Colorado State University – Pueblo Academic Program Assessment Report for AY 2019-2020 **Due: June 1, 2020**

Program: Physics **Date:** July 15, 2020

Completed by: Paul Chacon

Assessment contributors (other faculty involved in this program's assessment):

Please complete this form for each undergraduate, minor, certificate, and graduate program (e.g., B.A., B.S., M.S.) in your department. Please copy any addenda (e.g., rubrics) and paste them in this document, and submit it to the dean of your college/school as per the deadline established. The dean will forward it to me as an email attachment before June 1, 2020. You'll also find the form at the assessment website at http://www.colostate-pueblo.edu/Assessment/ResultsAndReports/Pages/default.aspx.

Please describe the 2019-2020 assessment activities for the program in Part I. Use Column H to describe improvements planned for 2019-2020 based on the assessment process. In Part II, please describe activities engaged in during 2019-2020 designed to close-the-loop (improve the program) based on assessment activities and the information gathered in 2018-2019. Thank you.

I. Program student learning outcomes (SLOs) assessed in this cycle, processes, results, and recommendations.

A. Which of the program SLOs were assessed during this cycle? **Please include the outcome(s) verbatim from the assessment plan.**	B. When was this SLO last assessed ? Please indicate the semester and year.	C. What method was used for assessing the SLO? **Please include a copy of any rubrics used in the assessment process.**	D. Who was assessed? Please fully describe the student group(s) and the number of students or artifacts involved.	E. What is the expected achievement level and how many or what proportion of students should be at it?	F. What were the results of the assessment?	G. What were the department's conclusions about student performance?	H. What changes/improvements to the program are planned based on this assessment?
(SLO #2) Understand and apply knowledge of the various subfields of physics	F19 S20 This assessment will be performed every year	The assessment tool is the MFAT in Physics	All graduating physics majors.	Criterion: ninety percent of CSU – Pueblo graduates at 50th percentile or higher	Only 1 of 3 grads have taken MFAT to date. Score was below 50th percentile	Unsatisfied	This student was our weakest in some time. We need a pattern to decide on a change.

(SLO #3) Effectively communicate their results orally and in writing	S20	Presentations in Phys 323	Junior level Physics students.	faculty attended 15 minute talks to provided oral and written independent assessment of substance and presentation quality.	Good substantive talks, with good audience questions, and suggestions for improvements.	Students need more practice in researching and presenting topics in physics.	Continue the major's seminar, where talks are given by faculty, visitors and students
(SLO #4) Learn independently, locate and use appropriate sources of technical material and make use of modern scientific and computational tools	F19 S20	Senior thesis presentations F19 S20 in writing and orally.	Senior thesis presentations in writing and orally F19 S20.	Senior thesis distributed and viewed by all program faculty.	See above.	See above.	See above

II. Follow-up (closing the loop) on results and activities from previous assessment cycles. In this section, please describe actions taken during this cycle that were based on, or implemented to address, the results of assessment from previous cycles.

A. What SLO(s) did you address? Please include the outcome(s) verbatim from the assessment plan.	B. When was this SLO last assessed? Please indicate the semester and year.	C. What were the recommendations for change from the previous assessment?	D. Were the recommendations for change acted upon? If not, why?	E. What were the results of the changes? If the changes were not effective, what are the next steps or the new recommendations?
(SLO #2) Understand and apply knowledge of the various subfields of physics at the undergraduate level.	Spring 2020	Work continues to strengthen the Phys 221-222 Calc-Based sequence to prepare students for upper division courses. Consider a math methods in physics course to aid student transitioning to advanced physics courses.	We now have a TT PhD in physics. Much discussion and work continues on analyzing and strengthening the lecture and lab curriculum and teaching practices. We plan on revising the lab curriculum during F20 S21.	The new TT shows promise in recovering some continuity and commitment to the program. We need at least one more TT Physicist, and one in Astronomy to begin to thrive. Majors have increased and maintained enough that we have been able to offer our advanced courses regularly again.
(SLO #3) Effectively communicate their results orally and in writing	Spring 20	Refine the new 10-15 minute end of course project and evaluated talk assignment again in Phys 323. And Below.	Partially—in Phys 323 but not yet in another upper division physics course. We need to arrange for more faculty participation and input in Sr. Seminar presentations.	Project and talk assignment have been effective and have faculty participation as attendees and evaluators. Institute miniresearch projects with talks in at least two upper level physics courses, Phys 323 (first jr. course) and one other prior to Phys 499.

(SLO #4) Learn independently, locate and use appropriate sources of technical material and make use of modern scientific and computational tools	Spring 20	Continue to consider implementing the above in another (existing or new) upper division course such as a math methods course or Phys 431 (E & M)	See above.	See above.

Comments: A strong physics service program is critical and central to our excellent engineering, chemistry, biology, exercise science and math and STEM education programs and careers. Also, exciting new potential: discoveries, applications and questions are emerging from physics of late.

A successful search hired our first new Tenure Track hire in physics since 1988. This is a promising start to a rebuilding of our Physics program and service course program.

It would indeed be a wonder (or perverse) if majors did not decrease once we lost the last of our four physics PhD's in 2014. Adequate staffing is a truly desperate need that cannot be avoided by cancelling the major, which is a small fraction of the service we offer to other departments and Gen Ed. Much entrepeneurship has, is and will continue to result from those who understand and can imagine the uses of basic principles of physical nature including matter, energy and information.

Note: Recent Program Review Items do not appear in this report. Response to program review will appear in the next cycle.

Program Review Update (to Last Program Review (2013-14) Dean's Report

Program weaknesses/challenges include the following:

--There are just two tenured (and no tenure-track) physics faculty members.

We are back to having two tenure-track physics faculty (one with a physics PhD).

--The number of majors is relatively small.

In the context of the very low faculty and financial resources for our program over these years, and the relatively low level of maths and science preparation of many incoming students, these results are actually remarkably good. These results suggest we can resurrect our once thriving program in physics with adequate support, commitment and effort.

--Undergraduate-level research activities are limited.

A couple of our recent visiting professor of physics and one of our professors of mathematics have stepped in to help mentor students in several projects for physics seniors to make up for the lack of tenured physicist, but we definitely need another active Physics PhD with a research program that can involve students. .

--The external reviewer noted significant diversity (both gender and ethnicity) among the students he met with.
Response: This continues, and we are generally much better than national benchmarks, due to our ambient demographics program culture..

--The external reviewer believed that current student learning outcomes and program goals need more refinement, and he recommended that assessment instruments and practices could be enhanced by increasing faculty 'ownership' of the tools.
Physics faculty as individuals and as a group have taken advantage of opportunities in curriculum development and done much revision and development in these areas, which is continuing.

--The external reviewer also recommended considering a more longitudinal approach to developing effective communication. While lab reports are a significant part of virtually every lab course, and most physics courses come with a corresponding lab, perhaps speaking skills could be enhanced along the student's coursework, rather than addressed solely in the 492/493/499 courses. (And while not mentioned by the external reviewer, there may be virtue in enhancing writing skills other than those focused on in lab reports.)
See the assessment report above on SLO 3 and 4. We have instituted small research projects with evaluated presentations in the Phys 323: Modern Physics course, now for the third year. We intend to introduce this practice into one other upper division course.

--The external reviewer also made reference to pedagogical techniques in the classroom, noting that perhaps those practices could be refined. Our new tenure track Physics hire, Dr. Hurst, is bringing us innovations in pedagogy, including more active and open-ended learning experiences, such as his "Creative Conundrums", lab instruction, dark matter research project involvements for students. Dr. Brown has made use of iClicker technology, as has Dr. Hurst. Astronomy instruction is highly web-based already, with one online section being offered in recent years, and now undergoing further development and improvement.

Recommended action items:
Increase communication with other departments, e.g. engineering and biology and chemistry, for multiple reasons:
-To increase potential collaborative research activity (both for undergraduate research projects, and perhaps for faculty-based research, e.g. through the existing space grant).
We have had a few students working on Spacegrant research over these years. Having no Physics PhD tenure-track faculty for several years has greatly depressed these possibilities.

-Potentially increase possibilities for more majors or second majors or minors in physics,
We have made some efforts here that produced results, including an informal "Aerospace" option involving one new course "*Orbital Mechanics*" in edition to existing courses.

-Consider enhancements to courses that emphasize communication (e.g. have students read a paper and report on the contents).
Results: We implemented student min-project and talks in Phys 323 (Modern Physics, offered each Spring pending enrollment) Spring 17. Spring 15 we had too few faculty, and Spring 16 we had no students sign up for Phys 323. We invite faculty to attend and fill out talk response forms along with the students. This was repeated successfully Spring 18 and Spring 19.