**Bakersfield College**

**Program Review – Annual Update 2015**

**I. Program Information:**

Program Name: Physics and Astronomy

Program Type:  Instructional  Student Affairs  Administrative Service

***Bakersfield College Mission****:* Bakersfield College provides opportunities for students from diverse economic, cultural, and educational backgrounds to attain Associate and Baccalaureate degrees and certificates, workplace skills, and preparation for transfer. Our rigorous and supportive learning environment fosters students’ abilities to think critically, communicate effectively, and demonstrate competencies and skills in order to engage productively in their communities and the world.

Describe how the program supports the Bakersfield College Mission: We primarily offer transfer level courses designed to satisfy the needs of science, engineering, computer science and architecture majors, allied health students, college general education requirements, and liberal studies teacher credential programs. Through our transfer degree, we provide a reliable means of transferring to four-year institutions in continuation of advanced degrees in fields requiring a rigorous background in physics and/or astronomy. In our courses we provide a rigorous and supportive learning environment to think critically in solving problems using logical reasoning and to communicate their knowledge and experiment results in a logically, coherent way. Community outreach efforts comprise a smaller, yet still important, part of the work we do.

Because the Astronomy courses are for the general education program only and are not part of the Physics degree, this program review will be divided into two parts for each question: (1) the astronomy courses and planetarium and (2) the physics courses leading to the Physics AST degree. Based on education and career goals articulated by students on a form the students fill out on the first day of astronomy classes each semester for the past ten years or so, over 95% of the students taking the astronomy courses are non-STEM majors and are not on a Physics pathway in any way shape or form. For purposes of the college’s program review process, astronomy is put under the physics umbrella to provide a venue for evaluating the astronomy offerings and needs. We will clearly distinguish between the astronomy and physics parts in the rest of this form.

Program Mission Statement: The mission of the Physics and Astronomy program is to provide the rigorous science foundation necessary for students to acquire the skills, knowledge, intellectual curiosity and scientific literacy essential for a wide variety of careers in this rapidly changing world. We definitely stress critical thinking with problem solving!!

**II. Progress on Program Goals:**

1. List the program’s current goals. For each goal (minimum of 2 goals), discuss progress and changes. If the program is addressing more than two (2) goals, please duplicate this section.

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| **Program Goal** | **Which institutional goals from the Bakersfield College Strategic Plan will be advanced upon completion of this goal? (select all that apply)** | **Progress on goal achievement**  **(choose one)** | **Comments** |
| 1. Discipline promotion | 1: Student Learning  2: Student Progression and Completion  3: Facilities  4: Oversight and Accountability  5: Leadership and Engagement | Completed: \_\_\_\_\_\_\_\_\_\_ (Date)  Revised: \_\_\_\_\_\_\_\_\_\_ (Date)  Ongoing: \_\_\_\_\_\_\_\_\_\_ (Date) | **Astronomy:** Continue outreach to community through planetarium shows and bi-monthly Night Sky column in Californian.  **Physics:** We intend to host the KHSD Physics Olympics at Bakersfield College every year that it will be held in order to promote interest in physics and engineering to students in the Kern high schools. |
| 2. Improve professional development through training in areas specific to STEM and pedagogy | 1: Student Learning  2: Student Progression and Completion  3: Facilities  4: Oversight and Accountability  5: Leadership and Engagement | Completed: \_\_\_\_\_\_\_\_\_\_ (Date)  Revised: \_\_\_\_\_\_\_\_\_\_ (Date)  Ongoing: \_\_\_\_\_\_\_\_\_\_ (Date) | **Astronomy:** STEM grant paid for Great Teachers Seminar for astronomy professor in Spring 2015. Astronomy professor self-funds other astronomy specific professional development.  **Physics:** Physics instructors intend to attend local chapter biannual meetings of the American Association of Physics Teachers, and also to participate in periodic webinars hosted by online services such as WebAssign. |
| 3. Develop understanding on how to use data analytics to improve student success | 1: Student Learning  2: Student Progression and Completion  3: Facilities  4: Oversight and Accountability  5: Leadership and Engagement | Completed: \_\_\_\_\_\_\_\_\_\_ (Date)  Revised: \_\_\_\_\_\_\_\_\_\_ (Date)  Ongoing: \_\_\_\_\_\_\_\_\_\_ (Date) | A goal that we’ve set for ourselves since the last update is to better understand how to use ATD data to target specific groups of students needing additional or different type of instructional intervention.  **Astronomy:** This goal not met! Need training opportunities. |

1. List new or revised goals (if applicable)

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| **New/Replacement Program Goal** | **Which institutional goals will be advanced upon completion of this goal? (select all that apply)** | **Anticipated Results** |
|  | 1: Student Learning  2: Student Progression and Completion  3: Facilities  4: Oversight and Accountability  5: Leadership and Engagement |  |

**III. Trend Data Analysis:**

Highlight ***any significant changes*** in the following metrics and discuss what such changes mean to your program.

1. Changes in student demographics (gender, age and ethnicity). **Astronomy:** no changes in *gender*. *Age:* trend in shifting proportion from less 19&younger to more 20-29 year olds seemed to partially reverse last year. It still more 20-29 year olds but the split is more even. Could be due to collegewide effort to capture more of the high school graduates (“increase high school yield”). *Ethnicity:* the ratio of Hispanic-Latino to White continues to increase with ratios now at 67% to 24%. Other groups have no change. **Physics:** no significant changes in age or gender are apparent over the last five years, but percentages of Hispanic-Latino students has steadily increased over the last 5 years from 47% to 65%.
2. Changes in enrollment (headcount, sections, course enrollment and productivity). **Astronomy:** students per section and productivity went down last year to lowest level in past 5 years though at 41/section and 21.6, they are still well above the college average. Could be due to more students making quicker decisions on whether to commit to a class before census date as more of them are getting their student ed plans and, therefore, have a better idea of their college path. **Physics:** The number of sections of physics courses has increased steadily over the last five years from 13 sections to 16 sections. The number of physics majors on the other hand has remained fairly constant at around 38 (with an unusual spike of 52 last year). The extra sections of courses in physics seems to be primarily due to a recent surge in engineering students taking courses in the calculus-based physics sequence.
3. Success and retention for face-to-face, as well as online/distance courses. **Astronomy:** No significant change in Success rates. Retention is highest of past 5 years. **Physics:** Physics has had fairly constant, but very high, retention rates over the past five years, ranging averaging about 91-92%. FTES has increased from 58 to 70 in the last five years.
4. Changes in the achievement gap and disproportionate impact (Equity). **Astronomy:** Cannot see *changes* with data provided because it combines last 5 years into a single number for each population group. Program review handbook needs to discuss how to measure disproportionate impact so I’m going on memory here of how to calculate it: if a group is 80% below the top group, then the given group is “disproportionately impacted”. Disproportionately impacted students include: ***Retention*** *Age:* students 30+ years old; *Ethnicity:* Asian/Filipino/Pac Islander. ***Success*** *Age:* students 20-29 yrs old; *Ethnicity:* Asian/Filipino/Pac Isl and Hispanic/Latino.
5. Other program-specific data that reflects significant changes *(please specify or attach).* All Student Affairs and Administrative Services should respond.

**IV. Program Assessment (focus on most recent year):**

1. How did your outcomes assessment results inform your program planning? Use bullet points to organize your response.
   * **Astronomy**
     + No need to modify astronomy course offerings.
     + Instruction about lunar phases needs to change. Need a lab to improve students grasp of lunar phases.
     + Using a new online homework system starting Fall 2015 that is $25 cheaper for students. Old HW system (Mastering Astronomy) was very good but price kept increasing. Will see how student performance compares under new HW system (Sapling Learning).
   * **Physics**
     + The enhanced version of WebAssign that was used only in the modern physics courses is now utilized in all of the course in both physics sequences. The available help and feedback given to students with problem solving assignments is superior and is deemed to be making a big difference in completion rates with problem sets.
2. How did your outcomes assessment results inform your resource requests? The results should support and justify resource requests.
   * **Astronomy**
     + No resource requests beyond the normal red pens and staples requests needed for evaluating assignments.
     + We continue to have a technology request for a new SciDome system based on the age of the system (system is now 9 years old).
     + Astronomy is a popular subject for the non-science major BUT it is very difficult subject because of the level of abstract reasoning required. The courses need more paid peer tutors who would need to be paid from GUI or other funds but not the STEM grant since Astronomy is not part of a science degree program.
   * **Physics**
3. How do course level student learning outcomes align with program learning outcomes? Instructional programs can combine questions C and D for one response (SLO/PLO/ILO).
   * **Astronomy**
     + Course SLOS mesh very closely with PLO.
     + Each Astronomy course stands on its own---they are not part of a sequence, so they achieve the same SLOs through different content. Mapping of SLO to PLO to ILO in matrix below.

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| **Course SLO** | **Program Learning Outcome** | **Institutional Learning Outcome** |
| Demonstrate a correct understanding of the cause of a given phenomenon, the physical nature of a given object, and the properties and processes of a habitable world [this is the "what we know" SLO] | Demonstrate a knowledge of and recognize the processes that explain natural phenomena | I. Think critically and evaluate sources and information for validity and usefulness.  II Communicate clearly and effectively in both written and oral forms *[we focus on written form]*  III. Demonstrate competency in a field of knowledge or with job-related skills. |
| Describe the scientific method, give the evidence for an explanation and describe the technique(s) used in determining either the property of something, how it interacts with its environment, or its origin and history [this is the "how we know" SLO] | Apply the methodologies of science when approaching a problem | I. Think critically and evaluate sources and information for validity and usefulness.  II Communicate clearly and effectively in both written and oral forms *[we focus on written form]*  III. Demonstrate competency in a field of knowledge or with job-related skills. |
| Solve word problems and apply concepts to new situations not given in the book or in lecture using logical, deductive reasoning. | Apply logical quantitative and qualitative reasoning in solving problems or analyzing arguments | I. Think critically and evaluate sources and information for validity and usefulness.  II Communicate clearly and effectively in both written and oral forms *[we focus on written form]*  III. Demonstrate competency in a field of knowledge or with job-related skills. |
| Use a computer to locate information on the internet. |  | I. Think critically and evaluate sources and information for validity and usefulness.  III. Demonstrate competency in a field of knowledge or with job-related skills. |

* + **Physics**
    - The physics courses each have different sets of SLO’s as mapped into PLO’s and ILO’s. These mappings are enumerated on the attached pdf files.

1. How do the program learning outcomes or Administrative Unit Outcomes align with Institutional Learning Outcomes? All Student Affairs and Administrative Services should respond.

***Institutional Learning Outcomes***:

*Think: Think critically and evaluate sources and information for validity and usefulness.*

*Communicate: Communicate effectively in both written and oral forms.*

*Demonstrate: Demonstrate competency in a field of knowledge or with job-related skills.*

*Engage: Engage productively in all levels of society – interpersonal, community, the state and the nation, and the world.*

1. Describe *any significant changes* in your program’s strengths since last year. **Astronomy:** No significant changes in the astronomy strengths. **Physics:** No significant changes in the astronomy strengths.
2. Describe *any significant changes* in your program’s weaknesses since last year. **Astronomy:** No significant changes in the astronomy weaknesses. **Physics:** No significant changes in the astronomy weaknesses.
3. If applicable, describe any unplanned events that affected your program. **Astronomy:** Not applicable. **Physics:** Not applicable.

**V. Assess Your Program’s Resource Needs:** To request resources (staff, faculty, technology, equipment, budget, and facilities), please fill out the appropriate form. <https://committees.kccd.edu/bc/committee/programreview>

1. Human Resources and Professional Development:
2. If you are requesting any additional positions, explain briefly how the additional positions will contribute to increased student success. Include upcoming retirements or open positions that need to be filled. **Astronomy:** None. **Physics:** It is too early to tell whether the recent spike in physics enrollments is a “lasting” phenomenon which may require an additional physics instructor to be hired.
3. Professional Development:
4. Describe briefly the effectiveness of the professional development your program has been engaged in (either providing or attending) during the last year, focusing on how it contributed to student success. **Astronomy:** (Future needs) Need training on how to use student data to pinpoint areas that need improvement in student performance! Hopefully, being a mentor will enable me to get the training I need. (Past prof dev) Great Teachers Seminar brought people from a variety of disciplines together to improve the craft of teaching. We shared tools that are successful and worked on problems/road blocks that were common to us all. **Physics:** Attendance of northen and/or southern California chapters of the AAPT brings instructors in contact with shared information concerning software and online services that afford effective learning sources.
5. What professional development opportunities and contributions can your program make to the college in the future? **Astronomy:** Come to a planetarium evening show! **Physics:** Resurrect a version of a “physics circus”.
6. Facilities:
7. How have facilities’ maintenance, repair or updating affected your program in the past year as it relates to student success? **Astronomy:** The Planetarium’s Goto Chronos star project is serviced every year by Ash Enterprises as part of an annual preventative maintenance contract for this $500K+ hardware. We also have an annual insurance type of agreement with Spitz, Inc. for the SciDome all-dome video projector. The SciDome is approximately $270K. Both the Goto Chronos and SciDome projector systems are an essential part of the Astronomy curriculum and their annual maintenance ensures we can continue to use them in the Astronomy classes and in our outreach to the community.
8. How will your Facilities Request for next year contribute to student success? Both the Goto Chronos and SciDome projector systems are an essential part of the Astronomy curriculum and their annual maintenance ensures we can continue to use them in the Astronomy classes and in our outreach to the community.

C. Technology and Equipment:

1. Understanding that some programs teach in multiple classrooms, how has new, repurposed or existing technology or equipment affected your program in the past year as it relates to student success? **Astronomy:** No new equipment last year. **Physics:** No new equipment or methods used.
2. How will your new or repurposed classroom, office technology and/or equipment request contribute to student success? **Astronomy:** A new SciDome system will be requested again. The SciDome system enables the students to visualize complex 3D models of astrophysical phenomenon that cannot be done with a flat 2D image. The SciDome system is an essential part of the Planetarium’s role in BC’s outreach to the community. The system is essentially a computer system with a data projector. The computers are now 9 years old. NONE of the money generated from ticket sales goes into any hardware replacement fund—they all go into GUI. BC student headcount served is between 250-350 (depending on number of sections offered) but over 5000 K12 + adult general public attend the planetarium shows. Without the SciDome system, the adult general public shows will not be offered.
3. Discuss the effectiveness of technology used in your area to meet college strategic goals. **Astronomy:** Planetarium technology addresses the Student Learning by developing curiosity and inquiry in illustrating phenomena that are intrinsically fascinating. Students will want to learn the math and critical thinking so they can understand the cool things happening in our universe. Planetarium technology also addresses the Leadership and Engagement through the Planetarium evening shows for the community that are always sold out and our relationship with the K12 school system through planetarium field trips. **Physics:** Simulations used in physics courses afford physics students the opportunity to work indirectly with equipment or techniques that would either be too expensive to afford or too dangerous to work with from a lab safety standpoint.

D. Budget: Explain how your budget justifications will contribute to increased student success for your program. **Astronomy:** No additional funding being requested. Justification of current expenses: increased professional development will enable faculty to increase student success but if we reduce current spending of our astronomy program, then the college will lose ground in the gains that have already been made. Possible budget augmentation would be toward paying for more peer tutors but since Astronomy students are not going into STEM fields, the STEM grant can’t be used.

**VI. Conclusions and Findings:**

Present any conclusions and findings about the program. This is an opportunity to provide a brief abstract/synopsis of your program’s current circumstances and needs.

* The **Astronomy area** in the Physical Science Department remains strong with steady enrollments and productivity levels. The Planetarium continues to be a place treasured by the community. Student success and retention levels could be improved with more paid peer tutors.
* The **Physics area** in the Physical Science Department remains strong in that is serves an ever increasing number of engineering students in their first two years of college. Physics majors tend to be few in numbers, and their hasn’t ben enough time to see if we can expect to see more and more AS-T degrees being offered in physics. But the retention rate in physics courses ranks with the highest in the college.

**VII. Forms Checklist (place a checkmark beside the forms listed below that are submitted as part of the Annual Update):**

[Best Practices Form](http://committees.kccd.edu/bc/committee/programreview) **(Required)**

Curricular Review Form **(Instructional Programs Required)**

[Certificate Form](http://committees.kccd.edu/bc/committee/programreview) **(CTE Programs** **Required)**

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[Faculty Request Form](http://committees.kccd.edu/bc/committee/programreview)  [Classified Request Form](http://committees.kccd.edu/bc/committee/programreview)  [Budget Form](http://committees.kccd.edu/bc/committee/programreview)

Professional Development Form  [ISIT Form](http://committees.kccd.edu/bc/committee/programreview)  [Facilities Form](http://committees.kccd.edu/bc/committee/programreview) (Includes Equipment)

Other: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_