**Bakersfield College**

**Comprehensive Program Review**

**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!!

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| ***Instructional Programs only:***   1. List the degrees and Certificates of Achievement the program offers: **Physics AS-T, Physics AS** 2. If your program offers both an A.A. and an A.S. degree in the same subject, please explain the rationale for offering both. 3. If your program offers a local degree in addition to the ADT degree, please explain the rationale for offering both. The Physics AS is supposed to be phased out but college wide Program Review data from Institutional Research shows there are still students getting local Physics AS degree. |

**II. Progress on Program Goals, Future Goals, and Action Plans:**

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 goals, please duplicate this section.

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| **Current Program Goals** | **Which institutional goals from the 2015-2018 Strategic Directions for Bakersfield College will be advanced upon completion of this goal? (select all that apply)** | **Progress on goal achievement**  **(choose one)** | **Comments** |
| 1. Discipline promotion | X 1: Student Learning  2: Student Progression and Completion  3: Facilities  4: Oversight and Accountability  X 5: Leadership and Engagement | Completed: \_\_\_\_\_\_\_\_\_\_ (Date)  Revised: \_\_\_\_\_\_\_\_\_\_ (Date)  Ongoing: 25 aug 2016 (Date) | A Physics Olympics is hosted by BC every year (spring semester on campus). This provides an effective promotion of our physics and engineering programs. |
| 2. Improve professional development through training in areas specific to STEM and pedagogy | X 1: Student Learning  X 2: Student Progression and Completion  3: Facilities  4: Oversight and Accountability  5: Leadership and Engagement | Completed: \_\_\_\_\_\_\_\_\_\_ (Date)  Revised: \_\_\_\_\_\_\_\_\_\_ (Date)  Ongoing: 25 aug 2016 (Date) | Experimentation is being done in two of the physics courses in order to incorporate more of a problem solving component in the lecture portion of the course. |

1. List the program’s goals for the next three years. Ensure that stated goals are specific and measurable. State how each program goal supports the College’s strategic goals. Each program must include an action plan.

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| **Future Goals** | **Which institutional goals from the 2015-2018 Strategic Directions for Bakersfield College will be advanced upon completion of this goal? (select all that apply)** | **Action Plan** | **Timeline for Completion** | **Lead person for this goal** |
| 1. Develop understanding on how to use data analytics to improve student success | X 1: Student Learning  X 2: Student Progression and Completion  3: Facilities  4: Oversight and Accountability  5: Leadership and Engagement | attend workshops and become part of the data coaching team at BC. Communicate with other colleges using “flipped” version of physics course offerings. | 2016-17 academic year. | Strobel for Astronomy and Darke or Park for Physics |
| 2. | 1: Student Learning  2: Student Progression and Completion  3: Facilities  4: Oversight and Accountability  5: Leadership and Engagement |  |  |  |

**III. Trend Data Analysis:**

Review the data provided by Institutional Research. Provide an analysis of program data throughout the last three years, including:

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 in 2014/15 but huge increase in 2015/16. The 2015/16 percentage of 67% is well above the college wide average of 51%. *Ethnicity:* the ratio of Hispanic-Latino to White has now stabilized at approx. 67% to 24%. Other groups have no change. **Physics:** With slight fluctuations over the last 5 years the gender make-up of physics students remains fairly constant at about 26% female / 74% male. The age distribution of physics students has changed over the last 5 years as the fraction of students under 19 has decreased from 33% to 23%, while the fraction of students between 20 and 29 has risen from 62% to 70%. The only changes in ethnicity over these 5 years has been a noticeable decrease in asian and white representation with a simultaneous increase in Hispanic representation (45% to 62%).
2. Changes in enrollment (headcount, sections, course enrollment, and productivity). **Astronomy:** Greater enrollment in 2015-16 attributed to more sections taught since productivity has been about 23 for the past 5 years => more sections \* same productivity = greater enrollment. Productivity is well above college wide average. **Physics:** The number of active sections of physics courses has increased from 13 to 19 in the last 5 years. Census day enrollments have also increased from 287 to 442 during this period. Number of students on first day waitlists in physics courses has tripled in this period from 35 to 89. Physics FTES has increased from 60.1 to 92.8, and subject productivity has increased slightly from 14.8 to 16.1 over this period.
3. Changes in achievement gap and disproportionate impact. **Astronomy:** No five-year trends given in data from IR due to small numbers: “the five years represented in this report were combined”. “Disproportionate impact” not defined in Program Review Handbook, so I am using what I recall from College Council: if a group is 80% below the top group, then the given group is “disproportionately impacted”. Disproportionately impacted students include: ***Retention:*** *Ethnicity:* Asian/Filipino/Pac Islander ***Success*** *Age:* students 20-29 years old; *Ethnicity:* African-American, American Indian, Asian/Filipino/Pac. Islander, Hispanic/Latino. **Physics:** Using the criterion as stated above in Astronomy, no ethnic group is either by retention or success disproportionately impacted. Retention rates only differ by 10% from high to low figures for all ethnic groups, and success rates only differ by 24% from high to low figures for all ethnic groups.
4. Success and retention for face-to-face as well as online/distance courses. **Astronomy:** Retention of 65% and Success of 37% well below college wide average. 95% or more are non-science majors and have an incorrect view of what astronomy is about when they sign up. Lack of college-level study skills is the biggest obstacle to success. **Physics:** No distance physics courses are yet offered, the following applies only to face-to-face instruction. Retention rates for physics has been fairly constant over the last 5 years varying between 91% and 94%. Success rates have been equally high and constant over this time period, ranging between 82% and 87%.
5. Degrees and certificates awarded (three-year trend data for each degree and/or certificate awarded). **Physics:** Large jump in 2015/16 with 5 AS and 6 AS-T degrees = 11 total degrees awarded. That 11 degrees awarded is almost three times higher than any of the previous 4 years and more than the previous 4 years combined.
6. Other program-specific data (please specify or attach).
7. List degrees and certificates awarded (three-year trend data for each degree and certificate awarded). Include targets (goal numbers) for the next three years.

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| Full Name of Degree or Certificate | 2011- 2012 | 2012- 2013 | 2013- 2014 | 2014- 2015 | 2015- 2016 | 2016- 2017 |
| Physics AS | 2 | 4 | 1 | 2 | 5 | 0 (phase out local degree!) |
| Physics AS-T |  |  |  |  | 6 | 12 |
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**IV. Program Assessment:**

Use attached **Assessment Report Form Comprehensive Tab**

1. Discuss your program’s strengths. **Astronomy:** popular classes with excellent planetarium outreach to community. **Physics:** High retention and success rates. Recent grant monies to fund convenient and quality STEM tutoring and supplemental instruction. Courses aligned with C-ID course descriptors to facilitate course transferrability. Physics AST easily obtainable in a reasonably short time.
2. Discuss your program’s weaknesses. **Astronomy:** success and retention rates are low. **Physics:** Enrollments in the introductory courses in the two physics sequences vary from year to year depending on adjunct faculty availability.
3. *If applicable,* describe any unplanned events that affected your program.

**V. Resource Analysis:** 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. **Physics:** Based on recent enrollments in physics courses over the last two academic years, the following course offerings are thought to be realistic for the coming years: Spring semester - 4 sections of Physics B4A (24 students/section), 4 sections of Physics B4C (20 students/section), and 2 sections of Physics B2B (20 students/section, handled by adjunct or new instructor); Summer session - 1 section of Physics B4A (24 students, handled by adjunct or new instructor); Fall semester - 5 sections of Physics B4B (20 students/section, one handled by adjunct or new instructor) and 5 sections of Physics B2A (24 students/section, one handled by adjunct or new instructor). This tentative schedule for a year amounts to loads for 3.10 full time physics instructors. As we currently have only 2 physics instructors, we are requesting one more full time physics instructor to be hired (or insure that adjuncts are available for the overage). It is important to note that if only 4 sections of Physics B4A are offered during the spring and/or summer sessions, the need for an additional full-time faculty member disappears completely.
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:** Data workshop led by Steve Waller in Fall 2016 flex week raised faculty awareness of what’s available. CTE Launchboard workshop led by RP Group in Fall 2016 flex week was also helpful in giving us the data to compare our program with other colleges. Planetarium’s October show will tie in with Cerro Author’s visit to increase positive publicity of BC in community and increase student interested in STEM-related fields. Summer Chautauqua short courses in Alaska and northern CA in 2016 will bring further illustrations to use in geology section of Solar System course. **Physics:** Attendance of the SCAAPT and/or NCAAPT physics teachers societies are instrumental in the sharing of instructional strategies and discussions of their effectiveness has been very important in physics instructors on campus making additions or changes to the way the physics courses are taught. There are 3 of these meetings per year for each of the two California regions served.
5. What professional development opportunities and contributions can your program make to the college in the future?
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 10 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. **Physics:** A budget for such would allow the physics program to employ critically needed STEM tutors, physics stockroom attendant, and an extra physics faculty member (or location of of usable and dependable adjuncts).

**VII. Faculty and Staff Engagement:**

1. Discuss how program members have engaged in institutional efforts such as college committees, presentations, and departmental activities. **Astronomy:** faculty member is on Budget Committee and Curriculum Committee and has release time in 2016-17 for Guided Pathways communication project. He is also one of the faculty reps on the faculty union CCA executive board. He gave a presentation on the budget implications of guided pathways at the February 2016 summit held at BC and gave a talk for the Renegade Talks program in April. **Physics:** Within the last academic year, one faculty member has conducted the Sumer MESA statics boot camp, served as the Bakersfield College Electrical Engineering Club advisor, served on the selection committee for a tenure track engineering instructor, served on the selection committee for a tenure track mathematics instructor, served on the selection committee for two adjunct physics instructors, and served on two mode A and B evaluation committees.
2. Instruction Only: Discuss how adjunct faculty are included in departmental training, discussions and decision-making. No adjunct faculty in Astronomy and the department just hired a Physics adjunct in Fall 2016. Physics adjuncts have always been invited to department meetings and CurricuNet training sessions in the past. But because those few adjuncts had full-time jobs that prevented them from most of those sessions, any “adjunct training” came from isolated conversations between the adjunct and department chair or the adjunct and the individual instructors whose extra sections they were handling.

**VIII. 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.

* **Astronomy area:** Astronomy 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.
* **Physics area:** Physicsin 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 been 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. One danger that might present itself from time to time is that the service that offering physics courses provides for engineering and physics majors critically depends on the college being able to offer at least 5 sections (120 students) of Physics B4A by the end of the summer session each academic year, preferably with 4 of them offered in the spring semester. In the past we have allowed only 60% of the students that we could have had on an engineering pathway to be accommodated due to the failure to offer these 5 sections of Physics B4A.
* **Physics area:** Another concern that we have for the physics program is that utilization of resources from a STEM grant has come to an end this fall, and there will be no more STEM tutors or SI utilization. We expect that student help from tutors will be greatly reduced this academic year. For what would be typically “second year” physics courses (Physics B4B and Physics B4C) we rely on “third” year students as capable tutors. Not a lot of excellent or highly motivated tutors remain for a third year at BC. We have this last summer contacted two very capable tutors to help with our second year physics courses. One student at first agreed, and then declined because the tutoring was not drop-in like the STEM tutoring was. The other student was very anxious to help out as a tutor, but the reduced hours of operation of the Tutoring Center made it almost impossible for him to be able to tutor during any free time he had.

**IX. 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: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_