes will be made to instruction, or the SLO and when?
Add SLO #5	I6. Graph HR diagrams and identify the major phases of stellar evolution. ILO - Information Competency	Assessment was based on a lab attempting to build an HR diagram.	April 2015	24 students took the assessment and scored 98%	Data was collected and students used computers to analyze data. We need improved computer labs
Add SLO #6	5. Use the scientific method to solve selected astronomical questions. . ILO - Inquiry and Reasoning	Assessment was based on a lab attempting to determine Jupiter's mass using its moons	April 2015	24 students took the assessment and scored 98%	Data was collected and students used computers to analyze data. We need improved computer labs

Course: Astro 10L

	Student Learning Outcomes (SLOs) As listed on EVC ACCC Course Outline *"On completion of this course, the student will..."*	Assessment Tool List the tools to assess each SLO (such as rubrics, projects, assignment, survey, etc.)	Evaluation Timeline When will the SLO be assessed?	Assessment Results Summarize collected data including how data were collected and number of students.	Analysis/Action Plan and Timeline What, if any, changes will be made to instruction, or the SLO and when?
Add SLO #1	Use astronomical instruments to measure stellar properties and quantify planetary motion. ILO - Inquiry and Reasoning	Students used portable telescope to perform alignment and pointing at celestial objects. Students must find a celestial target using a portable telescope. A system of rubric was used to assess students and graded when course content was delivered	February 2015	28 students took the assessment with a measure of student learning close to 94%	The Montgomery Hill Observatory will be purchasing new instruments and this aspect of the SLO will be better delivered.
Add SLO #2	2. Describe the major outcomes of current space missions searching for life footprints in our galaxy. ILO - Communication	A series of Multiple Choice questions adapted from available Concept Inventory (TOAST) will delivered a week prior to the final	December 2015		
Add SLO #3	3. Describe recent NASA-related missions and explain how they are working to elucidate the characteristics of planetary systems outside of our own. ILO - Inquiry and Reasoning	A series of Multiple Choice questions adapted from available Concept Inventory (TOAST) will delivered a week prior to the final	December 2015		
Add SLO #4	4. Explain the causes of major physical and chemical differences	A series of Multiple Choice questions adapted from available Concept Inventory (TOAST) will delivered a week prior to the final	December 2015		

ASTRO 10L is in urgent need of correct implementation of SLO assessment as our adjuncts were left to assess them without a central coordination. We the new hire of a full time in Physics and Astronomy, we are writing new lab modules and plan on submit a preliminary assessment in Spring 2017, and improve on our labs and assessment in Fall 2017.

Course Level — Algebra-Trigonometry General Physics A — PHYS 002A

Course: Phys 002A

	Student Learning Outcomes (SLOs) As listed on EVC ACCC Course Outline *"On completion of this course, the student will..."*	Assessment Tool List the tools to assess each SLO (such as rubrics, projects, assignment, survey, etc.)	Evaluation Timeline When will the SLO be assessed?	Assessment Results Summarize collected data including how data were collected and number of students.	Analysis/Action Plan and Timeline What, if any, changes will be made to instruction, or the SLO and when?
Add SLO #1	Apply kinematic equations to predict the motion of a uniformly accelerated object. (C-ID 1) ILO - Inquiry and Reasoning	Five multiple choice questions were designed to assess each of the current SLO's, except SLO's #4,6 which will be assessed during lab classes in fall 2015. This assessment is delivered without the offering of incentives (extra credits), or incorporating grades into course grading scale. It is also noteworthy that this assessment was submitted in the weeks prior to final exam when students are not readily remembering some of the topics covering during first months of class. Examination was timed to one hour.	May 2015	28 students of three sections participated in the survey, and SLO#1 scored 71%, corresponding to 20 correct responses.	This assessment measure student understanding of Newton's second law of movement, and data suggests a low level of understanding. Mastering the differences between operating vectors and scalar should be a "must" for any student attempting to enroll in this course. In addition, since the SLO #1 necessarily requires manipulation of algebraic operations (apply and predict), students should have mastered college-level algebra prior to enrolling in this course. Our recommendation is to introduce substantial changes in the pre req of PHYS 02A from the current Intermediate Algebra (MATH 013) to MATH 21 and/or MATH 22. If these changes are made, EVC will be at the same level of the majority of Community Colleges in the area, complying with required C-ID descriptors.
Add SLO #2	Apply Newton's laws of motion to solve problems involving multiple forces acting on an object. (C-ID 2) ILO - Inquiry and Reasoning	Five multiple choice questions were designed to assess each of the current SLO's, except SLO"s #4,6 which will be assessed during lab classes in fall 2015. This assessment is delivered without the offering of incentives (extra credits), or incorporating grades into course grading scale. It is also noteworthy that this assessment was submitted in the weeks prior to final exam when students are not readily remembering some of the topics covering during first months of	May 2015	28 students of three sections participated in the survey, and SLO#2 scored 57%, corresponding to 20 correct responses.	This assessment measure student understanding of Newton's second law of movement, and data suggests a low level of understanding. Mastering the differences between operating vectors and scalars should be a "must" for any student attempting to enroll in this course. Some of us spend one or two weeks explaining basics of vector operation, and these two weeks should be used

Course: Phys 002A

	Student Learning Outcomes (SLOs) As listed on EVC ACCC Course Outline *"On completion of this course, the student will..."*	Assessment Tool List the tools to assess each SLO (such as rubrics, projects, assignment, survey, etc.)	Evaluation Timeline When will the SLO be assessed?	Assessment Results Summarize collected data including how data were collected and number of students.	Analysis/Action Plan and Timeline What, if any, changes will be made to instruction, or the SLO and when?
		class. Examination was timed to one hour.			in delivered the already packed course content. Our recommendation is to introduce substantial changes in the pre req of PHYS 02A from the current Intermediate Algebra (MATH 013) to MATH 21 and/or MATH 22. If these changes are made, EVC will be at the same level of the majority of Community Colleges in the area, complying with required C-ID descriptors.
Add SLO #3	Formulate and solve mechanics and thermodynamics problems using the law of conservation of energy. (C-ID 3) ILO - Inquiry and Reasoning	Five multiple choice questions were designed to assess each of the current SLO's, except SLO's #4,6 which will be assessed during lab classes in fall 2015. This assessment is delivered without the offering of incentives (extra credits), or incorporating grades into course grading scale. It is also noteworthy that this assessment was submitted in the weeks prior to final exam when students are not readily remembering some of the topics covering during first months of class. Examination was timed to one hour.	May 2015	28 students of three sections participated in the survey, and SLO#3 scored 57%, corresponding to 20 correct responses (coincidental with data from SLO # 2)	The course content that includes the laws of thermodynamics, calorimetry, and thermometers is delivered, in general, at the end of a semester. The Physics 2A students were being exposed to this content while the assessment was being made. The common wisdom dictates that test performance yields better results if assessment is done close to when course content is being delivered. Our data suggests that this is not true. It is possible that in our attempt to emphasize Newton's Laws of motion, the other aspects of Thermodynamics and Waves, which bring students to lay back on their efforts to learn course materials delivered during last weeks of class. We propose to discuss this issue in upcoming meetings of Physics and Astronomy Department, and implement solutions this coming fall..
Add SLO #4	Present experimental findings in a scientific manner, using critical thinking and logic. (all C-ID) ILO - Comunnication ILO - Inquiry and Reasoning	We identified two laboratory exercises where students collect data, organize tables and figures, and provide results and conclusions observing proper display of significant figures and units. This SLO assessment tool requires that each student submit an independent lab report of both projects.	December 2015		

Course: Phys 002A

Add SLO #5	Analyze static and rotating systems using concepts of torque and angular acceleration. (C-ID 4) ILO - Inquiry and Reasoning	Five multiple choice questions were designed to assess each of the current SLO's, except SLO's #4,6 which will be assessed during lab classes in fall 2015. This assessment is delivered without the offering of incentives (extra credits), or incorporating grades into course grading scale. It is also noteworthy that this assessment was submitted in the weeks prior to final exam when students are not readily remembering some of the topics covering during first months of class. Examination was timed to one hour.	May 2015	28 students of three sections participated in the survey, and SLO#4 scored 14%, corresponding to 20 correct responses.	The results here were worse than guess work (5 options in the MC question). Since this question was the last of 5 questions, and the examination was timed, it is possible that students decided to apply "guess work" just to get out of the examination mode, specially if we recall that there were no "incentives" given for good performance (extra credit). In any case, we propose to discuss this issue in upcoming meetings of Physics and Astronomy department and implement solutions to improve student learning.
Add SLO #6	Collect, and analyze experimental data using appropriate units, significant figures, and estimating error propagation. (all C-ID) ILO - Communication ILO - Inquiry and Reasoning	We identified two laboratory exercises where students collect data, organize tables and figures, and provide results and conclusions observing proper display of significant figures and units. This SLO assessment tool requires that each student submit an independent lab report of both projects.	December 2015		

These SLO assessments measure student understanding of Newton's second law of movement, and data suggests a low level of understanding. Mastering the differences between operating vectors and scalar should be a "must" for any student attempting to enroll in this course. In addition, since the SLO #1 necessarily requires manipulation of algebraic operations (apply and predict), students should have mastered college-level algebra prior to enrolling in this course. Our recommendation is to introduce substantial changes in the pre req of PHYS 02A from the current Intermediate Algebra (MATH 013) to MATH 21 and/or MATH 22. If these changes are made, EVC will be at the same level of the majority of Community Colleges in the area, complying with required C-ID descriptors.

Algebra-Trigonometry General Physics B — PHYS 002B

Course: Phys 002B (Spring 2014: Castilla)

	Student Learning Outcomes (SLOs) As listed on EVC ACCC Course Outline *"On completion of this course, the student will..."*	Assessment Tool List the tools to assess each SLO (such as rubrics, projects, assignment, survey, etc.)	Evaluation Timeline When will the SLO be assessed?	Assessment Results Summarize collected data including how data were collected and number of students.	Analysis/Action Plan and Timeline What, if any, changes will be made to instruction, or the SLO and when?
Add SLO #1	Calculate the electric field and electric potential produced by a simple charge distribution. ILO -Inquiry and Reasoning	An assessment with questions covering subjects described in SLO # 1,2,3,4 , 5 were given in class after they finalized Midterm 3. Perhaps this was not the best timing since students were tired. In addition, no incentives were given in case assessment was completed and submitted. Few students just handed it back. A rubric (0-5) was established, and class scores averaged with percentages assigned to the averages.	Assessed on May 4, 2015	25 students completed the survey yielding an average of 52%	Physics 2B is a course with a long course content containing extremely abstract subjects. It gets earthy when we dive into circuit components, but the first months tend to be frustrating for students who struggled through Physics 2A: too many vector operations and too many field abstractions. This assessment included several contents given and tested in exam 1 (out of three exams), and certainly students were not happy to see these materials again after a midterm on optics. We will deliver the next assessment (same problems) more towards the week prior to final, after reviewing the concepts and closing up the course. We also need as a team to figure out how is the best way to deliver the course content, perhaps emphasizing certain contents in lab instead of lecture. This will be discussing in upcoming meetings of the Physics Department.

Course: Phys 002B (Spring 2014: Castilla)

	Student Learning Outcomes (SLOs) As listed on EVC ACCC Course Outline *"On completion of this course, the student will..."*	Assessment Tool List the tools to assess each SLO (such as rubrics, projects, assignment, survey, etc.)	Evaluation Timeline When will the SLO be assessed?	Assessment Results Summarize collected data including how data were collected and number of students.	Analysis/Action Plan and Timeline What, if any, changes will be made to instruction, or the SLO and when?
Add SLO #2	Calculate magnetic fields produced by simple current distributions, and predict electric potential induced by varying magnetic flux. ILO - Inquiry and Reasoning	An assessment with questions covering subjects described in SLO # 1,2,3,4 , 5 were given in class after they finalized Midterm 3. Perhaps this was not the best timing since students were tired. In addition, no incentives were given in case assessment was completed and submitted. Few students just handed it back. A rubric (0-5) was established, and class scores averaged with percentages assigned to the averages.	Assessed on May 4, 2015	25 students completed the survey yielding an average of 63%	Physics 2B is a course with a long course content containing extremely abstract subjects. It gets earthy when we dive into circuit components, but the first months tend to be frustrating for students who struggled through Physics 2A: too many vector operations and too many field abstractions. This assessment included several contents given and tested in exam 1 (out of three exams), and certainly students were not happy to see these materials again after a midterm on optics. We will deliver the next assessment (same problems) more towards the week prior to final, after reviewing the concepts and closing up the course. We also need as a team to figure out how is the best way to deliver the course content, perhaps emphasizing certain contents in lab instead of lecture. This will be discussing in upcoming meetings of the Physics Department.
Add SLO #3	Determine the trajectory of a charged particle moving in a region permeated by electric and magnetic fields. ILO - Inquiry and Reasoning	An assessment with questions covering subjects described in SLO # 1,2,3,4 , 5 were given in class after they finalized Midterm 3. Perhaps this was not the best timing since students were tired. In addition, no incentives were given in case assessment was completed and submitted. Few students just handed it back. A rubric (0-5) was established, and class scores averaged with percentages assigned to the averages.	Assessed on May 4, 2015	25 students completed the survey yielding an average of 57%	Physics 2B is a course with a long course content containing extremely abstract subjects. It gets earthy when we dive into circuit components, but the first months tend to be frustrating for students who struggled through Physics 2A: too many vector operations and too many field abstractions. This assessment included several contents given and tested in exam 1 (out of three exams), and certainly students were not happy to see these materials again after a midterm on optics. We will deliver the next assessment (same problems) more towards the week prior to final, after reviewing the concepts and closing up the course. We also need as a team to figure out how is the best way to deliver the course content, perhaps emphasizing certain contents in lab instead of lecture. This will be discussing in upcoming meetings of the Physics Department.

Course: Phys 002B (Spring 2014: Castilla) Page 4 of 5

Add	SLO #4	Calculate voltages, currents, and power dissipated in different components of an AC/DC circuit. ILO -Inquiry and reasoning	An assessment with questions covering subjects described in SLO # 1,2,3,4 , 5 were given in class after they finalized Midterm 3. Perhaps this was not the best timing since students were tired. In addition, no incentives were given in case assessment was completed and submitted. Few students just handed it back. A rubric (0-5) was established, and class scores averaged with percentages assigned to the averages.	Assessed on May 4, 2015	25 students completed the survey yielding an average of 92%	Perhaps the best way to explain the success rate in this SLO is the extensive use of computer support prior to the beginning of labs, and our attempt to provide each student with a circuit kit. We are not there yet, but close. The Division must provide the funds so that each student have his/her own circuit kit to run circuit labs.
Add	SLO #5	Calculate location and size of images formed by mirrors and lenses. ILO- Communication ILO- Inquiry and reasoning.	An assessment with questions covering subjects described in SLO # 1,2,3,4 , 5 were given in class after they finalized Midterm 3. Perhaps this was not the best timing since students were tired. In addition, no incentives were given in case assessment was completed and submitted. Few students just handed it back. A rubric (0-5) was established, and class scores averaged with percentages assigned to the averages.	Assessed on May 4, 2015	25 students completed the survey yielding an average of 84%	Students had to study this subject for Midterm 3, which explain the positive outcome.
Add	SLO #6	Analyze the phenomena of interference and diffraction in optics, predicting patterns produced by different types of slits. ILO - Inquiry and Reasoning	This SLO was not assessed. It will be part of an overall SLO assessment submitted to the students in December 2015	December 2015		
Add	SLO #7	Discuss how Quantum Mechanics and Relativity changed our views of the natural world. ILO - Inquiry and Reasoning	This SLO was not assessed. It will be part of an overall SLO assessment submitted to the students in December 2015	December 2015		

PHYS 2B has been taught by different adjuncts in the last few years, and we were not able to coordinate the implementation of a coherent set of SLO assessments. In spring and fall 2017, we gave the course to the leadership of a San Jose State professor, and we are designing a set of questions to be delivered at the end of spring 2017, with measures introduced in fall 2017, and re-evaluated at the end of fall 2017.

General Physics — PHYS 004A

Course: PHYS_004A

	Student Learning Outcomes (SLOs) As listed on EVC ACCC Course Outline *"On completion of this course, the student will..."*		Assessment Tool List the tools to assess each SLO (such as rubrics, projects, assignment, survey, etc.)	Evaluation Timeline When will the SLO be assessed?	Assessment Results Summarize collected data including how data were collected and number of students.	Analysis/Action Plan and Timeline What, if any, changes will be made to instruction, or the SLO and when?
Add	SLO #1	Solve problems involving accelerated motion using equations of kinematics. (EVC all) ILO - Inquiry and Reasoning	A timed assessment consisting of one of more multiple choice questions per SLO was submitted to the students in weeks prior to final exam. Students received no incentives to perform well in the exam, and grades collected are not part of course grade sheet.	First week of May 2015	A total of 23 students participated in the assessment, and data for SLO #1 turned out to be 100%	Lab equipment for mechanics must be continuously updated in order to better support our students. With the new Vernier tracks and carts, we are sufficiently equipped to attend three students per setting (would be better two students per setting), complementing lectures with high quality lab modules. It is also interesting to note that application of equations of kinematic, which is the key component of SLO #1, requires demonstrated mastery in Algebraic transactions, and 4A students have already completed Pre-Calculus courses, which make them prepared to succeed in SLO#1 type of assessments.
Add	SLO #2	Predict the position and velocity of an object if all external forces acting on it are known. (EVC 1,2,3,4,8) ILO - Inquiry and Reasoning	A timed assessment consisting of one of more multiple choice questions per SLO was submitted to the students in weeks prior to final exam. Students received no incentives to perform well in the exam, and grades collected are not part of course grade sheet.	First week of May 2015	A total of 23 students participated in the assessment, and data for SLO #2 turned out to be 71%	A combination of forces imply in a combination of vectors operation, adding complexity to the problem solving process. Since skills on adding vectors constitute such a fundamental tool in the entire General Physics section, we propose to design Pre-Lab assessment modules students should complete before starting their Mechanics Labs, highlighting vector operation students will encounter during planned lab activity. They should take 30 min to one hour at the most. Perhaps, we could flip the classroom and assign these Pre-Labs as part of mandatory

Course: PHYS_004A Page 3 of 4

		Student Learning Outcomes (SLOs) As listed on EVC ACCC Course Outline *"On completion of this course, the student will..."*	Assessment Tool List the tools to assess each SLO (such as rubrics, projects, assignment, survey, etc.)	Evaluation Timeline When will the SLO be assessed?	Assessment Results Summarize collected data including how data were collected and number of students.	Analysis/Action Plan and Timeline What, if any, changes will be made to instruction, or the SLO and when?
						homework activities. Students would then bring the handout completed for grading, and class would engage in discussion.
Add	SLO #3	Predict the position and speed of an object subjected to conservative and non-conservative forces. (EVC 4) ILO - Inquiry and Reasoning	A timed assessment consisting of one of more multiple choice questions per SLO was submitted to the students in weeks prior to final exam. Students received no incentives to perform well in the exam, and grades collected are not part of course grade sheet.	First week of May 2015	A total of 23 students participated in the assessment, and data for SLO #2 turned out to be 79%.	A combination of forces imply in a combination of vectors operation, adding complexity to the problem solving process. In addition, the use of non conservative forces brings differential equations or integrals into the mix, requiring advanced math skills. We propose to design Pre-Lab assessment modules students should complete before starting their Mechanics Labs, highlighting operations involving differential equations or integrals students might encounter during planned lab activity. They should take 30 min to one hour at the most. Perhaps, we could flip the classroom and assign these Pre-Labs as part of mandatory homework activities. Students would then bring the handout completed for grading, and class would engage in discussion.
Add	SLO #4	Analyze the motion of rolling and spinning masses. (EVC 6,8) ILO - Inquiry and Reasoning ILO - Comunnication	A timed assessment consisting of one of more multiple choice questions per SLO was submitted to the students in weeks prior to final exam. Students received no incentives to perform well in the exam, and grades collected are not part of course grade sheet.	First week of May 2015	A total of 23 students participated in the assessment, and data for SLO #2 turned out to be 47%.	This type of situation involves the notion of Torque, Angular acceleration, and Angular Momentum, which are quantities taught in the last month of a semester-wide Physics 4A course. Clearly students learning is not achieved and we should discuss strategies and propose solutions in upcoming Astro and Physics Department meetings.
Add	SLO #5	Employ the principle of the harmonic oscillator to solve more complex systems such as vibrating molecules. (EVC 7) ILO - Inquiry and Reasoning	A timed assessment consisting of one of more multiple choice questions per SLO was submitted to the students in weeks prior to final exam. Students received no incentives to perform well in the exam, and grades collected are not part of course grade sheet.	First week of May 2015	A total of 23 students participated in the assessment, and data for SLO #2 turned out to be 42%.	We created a question consisting of oscillating springs where students should use concepts of energy conservation and and displacement. This data clearly shows that students' learning is not being achieved. We propose to discuss this issue in future Department meetings and create a strategy to be employed in fall 2015.

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Add	SLO #6	Apply the concepts of gravitational force and potential energy to predict the trajectory of objects. (EVC 8) ILO - Inquiry and Reasoning	A timed assessment consisting of one of more multiple choice questions per SLO was submitted to the students in weeks prior to final exam. Students received no incentives to perform well in the exam, and grades collected are not part of course grade sheet.	First week of May 2015	A total of 23 students participated in the assessment, and data for SLO #2 turned out to be 42% (same number as in SLO#5)	The last assessed SLO's consist on questions covered in the last four weeks or less. It seems that students tend to do better in SLO's that assess course content delivered in the beginning of the semester. Perhaps, in the first few weeks of class students are fresh and rested and therefore tend to do well. Or perhaps they in saw these subjects before in middle or high school and are just reviewing it. Anyways, there is a down fall in learning and this issue should be addressed in future Department meetings.
Add	SLO #7	Apply Archimedes law to calculate the fraction of a floating object partially submerged. (EVC 9) ILO - Inquiry and Reasoning	This SLO was not assessed this time, but it will on fall 2015	December 2015		

We observed in the last 2 years a major upgrade in laboratory equipment and technology in our physics laboratories and, in particular, we start making use of a new science building. Our last reported round of SLO assessments was in May 2015 right before our move. We then we shift our efforts to complete the move, implement newly purchased equipment and adapting lab handouts to these new equipment. Last semester, we introduced our adjuncts to our policy of SLO assessments, and will submit them in all current physics sections this spring 2017.

General Physics — PHYS 004B

Course: Phys 004B

		Student Learning Outcomes (SLOs) As listed on EVC ACCC Course Outline *"On completion of this course, the student will..."*	Assessment Tool List the tools to assess each SLO (such as rubrics, projects, assignment, survey, etc.)	Evaluation Timeline When will the SLO be assessed?	Assessment Results Summarize collected data including how data were collected and number of students.	Analysis/Action Plan and Timeline What, if any, changes will be made to instruction, or the SLO and when?
Add	SLO #1	Solve real world problems involving electricity and magnetism. ILO - Inquiry and Reasoning	A list of multiple choice questions containing one or two questions per SLO was given to students of two Physics 2B sections. No incentives were given, and the examination was timed.	First week of May 2015	A total of 30 students participated in the survey and SLO #1 scored 87%	We have attempted to provide students with pre lab activities employing computer simulations to illustrate concepts that are delivered in hand-on labs. As of now, there are 12 computers in a class of 30 students maximum, which is not the ideal. We will works towards purchasing a roll-in cart with tablets so that each student can run its own simulation. Likewise, since electronics can only be learned if you do it, we will be working towards providing each student with a kit containing the basic elements of a circuit. We expect EACH student (30) with a lab kit by the end of spring 2016
Add	SLO #2	Calculate electric fields and electric potentials produced by simple charge distributions. ILO - Inquiry and Reasoning	A list of multiple choice questions containing one or two questions per SLO was given to students of two Physics 2B sections. No incentives were given, and the examination was timed.	First week of May 2015	A total of 30 students participated in the survey and SLO #2 scored 50%	We have attempted to provide students with pre lab activities employing computer simulations to illustrate concepts that are delivered in hand-on labs. As of now, there are 12 computers in a class of 30 students maximum, which is not the ideal. We will works towards purchasing a roll-in cart with tablets so that each student can run its own simulation. Likewise, since electronics can only be learned if you do it, we will be working towards providing each student with a kit containing the basic elements of a circuit. We expect EACH

Course: Phys 004B Page 3 of 4

		Student Learning Outcomes (SLOs) As listed on EVC ACCC Course Outline *"On completion of this course, the student will..."*	Assessment Tool List the tools to assess each SLO (such as rubrics, projects, assignment, survey, etc.)	Evaluation Timeline When will the SLO be assessed?	Assessment Results Summarize collected data including how data were collected and number of students.	Analysis/Action Plan and Timeline What, if any, changes will be made to instruction, or the SLO and when?
						student (30) with a lab kit by the end of spring 2016
Add	SLO #3	Apply the principle of conservation of energy to determine the trajectory of a charge moving in an electric and magnetic fields. ILO - Inquiry and Reasoning	A list of multiple choice questions containing one or two questions per SLO was given to students of two Physics 2B sections. No incentives were given, and the examination was timed.	First week of May 2015	A total of 30 students participated in the survey and SLO #3 scored 77%	We have attempted to provide students with pre lab activities employing computer simulations to illustrate concepts that are delivered in hand-on labs. As of now, there are 12 computers in a class of 30 students maximum, which is not the ideal. We will works towards purchasing a roll-in cart with tablets so that each student can run its own simulation. Likewise, since electronics can only be learned if you do it, we will be working towards providing each student with a kit containing the basic elements of a circuit.We expect EACH student (30) with a lab kit by the end of spring 2016
Add	SLO #4	Determine voltages, currents, and power dissipated in different components of an AC/DC circuit. ILO - Inquiry and Reasoning	A list of multiple choice questions containing one or two questions per SLO was given to students of two Physics 2B sections. No incentives were given, and the examination was timed.	First week of May 2015	A total of 30 students participated in the survey and SLO #4 scored 60%	We have attempted to provide students with pre lab activities employing computer simulations to illustrate concepts that are delivered in hand-on labs. As of now, there are 12 computers in a class of 30 students maximum, which is not the ideal. We will works towards purchasing a roll-in cart with tablets so that each student can run its own simulation. Likewise, since electronics can only be learned if you do it, we will be working towards providing each student with a kit containing the basic elements of a circuit.We expect EACH student (30) with a lab kit by the end of spring 2016
Add	SLO #5	Calculate the induced voltage generated by simple distributions of varying currents and moving magnets. ILO - Inquiry and Reasoning	A list of multiple choice questions containing one or two questions per SLO was given to students of two Physics 2B sections. No incentives were given, and the examination was timed.	First week of May 2015	A total of 30 students participated in the survey and SLO #5 scored 87%	We have attempted to provide students with pre lab activities employing computer simulations to illustrate concepts that are delivered in hand-on labs. As of now, there are 12 computers in a class of 30 students maximum, which is not the ideal. We will works towards purchasing a roll-in cart with tablets so that each student can run its own simulation. Likewise, since electronics can only be learned

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						if you do it, we will be working towards providing each student with a kit containing the basic elements of a circuit.We expect EACH student (30) with a lab kit by the end of spring 2016

We have provided students with pre lab activities with computer simulations and other activities designed to illustrate concepts that are delivered in labs. As of now, each student has access to a computer, which is a major upgrade since our last matrix report. We are also providing each student with a circuit set so that learning is more effective than done previously. A new round of SLO assessment will be submitted at the end of this spring semester.

General Physics — PHYS 004C

Course: Phys 004C

		Student Learning Outcomes (SLOs) As listed on EVC ACCC Course Outline "On completion of this course, the student will..."	Assessment Tool List the tools to assess each SLO (such as rubrics, projects, assignment, survey, etc.)	Evaluation Timeline When will the SLO be assessed?	Assessment Results Summarize collected data including how data were collected and number of students.	Analysis/Action Plan and Timeline What, if any, changes will be made to instruction, or the SLO and when?
Add	SLO #1	Solve real world problems involving propagation of light and heat. C-ID # 1; Lab #1 ILO - Inquiry and Reasoning	The assessment tool of the first four SLO's consisted on students demonstrating skills on problem solving. Problems were presented to the students in the last few weeks of classes, no incentives were given (extra credits, etc) nor the gradings became part of course overall grade. Questions were corrected manually on a scale of 0 - 20 on each SLO.	First week of May 2015	21 students took the survey yielding and average of 63%.	The assessment results show a global average, but if we sample the data in categories of grades lower than 5, 10, 15 and 20 points, we realize that the class has a "camel distribution: about half of the class does much better than the rest (15 points or more when compared with less than 15 points), and we note that those students doing well, in general, have superior math skills than their "lower ranked" peers. We will bring this problem to our Department meetings and discuss strategies to improve performance.
Add	SLO #2	Predict the transfer of heat among materials. C-ID Lab # 2 ILO - Inquiry and Reasoning	The assessment tool of the first four SLO's consisted on students demonstrating skills on problem solving. Problems were presented to the students in the last few weeks of classes, no incentives were given (extra credits, etc) nor the gradings became part of course overall grade. Questions were corrected manually on a scale of 0 - 20 on each SLO.	First week of May 2015	20 students took the survey yielding and average of 60%.	The assessment results show a global average, but if we sample the data in categories of grades lower than 5, 10, 15 and 20 points, we realize that the class has a "camel distribution: about half of the class does much better than the rest (15 points or more when compared with less than 15 points), and we note that those students doing well, in general, have superior math skills than their "lower ranked" peers. We will bring this problem to our Department meetings and discuss strategies to improve performance.

Course: Phys 004C

		Student Learning Outcomes (SLOs) As listed on EVC ACCC Course Outline "On completion of this course, the student will..."	Assessment Tool List the tools to assess each SLO (such as rubrics, projects, assignment, survey, etc.)	Evaluation Timeline When will the SLO be assessed?	Assessment Results Summarize collected data including how data were collected and number of students.	Analysis/Action Plan and Timeline What, if any, changes will be made to instruction, or the SLO and when?
Add	SLO #3	Analyze the physical propagation of light through different media, by drawing light ray diagrams characteristics of reflection and refraction. C-ID # 1; Lab #1 ILO - Communication ILO - Inquiry and Reasoning	The assessment tool of the first four SLO's consisted on students demonstrating skills on problem solving. Problems were presented to the students in the last few weeks of classes, no incentives were given (extra credits, etc) nor the gradings became part of course overall grade. Questions were corrected manually on a scale of 0 - 20 on each SLO.	First week of May 2015	19 students took the survey yielding and average of 61%.	The assessment results show a global average, but if we sample the data in categories of grades lower than 5, 10, 15 and 20 points, we realize that the class has a "camel distribution: about half of the class does much better than the rest (15 points or more when compared with less than 15 points), and we note that those students doing well, in general, have superior math skills than their "lower ranked" peers. We will bring this problem to our Department meetings and discuss strategies to improve performance.
Add	SLO #4	Analyze the phenomena of interference and diffraction in optics, predicting patterns produced by narrow slits: single, double and multiple. C-ID # 2; Lab #1 ILO - Inquiry and Reasoning	The assessment tool of the first four SLO's consisted on students demonstrating skills on problem solving. Problems were presented to the students in the last few weeks of classes, no incentives were given (extra credits, etc) nor the gradings became part of course overall grade. Questions were corrected manually on a scale of 0 - 20 on each SLO.	First week of May 2015	18 students took the survey yielding and average of 51%.	TThe assessment results show a global average, but if we sample the data in categories of grades lower than 5, 10, 15 and 20 points, we realize that the class has a "camel distribution: about half of the class does much better than the rest (15 points or more when compared with less than 15 points), and we note that those students doing well, in general, have superior math skills than their "lower ranked" peers. We will bring this problem to our Department meetings and discuss strategies to improve performance.
Add	SLO #5	Explain how Relativity and Quantum Mechanics changed our view of the physical world. C-ID # 3, 4 ILO - Inquiry and Reasoning	The assessment tool consists on at least one multiple choice question presented to the student at the end of term	Spring 2016		
Add	SLO #6					

Our last report indicates a lower percentile of less than 65% in assessed SLO's, and we identified lacking of lab equipment as a major factor. Another round of assessments is planned for spring 2017, measures introduced in fall 2017, and re-assessment scheduled in fall 2017.

Earth Science — PHYSC 012

Course: PHYSC 012

		Student Learning Outcomes (SLOs) As listed on EVC ACCC Course Outline "On completion of this course, the student will..."	Assessment Tool List the tools to assess each SLO (such as rubrics, projects, assignment, survey, etc.)	Evaluation Timeline When will the SLO be assessed?	Assessment Results Summarize collected data including how data were collected and number of students.	Analysis/Action Plan and Timeline What, if any, changes will be made to instruction, or the SLO and when?
Add	SLO #1	Apply the scientific method to formulate solutions to real world situations, using critical thinking and logical reasoning (C-ID lec 1; C-ID lab 1,4,5) ILO - Communication ILO - Inquiry and Reasoning	Students were engaged in a semester-wide project on Climate Change where the final product is a public poster presentation summarizing the following aspects of the project: Physical Science evidence of Climate Change, Human Right issues affecting communities impacted by Climate Change, and demonstration of civil activism by promoting actions that will help reversing the problems. Two assessment tools were employed: one gradual and spread over the semester, and another centered on a final poster presentation. The first assessment was done during selected lab hours using a rubric grading system (0-5) where the following aspects of a group work were observed: student engagement in the tasks presented, debating skills, collaborative approach to resolve situations, and proper use of in class computers. The second assessment was based on the poster presentation.	The rubric assessment tool was employed throughout the semester and final data collected on the first week of May. The poster presentation is done in the week of finals.	24 students took this assessment during the semester resulting in a final average of 87.3%. Assessment results for the poster presentation will be presented in the following semester since it is done in the week of finals.	The are no changes predicted in the implementation or assessment of this SLO
Add	SLO #2	Describe direct and alternate pathways within the rock cycle (C-ID lec 2,3; C-ID lab 1,2,5) ILO - Communication ILO - Inquiry and Reasoning	The assessment tool chosen consists on 5 multiple choice questions covering specifics of this SLO, and presented to students with multiple choice questions assessing the other SLO's	December 2015		

Course: PHYSC 012

		Student Learning Outcomes (SLOs) As listed on EVC ACCC Course Outline "On completion of this course, the student will..."	Assessment Tool List the tools to assess each SLO (such as rubrics, projects, assignment, survey, etc.)	Evaluation Timeline When will the SLO be assessed?	Assessment Results Summarize collected data including how data were collected and number of students.	Analysis/Action Plan and Timeline What, if any, changes will be made to instruction, or the SLO and when?
Add	SLO #3	Explain the main tenets of the Plate Tectonics Theory, indicating the variety of geologic features arising from plates interactions (C- ID lec 2,4; C-ID lab 1, 3,4) ILO - Communication ILO - Inquiry and Reasoning	Course content on plate tectonics is normally delivered in the second month of class and tested in the second course midterm (out of three midterms). There is a computer simulation (PHET - Colorado on Plate Tectonics) we explore in Lab hour that could not run this semester since the computer labs at LE - 204 did not have updated plug-ins and flash. The assessment tool consists on a series of five multiple choice questions covering different aspects of plate tectonics and landscapes associated with it. This is delivered at the end of the semester when students are not directly studying the subject in class or in homework. Students received no incentives to "do well", like extra credits, nor grades collected were incorporated into the course grading scale. Responses were received from anonymous students.	May 2015	21 students took the assessment and percentage of correct answers were 40%	The assessment was timed (2 min per question) and handed out at the beginning of class. The low score can be interpreted in the following ways: 1) Students did not learn the subject properly, specially when we note that the scheduled computer lab was not delivered due to outdated software in LE-204; or 2) students did not put effort to answer the questions properly. Some scantrons came all marked in the same column; or 3) some of the students needed more time to read and understand the questions (this course has a large percentage of ESL students). These are the measures that will be implemented in fall 2015 as an attempt to address the low score: 1) Ensure that the students complete scheduled lab, providing proper report. 2) This assessment will be done at the end of semester again, but expanded to include assessment of all other SLO's. The incentive to "do well" will be replacing the lowest score in any of the three previous midterms with the assessment grade, if larger. 3) Provide examination time consistent with the other midterms so that ESL students have time to comprehend the questions and choose proper answers.
Add	SLO #4	Explain the workings of Earth's major cycles such as the rock, carbon, hydrologic, and salt cycles, listing examples of their interactions and interdependencies (C-ID lec 1,2; C-ID lab 1,3,5) ILO - Communication ILO - Inquiry and Reasoning	The assessment tool chosen consists on 5 multiple choice questions covering specifics of this SLO, and presented to students with multiple choice questions assessing the other SLO's	December 2015		

The PHYSC 012 course outline is being revised, and a new course outline planned to be submitted to division curriculum committee in fall 2017.

Analysis

In fall 2016, all sections of a given course were assessed at the last week of classes but students were left without “incentives”. It was an anonymous survey. The outcome reflects “guess work”. Assessments will be repeated in 2017, at this time incorporating assessment in the final exam.

It is also crucial to ensure academic success of our students in courses that are basic in a sequence such as PHYS 004A or PHYS 002A. We have partnered with the EVC tutoring center and the MSRC to ensure that students in danger of failure receive adequate academic support. We have also encouraged faculty to participate in the ‘Early Alert” initiative, directing students to proper mentoring protocol. Our Division has been a leader in “Early Alert” efforts. In addition, full time Physics 4B and 4C courses instructors have participated in the “EVC — Service Learning” program offering 4B/4C students the opportunity of receiving “Service Learning” credits by mentoring entry-level 2A/4A students. Although in preliminary phase, this project is pairing 10 students during 2 hours/week supervised mentoring this semester. Data about this initiative will be collected later in the fall, and evaluated.

A substantial investment in new instruments amounting over has significantly improved the quality and reach of our Physics and Astronomy (see table in Part F-1). After the completion of the 2010/2011 Program Review we set the goal of purchasing equipment sets to be shared by two students on each lab, except when certain activities demand “solo” participation of a student for better learning. In particular, students on track to major in Engineering must not only learn basic Physics but also develop sufficient hands-on training on circuit components, power supplies, transformers, oscilloscopes and others. In addition, the move to a new science building equipped each student with a computer and state-of-art lab equipment.

3. What plans for improvement have been implemented to your courses or program as a result of SLO assessment?

The astronomy Astro 10 course receives strong inflow of students from other programs and degrees, as astronomy fills people’s imagination and curiosity about the workings of our Cosmos. On the contrary, Physics courses are mandatory for STEM majors, explaining the tide correlation between increasing and decreasing enrollment trends in Physics courses with other STEM fields. The health of our Physics program has been traditionally governed by the achievements of all other STEM programs together. However, the creation of an AS-T degree in Physics provides a unique opportunity for the department to lead its own growth, breaking the dependency from the other STEM programs. We noticed that data in sit and headcount students have observed a growth in high school enrollees, suggesting that efforts could be made to recruit from this particular student cohort, exactly at the time they are making career choices and settling on more or less constraint academic routes. In 2014, we initiated a project designed to establish a pipeline connecting middle school underserved students with the Universities, and managed by community colleges. Underrepresented students, especially African Americans and Latinos, carry the lowest rates of PhD laureates in STEM fields, and our project attempted not only provide a share to the solution by working with the children since middle school, but also to follow them through the university sophomore years. We tentatively termed this project Space and Technology Academy, and here are its main tenets and goals:

Overview: The Space and Technology Academy — EVC (STA) will promote scientific research in STEM areas, targeting minority groups that are traditionally underrepresented in the STEM working force. Community colleges will manage the program by bridging universities and federal research centers with the K-12 school system. K-12 school systems will be targeted by utilizing after school programs and college organizations that are already chartered, to initiate active research in STEM academic areas. Research projects will make use of scientific data made available to the community once proprietary time is ended. Participating high school and community college students will enroll in two courses currently in development. The first, is a semester long course fully transferrable to 4-years college that will provide students with the skills needed to do research on a given STEM area. The second course will enroll students any time after junior high and lasts for up four years. Supervisors will consist of qualified community college professors. Additionally, students will participate in a mentorship/tutoring program where they will learn how to engage an even younger (middle school aged) generation of students.

Intellectual Merit: Engaging students in research is an alternative method of teaching science to K-14 student. Traditionally speaking, students are taught through lectures and labs. While the latter provides a baseline of general concepts where students are taught to use mathematics to solve real world situations, the former presents hands-on experiments where students are led to analyze data and communicate results in oral and/or written reports. Although attending lectures, labs, and developing problem solving skills constitute large portion of what "learning science" is all about, actual scientific research has been left outside the K-14 arena, which renders incomplete the instruction of modern science. In addition, in the classroom setting, struggling students often have their attention directed to passing their English and Math. Although all students suffer from this to some degree, underprivileged minorities and first-generation college students are often hit the hardest. Here lies the cause of STEM jobs not being populated by minorities of underprivileged background and first generation college students: Due to their circumstances in the middle school years, they miss out on a robust foundation of the basics (mathematics, physical sciences). By the time (or, if ever) they are drawn back to STEM fields (perhaps through a movie, a presentation, or a science fair project), they are driven away by the lacking of basic knowledge they did not absorb early on. This program is unique in that it will mend this pipeline. The middle schooler will receive tutoring and mentorship by a high schooler via a partnership with the Learn to Be Foundation, which currently provides free tutoring to over 5,000 youth around the nation. While the high schooler is engaged in mentoring, he/she will participate in innovative research projects and enroll in formal college coursework, which will be transferable to the university level. Additionally, the high schooler will receive a small stipend to enhance engagement in the STA program.

Broader Impacts: This program will produce the following tangible results: 1) It will expose the joys of doing science in a non-classroom setting to minorities (women, Black, Hispanic, disabled) at a young age, when there still enough time to provide the needed academic support, mentoring, and economical assistance, 2) It will give middle schoolers someone to relate to, increasing the chances they remain in STEM fields, 3) It will give participating community college and high school students stronger motivation to pursue a STEM career when they begin University, contributing to increase the graduation rates of underrepresented minorities in these areas, 4) It will create collaborations between all parties involved in newly released data products: university professors, graduate students, and technologists who conceived the instruments used in the research.

Part of the STA was to engage the community of residents in EVC led projects, and for that we engaged social media and included the Montgomery Hill Observatory as part of the project. Below is a summary of achieved goals in 2016.

January 2016
Stargazing Night & Public Talk: "Our Fantastic Moon" by Dr. Celso Batalha
Attended by: 50 people
Date/Time: Friday, January 8th, 6 pm — 7 pm
Location: Visual Performing Arts (VPA) theater, Evergreen Valley College,
3095 Yerba Buena Rd., San Jose, CA 95135

Abstract: The full moon is the second brightest object in the sky. This talk will be initiated with a historical overview of the role played by the moon in Indian, Mesopotamian, and Meso-American cultures. It will be proceed with a discussion of few curious facts about the geometry of its orbital motion and cyclic events. We complete with a survey of high resolution pictures and videos released by several lunar missions, especially the Lunar Reconnaissance Orbiter (LRO).

February 2016

Stargazing Night & Public Talk: "A Planet for Goldilocks: NASA's Search for Life Beyond the Solar System"
by NASA scientist Dr. Natalie Batalha

Attended by: 150 people
Sponsored by: Nothing Bundt Cake, Evergreen, San Jose
Date/Time: Friday, February 5th, 6 pm — 7 pm
Location: Visual Performing Arts (VPA) Theater, Evergreen Valley College,
3095 Yerba Buena Rd, San Jose, CA 95135

Abstract: Not too hot, not too cold" reads the prescription for a world that's just right for life as we know it. Finding evidence of life beyond Earth is one of the primary goals of science agencies in the United States and abroad. The goal looms closer as a result of discoveries made by NASA's Kepler Mission. Launched in March 2009, Kepler is exploring the diversity of planets and planetary systems orbiting other stars in the galaxy. Finding inhabited environments is a path of exploration that stretches decades into the future. It begins by determining if Goldilocks planets abound. Dr. Batalha will describe the latest discoveries of NASA's Kepler Mission and the possibilities for finding inhabited environments in the not-so-distant future.

March 2016

Stargazing Night & Public Talk: "The Universe of Galaxies and STEM Research Opportunities for Young People"
by Raja Guha Thakurta, a leading astronomer and professor at the University of California Santa Cruz

Attended by: 150 people
Sponsored by: Rajjot Indian Cuisine & Sweets, Evergreen, San Jose
Date/Time: Friday, March 18th, 7 pm — 8 pm
Location: Visual Performing Arts (VPA) Theater, Evergreen Valley College,
3095 Yerba Buena Rd, San Jose, CA 95135

Abstract: The talk will be divided into two segments.
Segment 1: How galaxies play host to the recycling of elements through successive generations of stars and gaseous nebulae.
Segment 2: The Science Internship Program, the Global SPHERE Network, and the importance of engaging young people in real STEM research projects outside the traditional classroom.

April 2016

No Stargazing Night because of rain!
Public Talk "Searching for meteorites in Antarctica"
by Dr. Monika Kress, Professor of Physics & Astronomy at San Jose State University

Attended by: 50 people
Sponsored by: New Seasons Market, 5667 Silver Creek Valley Rd, San Jose, CA 95138
Date/Time: Friday, April 8th, 7:00 pm – 8:00 pm
Location: Visual Performing Arts (VPA) Theater, Evergreen Valley College,
3095 Yerba Buena Rd, San Jose, CA 95135

Abstract: Meteorites fall on the Earth at a rate of 30,000 kg/year. Antarctica is an ideal hunting-ground for these precious samples of other worlds, so each year, the National Science Foundation funds a handful of scientists to search the icy wastelands to recover as many meteorites as possible. In this talk, Dr Kress will discuss the science of meteorites and what it was like to camp out for two months in the most inhospitable place on Earth.

Public Solar Viewing at the EVC Library:
Date/Time: Tuesday, April 19, 2016, 10 am – 2 pm
Location: Evergreen Valley College Library
3095 Yerba Buena Rd, San Jose, CA 95135
Attended by: 100 people

Public Solar Viewing at the EPIC Cultural Event
Date/Time: Saturday, April 30, 10 am – 4 pm
Where: Evergreen Village Square, San Jose, CA 95135
Attended by: More than 300 people

May 2016
Stargazing Night & Public Talk: “Searching for a second genesis of life in our Solar System”
by NASA Planetary scientist & Astrobiologist Dr. Chris McKay
Attended by: 250 people
Sponsored by: Rajjot Indian Cuisine & Sweets, Evergreen, San Jose
New Seasons Market, 5667 Silver Creek Valley Rd, San Jose, CA 95138
Date/Time: Friday, 6 May, 7 pm – 8 pm
Location: Visual Performing Arts (VPA) Theater, Evergreen Valley College,
3095 Yerba Buena Rd, San Jose, CA 95135

Abstract: The search for a second genesis of life in our Solar System is a prime goal of astrobiology. Where might we find it? Following the water, the plume of Enceladus is the most likely target for a near term mission. Meters below the surface of Mars provides a second interesting site possibly holding the remains of past life. The methane seas of Titan may have life and if they do that life will be fundamentally different from life as we know.
June 2016

Event: Vintage Silver Creek Senior Solar Viewing Trip
10 seniors attended
Date/Time: Thursday, June 9th, 10 am — 12 pm
Location: Montgomery Hill Observatory, Evergreen Valley College,
3095 Yerba Buena Rd, San Jose, CA 95135

Stargazing Night & Public Talk “Mesoamerican Astronomy”
by Evergreen Valley College professors — Gustavo Flores and Artura Villarreal
Attended by: 50 people
Date/Time: Friday, June 17th, 7 pm — 8 pm
Location: Visual Performing Arts (VPA) Theater, Evergreen Valley College,
3095 Yerba Buena Rd, San Jose, CA 95135

Abstract: Current knowledge about the ancient Mesoamerican astronomers will be presented in particular, some of the methods employed in the creation and storage of knowledge about position of stars and planets, techniques used in the construction of astronomical observatories, and sites of astronomical significance will be described. The talk will end with the information about stargazing in Mesoamerica which is currently done by Indigenous communities.

July 2016

Stargazing Night & the Astronomy Multicultural Night — Part 1: “Middle Eastern and Asian perceptions of the night sky”

Attended by: More than 150 people

Sponsored by: Rajjot Indian Cuisine & Sweets, 3327 San Felipe Rd, San Jose, CA 95135
Caspian Village, Mediterranean Restaurant & Dining, 2881 The Villages Pkwy, San Jose, CA 95135
New Seasons Market, 5667 Silver Creek Valley Rd, San Jose, CA 95138
WeMo Connect.com (A service of WemoTech.com), Technical Bootcamps & trainings
4701 Patrick Henry Drive, Building # 23, Suite G, Santa Clara 95054

Date/Time: Friday, July 15, 7 pm – 8:15 pm

Location: Visual Performing Arts (VPA) Theater, Evergreen Valley College,
3095 Yerba Buena Rd, San Jose, CA 95135

Abstract: EVC’s Public Astronomy Program celebrated the diversity of EVC’s neighboring community with Astronomy. We blended the religion and performing arts of the Middle Eastern and the Asian cultures by exploring ancient sky along cultural views. The Astronomical information was provided related to those objects. Highlights of the event:
Sufi whirling prayer (dance) on Rumi's celestial poetry by Bay Area Sufi Order sufis.
Indian Hindu religious dances having astronomy background, performed by Indian dance school “Indraadhanush “dancers groups.
Verses from the Quran, related to celestial objects.
Famous Urdu and Persian poetry related to celestial objects.
Free Middle Eastern and Indian food during social community half an hour.

Safari Kids Day Solar Viewing Trip:

Attended by: 45 kids

Date/Time: Thursday, July 28, 2016,

Location: Montgomery Hill Observatory, Evergreen Valley College,
3095 Yerba Buena Rd, San Jose, CA 95135

August 2016

Stargazing Night & Public Talk: “Near Earth Asteroid Space Missions and the Impact Hazard”
by SETI’s research scientist and an expert on near Earth asteroids – Dr. Michael Busch.

Attended by: More than 65 people

Sponsored by: WeMo Connect.com (A service of WemoTech.com), Technical Bootcamps & trainings,
4701 Patrick Henry Drive, Building # 23, Suite G, Santa Clara 95054

Date/Time: Friday, August 12th, 7 pm — 8 pm

Location: Visual Performing Arts (VPA) Theater, Evergreen Valley College,
3095 Yerba Buena Rd, San Jose, CA 95135

Abstract: The near-Earth asteroids are a population of objects on orbits that come near that of Earth. They are accessible targets for spacecraft missions, but also pose a hazard: asteroids can and do impact Earth. Michael will review programs to discover and characterize near-Earth asteroids, and current and future spacecraft missions to study asteroids and to address the impact hazard.

September 2016
Stargazing Night & Public Talk: "Mesoamerican Astronomy"
by Dr. Alejandro Garcia, Professor of Physics & Astronomy, San Jose State University
Attended by: 100 people
Sponsored by: WeMo Connect.com (A service of WemoTech.com), Technical Bootcamps & trainings, 4701 Patrick Henry Drive, Building # 23, Suite G, Santa Clara 95054
Date/Time: Friday, September 9, 7 pm — 8 pm
Location: Visual Performing Arts (VPA) Theater, Evergreen Valley College, 3095 Yerba Buena Rd, San Jose, CA 95135

Abstract: Motion picture directors strive to tell interesting stories set in compelling worlds. In this creative process physicists can help them in a variety of ways. Professor Alejandro Garcia (San Jose State Univ.) has been a physics consultant for DreamWorks Animation since 2011 with screen credit on Madagascar 3: Europe's Most Wanted and Mr. Peabody and Sherman. He also teaches Physics of Animation, a course developed with the support of the National Science Foundation. In this talk Prof. Garcia will describe his work on DreamWorks' upcoming film, Trolls.

October 2016
Stargazing Night & Public Talk: "Pluto, Ceres, and Below: What is a Planet?"
by Dr. Gibor Basri, professor of Astronomy at University of California, Berkeley.
Attended by: 106 people
Sponsored by: WeMo Connect.com (A service of WemoTech.com), Technical Bootcamps & trainings, 4701 Patrick Henry Drive, Building # 23, Suite G, Santa Clara 95054
Date/Time: Friday, October 7th, 7 pm — 8 pm
Location: Visual Performing Arts (VPA) Theater, Evergreen Valley College, 3095 Yerba Buena Rd, San Jose, CA 95135

Abstract: In Summer 2015 we got our first (and probably only, in your lifetime) close-up look at Pluto. It was a good year for dwarf planets, since we also visited the warm one: Ceres. Professor Basri will talk about Pluto's history as a planet (or not), and why it has had a rough time. He will then talk about what we learned at Pluto (so far), compared with Triton (a similar body) and Ceres (a rather different case). He will say a little about the Kuiper Belt (in which Pluto resides) and the origin of Pluto's interesting orbit. Finally, he'll briefly address the large limit for planets (beyond which lie the brown dwarfs).

November 2016
Stargazing Night & Public Talk: "Water in the Universe: from the Milky Way to Distant Galaxies"
by Dr. Michael Kaufman, Professor & Chair of the Dept. of Physics & Astronomy at San Jose State University
Attended by: 72 people
Sponsored by: WeMo Connect.com (A service of WemoTech.com), Technical Bootcamps & trainings, 4701 Patrick Henry Drive, Building # 23, Suite G, Santa Clara 95054
Date/Time: Friday, November 4, 7 pm — 8 pm
Location: Visual Performing Arts (VPA) Theater, Evergreen Valley College, 3095 Yerba Buena Rd, San Jose, CA 95135

Abstract: Water is widely believed to be the key to the existence of life. Water was discovered in the interstellar space in 1969, and is now known to be wide-spread in the universe, from nearby star-forming regions to distant galaxies. Dr. Kaufman discussed how we study water in the space.

December 2016

Stargazing Night & Public Talk: "Science Expeditions to Planetary-like environments and the search for life in the Solar System" by Dr. Rosalba Bonaccorsi, Astrobiologist, SETI Institute's Carl Sagan Center, NASA Ames Research Center.

Attended by: 152 people

Sponsored by: Rajjot Indian Cuisine & Sweets, 3327 San Felipe Rd, San Jose, CA 95135

Date/Time: Friday, December 2, 2017, 7 pm — 8 pm

Location: Visual Performing Arts (VPA) Theater, Evergreen Valley College, 3095 Yerba Buena Rd, San Jose, CA 95135

Abstract: The Astrobiology-driven search for Life in the Solar System and beyond begins here on Earth. In connection with this search, the NASA vision for Space Exploration involves robotic missions to prepare for humans living, working on the surface of Mars, and exploring it for finding indicators of life. The near future search for life will target Ocean Worlds such as Enceladus and Europa, icy moon with potentially habitable subglacial briny oceans.

Over the past 10 years we have been planning and conducting NASA Spaceward Bound field expeditions to terrestrial planetary analog environments where we can gain scientific knowledge; and test technologies and analytical protocols for life detection. During SB expeditions we train teachers and educators as well as the next generation of scientists and space explorers; and we engage the local communities and the general public.

In this talk Rosalba will present examples of expeditions to extreme and remote deserts in Chile (Atacama), Namibia, New Zealand, Australia, Antarctica, and the Himalayas. A summary of the latest 2016 SB India Expedition to the Leh-Ladakh region will be also presented.

4. As a result of SLO assessment data, will you be requesting additional resources for your program or courses (i.e. additional faculty, equipment request, program personnel…)?

It is explained in Part F-1 the rationale of hiring requested by these Departments, which consist of:

- A full time faculty member
- A full time lab technician
- An adjunct faculty overseeing the "Advanced STEM lab"

Likewise, a list of new instruments is indicated in Part F-1, which includes the complete upgrade of our major telescope, camera, and acquisition of an instruction spectrometer to complement existing lab equipment used by PHYS 2B, PHYS 004C, and ASTRO 10L students. The requested spectrometer has enough resolution to resolve absorption and emission lines produced in stellar atmospheres, as we all as circumstellar gas. Detailed scrutiny on data taken in Astro 10 SLO assessment measured the following:

Questions based on the tools astronomers use to retrieve physical properties of celestial objects (spectroscopy, and atomic absorption, emission and scattering) came with few right answers, and I suspect those were guessed. We will implement visualizations such as those available in PHET Colorado or exercises given in ComPADRE, and assess students with short quizzes in Moodle. This will be discussed with Astro professors in future meetings of our Physics and Astronomy Department, and implemented in spring 2016.

C-ID requirements prevent us from replacing real world data taken with software simulations, requiring therefore an instructional spectrometer. It will be used by physics and astronomy students, and by honors students working in the "Advanced STEM lab". In addition, high school students currently engaged in research projects with some of our faculties will count on such advanced instrument to collect data, which can only be used in conjunction with real telescope and observatory such as ours.

PART D: Faculty and Staff

1 & 2. List current faculty and staff members in the program, areas of expertise, and how positions contribute to the program success.

Celso Batalha, Ph.D, Full Time Physics and Astronomy Instructor

B.S Physics — Pontificia Universidade Catolica, Rio de Janeiro — Brasil.
M.S Physics — Pontifical Universidade Catolica, Rio de Janeiro — Brasil.
PhD. Astrophysics — Observatory nacional, Rio de Janeiro — Brasil.

<u>Area of Expertise:</u>

- Observational Astronomy, spectroscopy, photometry, and spectral synthesis, with related papers published in peer-reviewed professional magazines.
- Experience in conducting scientific research, incorporating undergraduate students in the process of developing and presenting final scientific results.
- Managerial skills in leading working groups focusing in education and scientific projects.
- Experience teaching in various California community colleges, including teaching upper division courses at Brazilian and American universities.
- Courses taught in Astronomy, Physics, and Earth Sciences at EVC: PHYS 2A/2B; PHYS 4A/4B/4C; ASTRO 10/10L/14/16; and PHYSC 012.

Physics and Astronomy laboratories demand constant upgrade of technologies employed. As a full time faculty, I follow the release of new equipment, and try to update myself on the different methods of delivering course contents using new technologies. The 2010 Physical Review document identified several areas of weaknesses in our program, mostly associated with outdated equipment. It recommended an in depth reformulation and modernization of labs, and suggested the use of laboratory time to assess SLO's. This modernization and reformulation of labs were initiated in 2014 and is currently under way. Listed below are some areas that I effectively intervene to improve our academic delivery.

- Update of Physics and Astronomy course outlines.
- Work with the Division Dean creating an AS-T degree in Physics.
- Create course and program levels SLO's.
- Supervise SLO's assessment of Physics and Astronomy courses, collecting data, and suggesting strategies to improve student learning.
- Oversee the purchase and modernization of instruments at the Montgomery Hill Observatory, and physics labs.
- Supervise the work of "Federal Work Students" in our labs.
- Organize monthly meetings of the Physics and Astronomy departments, write minutes for these meetings, and foment internal discussion among faculties and lab technicians intended to improve our course deliveries.
- Initiate the use of video analysis in Physics courses.

- Organize data on student success, student and faculty FTE ratio in order to support the hiring of a new Full Time Faculty for the Physics Department. This data was presented before the Academic Senate.
- Partial participation in the hiring committee of a Full Time Faculty for Physics and Astronomy.
- Interview adjuncts to fill needed positions in Physics, Astronomy, and Earth Sciences, and assist these new hires.
- Pass student evaluation of adjuncts, observe their teaching methods, and indicate areas of improvement.
- Represent the Physics and Astronomy Departments in EVC events designed to publicize our courses.
- Propose the purchase of new equipment and its release, writing up accompanying instructions for the students (lab handout).
- Receive high school students at the Montgomery Hill Observatory, especially the members of the Society for the Advancement of Chicanos and Native Americans in Science (SACNAS).
- Attend the EVC — High School counselor's day, publicizing our Astronomy and Physics programs.
- Manage the outreach activity of the Astronomy Department that includes: a monthly lecture series at the VPA, featuring scientists from local universities and research centers (100 or more visitors); promote a monthly stargazing at the observatory (100 or more visitors); host private gathering at the observatory for groups such as middle schools, boys and girls scouts, senior centers, and others; foment the creation of astronomy clubs at local high schools; display new telescopes at the library; and others. Most of the time, the hard work is done by volunteers, including adjunct professors, lab technicians, students, and outside volunteers.
- Visit Evergreen High, Silver Creek, and Overfelt High publicizing our Physics and Astronomy programs.
- Manage a partnership of EVC with the Stanford "InteGrate" program, designed to divulge Earth Science curricula in community colleges (2015).
- Supervise astronomy research for high school students (Evergreen High and Overfelt High) interested in becoming Astronomers.
- Establish a partnership between EVC and the Goldstone Apple Valley Radio Telescope (GAVRT). This partnership allows our students to collect real astronomical data on a 34 meters radio telescope located in southern California.
- Mentor high school students indicated by the program "YouResearch" at http://www.youresearch.org/

Professional Development, Grants Received, and Publications in the last 5 years:

- Participate in monthly meetings (2013-2015) at the Stanford Human Rights Education Initiative, as an attempt to introduce elements of Human Rights Education in our Physic 012 course.
- Publication: "Implementing Human Rights Education in the Science Curriculum" — http://shrei.stanford.edu/sites/shrei.stanford.edu/files/Celso%20Batalha%20LP.pdf
- Recipient of the 2013-2014 Stanford Human Rights Initiative: http://shrei.stanford.edu/fellows/2013_2014_shrei_fellows.
- Attend the ATA Physics workshop in Arizona — 2014.

Masuda, Michael M., Physics & Astronomy Instructor

<u>Education</u>

1. MS Physics – San Jose State University
2. BS Physics – Lasers and Optics Concentration (San Jose State University)
3. BS Physics – Condensed Matter Physics Concentration (San Jose State University)

Areas of Expertise

Prof. Masuda has been teaching various physics courses (Phys 1, 2A, 2B, 4A, 4C) at Evergreen since 1997 and the astronomy courses (Astro 10 and 10L) since 2000, but his background in teaching physics starts in 1991 at SJSU--where he honed my skills as a lab instructor for algebra/trigonometry based physics, calculus based physics, as well as conceptual physics. He tends to use lots of props and demos—a "habit" which arose from teaching labs.

Prof. Masuda utilizes a pedagogy I call "immersion technique"—immersing the students in audio, visual, physical and tactile multi-media methods to convey course material and to allow students to connect course material with aspects of their daily lives. He encourages focused and directed peer-to-peer discussions in class, outdoor activities, and often assign semester journals for the students to reflect and contemplate course material outside of class. He relates his personal experiences as a "confused and frustrated student in physics" (i.e., what didn't work) towards the constant improvement of his teaching methods.

This professor's expertise includes:

1. PASCO and VERNIER computer-interfaced experiments using LoggerPro.
2. Online, offline, and smartphone planetarium apps, such as Stellarium, SkyViewCafe, Starry Night, SkyGuide, Planet Finder, Google Sky, etc., and Smartphone physics apps, such as Analyzer, Oscillo, dB Meter, etc.—towards making the course material one that the students can relate with everyday experiences.
3. Utilization of Dropbox, MS Word, MS Excel—to keep up-to-date rosters and student records on hand using iPad platform.
4. Literacy in online forums, multimedia, communication, general information, and computers.
5. Assorted Physics and Astronomy instrumentations.
6. Interdisciplinary skill sets between physics and musical instruments.
7. Research experience (9 years) at NASA Ames Research Center in geophysical research—tracing the remnants of water presence in mineral samples and in fused silica.
8. Faculty Advisor (7 years) of MASTEP Math and Science Club, which will be starting up again shortly.
9. Outreach experience and activities with local K-12 schools.

He Contributes to Program Success by:

1. As faculty advisor, he envisions a system where the Math and Science Club members will be recruited to help with an ongoing Outreach Math and Science Program--where visits to the K-12 schools involving math and science demonstrations and hands-on activities will help generate interest for our campus, our program, and should result in an influx of future math and science students.
2. As a lab instructor, he has created a lab manual for Phys 1, and have contributed to the development of labs for Astro 10L, Phys 2A, 2B, 4A, and 4C. I strive to maintain a balance between utilizing the state-of-the-art technology and utilizing everyday equipment—so that the student never loses sight of the connection between the scientific concepts and real life applications.
3. As an instructor, his teaching pedagogy is a multiple-tactic approach involving several avenues of sensory communication--effective in reaching various student learning styles. He often brings in outside props, such as musical instruments, to reinforce and supplement concepts introduced in class. He also employs YouTube and have made instructional tutorial videos for my physics students.
4. Learning Activities/Workshops

He has participated in various training workshops at Gavilan College in Gilroy, including the following topics:

- Students with PTSD and post-military service needs
- Students with physical and mental disabilities
- Expectations of a terrorist attack on campus

5. Publications & Presentations

- "Instabilities of Water Columns," M. C. Fallis, M. M. Masuda, R. C. LeRoy, and N. Neisan, in "Nonlinear Physics for Beginners," pp. 301 — 307, (L. Lam, World Scientific, 1998).
- "Highly mobile oxygen hole-type charge carriers in fused silica," F. Freund and M. M. Masuda (1991) J. Mater. Res., vol. 6, no. 8, 1619 — 1622.
- "Verification of charge distribution analysis via interferometry," M. M. Masuda and F. Freund (1997), San Jose State University, San Jose, CA.
- "Quick and Easy Demo: Measuring the diameter of a human hair using a laser pointer," M. M. Masuda, AAPT Meeting (1997), Santa Rosa Community College, San Ramon, CA.
- "Quick and Easy Demo: The 12-inch DUI detector (or How to measure reaction time using a ruler)," M. M. Masuda, AAPT Meeting (1997), Santa Rosa Community College, San Ramon, CA.
- "Quick and Easy Demo: Easy to construct vortex air cannons," M. M. Masuda, AAPT Conference (1998), U C Santa Cruz, Santa Cruz, CA.

6. Learning Philosophy

The human brain remembers information best when emotions and/or multiple sensory avenues are involved. By immersing the student with audio, text, images, and tactile demos during class, involving the student to keep a journal for their experiences outside of class and how it relates to physics/astronomy topics, and getting the students involved in group sessions towards completion of a project—the students connect with the material at a much deeper level. He starts with a little historical background for the material, then move to concept without math, then incorporate the math with formulae and examples, and then follow-up with conceptual (and mathematical, if required) questions for the class. He utilizes the "talk with your neighbor" peer-to-peer approach used by Paul Hewitt for his conceptual physics course, to engage the students into thinking about the material during class. On occasion, he takes the class to the campus observatory, or simply outdoors to have them see the concepts discussed in class depicted in real life.

3. Describe the departmental orientation process (or mentoring) for new full-time and adjunct faculty and staff (please include student workers such as tutors and aides).

In 2016 we hired a full time faculty for physics and astronomy, and have followed guidelines provided by the Dean to ensure this new professor adheres to the philosophy implemented in our department: upgrade lab as needed, make full use of lab time for instruction, and provide students with access to tutoring and mentoring. New hire must also follow course SLO's and provide students with clear syllabus of his/her courses. Adjuncts are assigned a mentor, invited to attend our department meetings, and taped archived sections are emailed to them. When hired, they must agree in submit SLO assessments, collect, and share results. We periodically visit adjunct classrooms, and report on their performance, and give advice on possible improvement.

Achieving the goals of our SLO's require robust lab support, which implies on having dedicated laboratory technicians. We hired another lab technician on a temporary basis, and are urgently requesting the hire of a full time lab technician. We also hired two student helpers. Student helpers are oriented in tiding labs after class is over, putting away equipment, wires, and cables, ensuring that labs are ready for use when needed.

PART E: Budget Planning and Resource Allocation

1. Current Budget
    A. Identify the budget currently allocated for the department/program through the division budget (fund 10). Discuss its adequacy in meeting your program's needs.

The physics budget for the years after the last program review were:

- 2011-2012: $5,815 (supplies)
- 2012-2013: $5,965 (supplies)
- 2013-2014: $5,227 (supplies)

The 2011 program review identified insufficient support for the Physics and Astronomy departments, and $38,708.00 were invested in equipment to modernize physics labs.

- 2014-2015: $6,715 (supplies) and $5,648 (equipment)

The Division of MSE realized that our supply budge was not sufficient to attend our demands and comply with requirements indicated by the SLO's, raising therefore our budget.

- 2015-2016: $8,815 (supplies) + $32,000 in equipment.

Therefore, the total supply budget for the last 5 years was $ 32,537. The total equipment budget for the last 5 year was $ 76,356. The Astronomy department used approximately $ 15000.00 to upgrade its portable telescopes used in Astronomy laboratory classes. These funds were donated by the community at the time the Montgomery Hill Observatory was created, and largely fundraised by a prior staff member, Georgiana Rudge.

    B. Identify any external (fund 17) funding the department/program receives, and describe its primary use.

There is some fund 17 supply monies available for the FY 2016-2017 of about $3000 that will be used to buy supplies for the Physics 004C classes which have been underfunded and undersupplied over the past six years.

    C. Explain any grants or other external funding sources (partnerships) for which your program is benefiting from.

None.

2. Explain any grants or other external funding sources for which your program would be a good candidate. Do you have plans to apply for such sources?

The Space Technology Academy (STA) was first put together for the "Inclusion Across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science (NSF — INCLUDES), with final awards announced early in the fall last year. We passed the preliminary call with grades "excellent", "good" and "good", but not on the final run. We learned that a second submission for this grant would require more effective support from the college, a reason why elements of the STA is openly introduced and discussed in this review. The college has given support by allowing us to use the VPA every first Friday of the month, and providing technical support. This project needs more support with the hiring of a full time lab technician and a as indicated below.

We also plan on applying for the RUI/ROA Research in Undergraduate Institutions, which has the scope of supporting research by faculty members in predominantly undergraduate institutions. It also attempts at strengthening the research in groups of underrepresented undergraduates as long as the research is integrated with education. Faculties involved must coordinate research with the Universities, which will spread our network.

PART F: Future Needs:

1. Please describe any unmet needs for your program and how you plan to address them. Are any additional resources needed to accomplish your program's outcomes? Please provide rationale on how the requests tie into the strategic initiatives, college mission, SLO Assessment or Student Success

Hire of a full time faculty — We recently hired a full time faculty for the physics and Astronomy departments, but it was a replacement for a retired professor. According to data collected in 2014, 2.1 load were taught by adjunct faculty, or 48.2% of the total load for both departments. In fall 2014, the result was 2.9 load taught by adjuncts or 66.3% of the total load. Astronomy was enrolling 326 students and physics 194 students, with a total of 520 students. These students in 2014 were being served by 1.5 full time faculty members (one had a reduced load of 50%), forcing the Division of MSE to employ 6 adjuncts. For comparison, Chemistry attended 396 students, 194 students less than Physics + Astronomy, and served by 4 full timers and 1 — 2 adjuncts.

In spring 2015, physics and astronomy adjuncts were responsible for 52% of the load whereas chemistry adjuncts were responsible for 42% of the total load. Moving to Fall 2015, physics and astronomy adjunct faculties were responsible for 57% of the load whereas 20% of the chemistry adjuncts were responsible for the load. Data read off MyWeb in fall 15 indicated that astronomy was enrolling 319 students, physics enrolled 152 students, totaling 471 students. These students were served by 1.5 full time faculty (one has a reduced load of 50%). The Division currently employed 7 adjunct faculty. For comparison, chemistry attended a total of 350 students (121 students less than astronomy and physics together) served by 3 full timers and 4 adjuncts.

We urgently request the hiring of a full time faculty, which will bring us closer to our standards in mid-2000's of three full timers. In addition, our full timers will be dedicating extra hours to ensure the success of the STA participating in coordinated activities with middle and high schools.

Upgrade of equipment in the roll-off-roof building — The C14" is our major telescope but it was purchased in the 70's when the college was established. The old technology renders impossible a quick change in telescope pointing, and the image quality delivered by modern cameras is not being achieved. As of now, the telescope is primarily used for public inspection and not for student learning in our Astro 10L laboratory.

The eyepieces currently employed in visual inspection must also be replaced by a modern CCD camera, which will promote not only the modernization of current astronomy lab modules but also the creation of new courses such as "Introduction to Astrophotography", ASTRO 20 — "Elements of Research I" and ASTRO 22 — "Elements of Research II".

We summarize below our needs for the following 5 years:

Item	Catalog ID	#	Cost Each	Total Cost
ProScope 5MP Microscope Camera — Vernier	BD-PS-MC5UW	3	$299.00	$897.00
Vernier Circuit Board	VCB2	32	$129.00	$4,128.00
Vernier Projectile Launcher	VPL	2	$319.00	$638.00
Vernier Centripetal apparatus	160783	15	$449.99	$6,749.85
DTS-MEC	DTS-MEC	34	$184.00	$6,256.00
Vernier Neon Spectrum tube	ST-NE	17	$37.00	$629.00
Vernier Sodium Spectrum Tube	ST-NA	17	$37.00	$629.00
Vernier Nitrogen spectrum tube	ST-N	17	$37.00	$629.00
Vernier Helium spectrum tube	ST-HE	17	$37.00	$629.00
Charge sensor	CRG-BTA	17	$75.00	$1,275.00
Radiation sensor	VRM-BTD	17	$169.00	$2,873.00
Colorimeter	COL-BTA	17	$115.00	$1,955.00
Dual Range Motion Sensor	DFS-BTA	17	$109.00	$1,853.00
Force Plate — Vernier	FP-BTA	17	$275.00	$4,675.00
Sound Level Meter	SLM-BTA	17	$199.00	$3,383.00
PH Sensor	PH-BTA	17	$79.00	$1,343.00
Gas Pressure Sensor	GPS-BTA	17	$83.00	$1,411.00
Blood Pressure sensor	BPS-BTA	17	$105.00	$1,785.00
LAabQuest2	LABQ2	34	$329.00	$11,186.00
Power Amplifier	PAMP	17	$ 199.00	$ 3,383.00
Go!Temp	GO-TEMP	20	$39.00	$ 780.00
Compact Thermal expansion Apparatus — PASCO	TD-8578	17	$349.00	$ 5,933.00
STEAM Generator	TD-8556A	17	$499.00	$ 8,483.00

Item	Catalog ID	#	Cost Each	Total Cost
Spectrograph System	Shelyak ESHEL Complete Spectrograph System # SKU SL-ES0007 $19,005.00	1	$19,005.00	$ 19,005.00
CCD Camera	SBIG STXL-16200 Ultimate Package # SKU: STXL16200-Ultimate	1	$13,541.00	$ 13541.00
20" Telescope	ALLUNA RC20 Ritchey-Chretien Telescope 510mm f/8.0 system	1	$47,206.00	$ 47206.00
Mount	PARALLAX HD300C GEM Weight load Max.300lbs	1	$25,000.00	$ 25000.00
3-D Printer (Makerbot Replicator 2X with filament spools	Model # MP05927	1	$5,500.00	$5,500.00
			TOTAL	**$181,754.85**

Once the STA is established, it will required specific budget to run its outreach and academic components. On a 6-years stretch, we project resuming and planning bimonthly lecture series, with costs on honorarium and renting VPA listed below (figures on Table are for 6 months range). The Advanced Laboratory in Physics and Astronomy will require computer with specific computer language installed (IDL), while the outreach efforts will require a budget for marketing. Federal Work students will be hired to help reducing the load of costs.

Additional costs of the Space and Technology Academy for equipment and outreach over a 6-year period	
Honorarium — Speaker Series	$10,800.00
Renting VPA	$12,600.00
Laptop to Control 20" Telescope	$2,500.00
Secretarial Materials	$3,000.00
Marketing	$30,000.00
IDL Site License	$16,000
Advanced Laboratory	$6,000.00
Inflatable Planetarium	$75,000.00
Non-Instructional Load	$205,363.00
Total	**$331,263.00**

2. What faculty positions will be needed in the next six years in order to maintain or build the department? Please explain. What staff positions will be needed in the next six years in order to maintain or build the department? Please explain.

We foresee the astronomy and physics programs growing to the point of requiring the hiring of full-time faculty and staff as follows:

- *Full Time Faculty for Physics and Astronomy* — Our analysis predicts a residual growth in high school students taking our physics and astronomy courses. The current ratio of full time faculties to courses/students is one of the lowest in the division and does not allow for growth. We indicated in the previous section the need of an immediate hiring of a full time for physics and astronomy. With the formalization of the STA, we request the hiring of two full timers instead.

- *Adjunct Faculty for Advanced Labs — 3 hours/week*- The creation of an advanced lab in physics and astronomy will require a professor to oversee it, implementing advanced lab exercises and writing companying hand-outs. In addition, her/his duties will include planning and execution of field trips to science labs firms to enrich our student's understanding of STEM fields and expand their horizons. This will increase the number of students taking honors-credit. Our labs are being structured to allow for independent open-ended project developed by students outside classroom time. This can also be facilitated by the professor in charge of this lab. This service can be expanded to Chemistry, Biology and other STEM fields in the Division. This position can be waived if we get approved the hiring of two full time faculties for physics and astronomy.

- *Full Time Laboratory Technician* — As of 2016, all activities under the umbrella of STA is being maintained by volunteered work of EVC faculties and staff. Once the STA becomes official, it will require allocated personal. STA will assist astronomy clubs in high schools, create and maintain undergraduate research at the Montgomery Hill Observatory, especially after purchasing the new 20" RC Telescope. A full time lab technician will assist professors and students executing night observations and projects at the Montgomery Hill Observatory. As in 2016, the departments of physics and astronomy have support of two part time lab assistants, which together provide 20 hours/week work load to each department, which is equivalent to one full-time lab tech overseeing both departments. We have optimized the available staffing by applying identical labs/week to all sections of a course, and even to different courses whenever possible (ex: PHYS 02A and PHYS 004A). Expansion and improvement of our courses will demand increasing staff support. Altogether, physics, astronomy, and the STA with its advanced research lab will require 1.5 full time lab assistants, which implies in the changing of one of the part time positions into a full time position, with supporting staff available early in the morning when several sections start, and late afternoon when several evening sections start.

- *20% Non-Instructional Load for a Computational Data Scientist Consultant*- Astronomy Research is strongly entangled with computer software and packages, often requiring support from an experienced consultant. With the help of Mr. Lee Rotter, a retired scientist with past employment in UC Santa Cruz and Perry Observatory, we formalized EVC student access to the Goldstone Apple Valley Radio Telescope (GAVRT), as suggested but our President Henry Yong, creating a package to read out an electronic file containing a night worth of radio data obtained by our students. As research develops with participant high school students, more troubleshooting interventions will be required to prevent delays when delivering results.

- *20% Non-Instructional Load for a professor to create the "Elements of Research 10 " course outline* — This course is key to the Space Technology Academy, and must be designed in such a way as to facilitate its implementation in other Community Colleges, while being articulated with CSU's. The SJSU course, PHYS 040 — Computational Physics, presents itself as the university course to be mirrored. A full curriculum must be developed with in class activities, take home projects, assessments, required pre-reqs, and learning goals.

- *20% Non-Instructional Load for a Community Outreach Person* — Recruiting of middle and high school students demands intense collaborative work with community leaders, schools, and parents. The success of the STA in the last two years — as far as the number of attendees in talks and stargazing's are concerned — requires a person in charge of managing.

To ensure the success of the proposed STA program in its initial stage, and complementing the jobs/activities listed above, we are still counting on the strong volunteering work offered by faculty and community members in the following actions:

- *Implementation of NASA curricula for middle schools* — Contacts were initiated with underserved middle schools, and physics and astronomy faculty will volunteer time to implement a few modules with middle schools.
- *Development of advanced STEM research with high school students* — This is currently underway with some of our professors leading this effort, and will intensify once the STA program is officially launched, in which case the courses Elements of Research 10 (ER10) and ER20 will be introduced to these students.
- *Hosting bimonthly lecture series* — During the 2016 academic year, we proved the viability of hosting a monthly lecture series at the VPA theatre, sometimes reaching a peak of 200 visitors. The STA will still carry this project but with a talk every two months.

3. Does your program require any additional facilities, equipment, technology and/or supplies over the next six years (above and beyond the program's current budget)?

A large fraction of our current lab needs is being replaced with the current budget, but an expansion of our department scope with the creating of the STA will demand more specialized equipment and software. In particular, the addition of research as a mean to recruit underserved students will required modernization of our largest telescope, the C14 purchased in 70's, with purchase of a 20" optical telescope with a new mount and pier. A telescope such as this comes with attachments such as a CCD camera to enable photometric and spectroscopy campaigns, and a state-of-art spectrograph. Table below displays a range of new equipment needed, and total cost

PART G: Additional Information

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

There is no additional information to add.

PART H: Annual Assessment: Program Faculty and PR Committee

Please attach copies of any Annual Reviews that you have completed in the last six years (if applicable)

There have been no annual PR reviews.

PART I: Resource Allocation Table

Program Reviews provide a valuable source of information for the College as it makes decisions on resource allocation, both in terms of funding and cuts. The following information, in table format, will be used by the College Budget Committee to help inform EVC's Budget and Planning Process.

Item Title	Response
Productivity (WSCH/FTEF)	456
Student Success Rate (Retention Rate)	69.3%
Number of class sections offered by your program	22
Changes in enrollment	2012–2015, a decline of 3.8% headcount
Your Program's Current Budget (from Fund 10)	$14,919.00
Current External Funding (from Fund 17)	$9,796.00
Future Needs: Faculty (Estimated Additional Cost)	$105,000.00/yr
Future Needs: Staff (Estimated Additional Cost)	$78,955.00/yr
Future Needs: Facilities (Estimated Additional Cost)	$87,600.00
Future Needs: Supplies (Estimated Additional Cost)	$181,754.85 w/o Space Academy $55,210/year additional with Space Academy

**** Do your program's future needs assume that your program's enrollment will remain stable or do they depend upon enrollment growth? If they depend on growth, please explain the growth projections on which you are basing your assumptions. You may attach any supporting documentation to explain or support assumptions.***