Weber State University Physics Department Program Review Report. April 15, 2019

Presented to:

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Program Review Team members:

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Summary: After review of the self-study prepared by the Physics Department, the Program Review Team met on March 19, 2019 to carry out the following:

- Met with Dean Easter Pilcher and Associate Dean Barbara Trask.
- Met in small groups with Physics faculty, staff, current students, and alumni.
- Toured teaching and research facilities.

Report:

A – Mission

"The mission of the Department of Physics at Weber State University is to provide high-quality instruction in physics at the undergraduate level. This includes providing courses in the general education area of physical science, pre-professional, science, engineering and pre-engineering courses in physics, and courses and programs for those who want to major or minor in physics."

The WSU Physics department is clearly meeting its mission of high quality instruction at the undergraduate level. Hallmarks of the program include very strong relationships between students and faculty, individualized instruction in the upper division, a significant and sustained commitment to teaching, and model programs for community outreach and education. They are providing high quality courses in all of the areas described above.

B – Curriculum

The WSU Physics department's curriculum is consistent with Physics programs across the nation and appears (albeit a difficult thing to assess in a one day study) to satisfy national expectations for content. As documented in the self-study, the department has focused heavily on evolving assessment strategies throughout the curriculum (discussed below in C). Several other aspects of the curriculum have emerged that are laudable: (i) development of Signature Assignments that address Big Questions, (ii) new courses (eg 3040 and 3420) that address prior weaknesses/gaps in the curriculum, and (iii) strong research experiences for students through independent study. Looking to the future, the major opportunities for curriculum reform are (i) to revise the 'feeder' courses to attract more majors and thereby justify faculty growth, (ii) adopt more student-focused teaching methodologies in the upper division, and (iii) continue to

understand the curricular needs of physics students as they graduate and evolve the curriculum accordingly.

C – Student Learning Outcomes and Assessment

The department has focused heavily on evolving their assessment strategies (both formative and summative) throughout the curriculum and it appears there is a healthy internal discussion on-going amongst the faculty. Student learning outcomes are well thought out and do not appear to need major revisions. As the self-study documents, there may be minor value in periodically re-examining these goals. What is unclear from the assessment is if the results of the assessment are effectively feeding back to the faculty to reflect upon and alter their teaching methodologies.

As stated in the Self Study report, the department has recently focused on assessment of general education physical science goals, objectives, and outcomes. This effort is to be commended in the light of new general education initiatives across the WSU campus. The department is encouraged to collaborate closely with GEIAC to assure consistency with institutional gen ed objectives.

D – Academic Advising

Currently the academic advising for Physics majors is handled by the department chair. Since most faculty have the perception that they are oversubscribed, this is a reasonable choice. There is clearly a significant amount of career and personal advising from the faculty in their numerous interactions with students. In our conversation with students, they felt that they had incredible access to the faculty, had built strong relationships with the faculty, and viewed the faculty as their mentors. This is a clear strength of the program.

E – Faculty

The faculty of the WSU physics department are leaders at the College, University, and national level in a variety of areas. They have won a variety of teaching and research awards at the University and state level, they are engaged as authors of internationally important textbooks, they have served as editors of important international journals, and they are leaders in the community. A clear strength of the department is the strong relationships that the faculty maintain with each other. They are a model for active maintenance of professional relationships in a department. Another key strength is the gender diversity among the faculty, which is unfortunately a rarity in the field of Physics. One concern is that the faculty almost universally complained about their work loads and the decrease in faculty numbers over the last 10 years. Also, the tenure track faculty is significantly lacking in junior faculty with only one assistant professor and one associate professor. While the efforts of the faculty overall remain robust, the lack of junior faculty will at some point create an experience gap since the pipeline for the future leaders of the department cannot be maintained without the hiring of new faculty. The main solution proposed by faculty for this problem was the addition of faculty members. The department has cut some General Education offerings to deal with their lower numbers. One question has to be the sustainability of the current efforts and course offerings of the department without some kind of change. A few possible outcomes, should no change

occur, would be faculty burnout, retention problems, decreases in current course offerings, or a retreat from some of the important programs that are currently being managed by faculty. We identified a couple of possible areas where challenges occur and where the department could look for creative solutions:

1. Research: Many of the faculty are actively involved in mentoring undergraduate research students and there is representation at the national level through involvement in the Council for Undergraduate Research. Many of these efforts are funded by high level grants and are at the cutting edge of research and innovation. While undergraduate research is not specifically required in all Physics major programs, there is a perception among most students that it is required in some sense for them to be competitive in the job/graduate school markets. Our perception is that much of the faculty effort required to maintain this work is not really supported in faculty loads. One reason for this is that students who are being paid for research are not signed up for department research course credits. Also, some students do not wish to commit to the rigors of the commitment required for course credits, but want to be involved in research anyway and thus still work with faculty on research projects without being signed up for research credit. Also, the faculty load for research that is carried out in interdisciplinary projects is not well accounted for in the PPM and is not being fully accounted for in faculty loads. Another challenge is the time required to manage grants. WSU's infrastructure to support faculty grants is limited and significant time is required to manage the financial, material, and personnel challenges of grants.
2. Community Outreach. While the work done by the department in the community is a model for the college and University, the faculty effort required to maintain this work is immense. There is limited load provided for this work and it is largely resting on the backs and the hearts of the faculty of the department. Efforts such as Science in the Parks, the Ott Planetarium, and the Physics Open House are clearly exemplar programs, however, we question the sustainability of these efforts with the current level of resources in the department. Should no additional resources be provided to the department in the future, will the faculty be able to maintain this level of effort or will they have to be abandoned? Are these types of efforts being included in the assessment of department's value to the University when resources are allocated?
3. Teaching: The faculty of the physics department are universally passionate about undergraduate education. While there is clearly cutting-edge teaching going on in some parts of the department, our perception is that the department's approach to teaching overall remains somewhat teacher centered and that active learning pedagogies are not being implemented across the curriculum. The physics students we spoke with stated that most of their instruction was lecture based and conversations with faculty supported the perception that a significant number of the faculty in the department use lecture as the primary mode of content delivery. This is not to say that there is not significant student-centered teaching occurring in the department, however, it does not appear to represent the overarching culture of the department. While some of the faculty expressed a desire to undertake curriculum reform to embrace evidence-based teaching practices, the reality is they do not presently have the bandwidth to undertake a substantive reform.

F – Program Support

Department faculty made it abundantly clear that physics program support is marginal in some respects and insufficient in others. Support staff is barely adequate "in quantity and background", creating a challenge to maintain laboratory equipment for teaching and research. While the administration is generally supportive of the program, the department's budget is marginally adequate to maintain the program at current levels of operation. The department chair stated that the department needs at least an additional 1.5 FTE faculty members to operate the department at a level that the department once experienced prior to the retirements of two faculty members that were not replaced. This has effectively reduced the time that faculty have to conduct research, explore new teaching pedagogies, and engage in community outreach. The laboratory support staff appears to be relatively underutilized while instructional staff is stretched too thin.

G – Relationships with External Communities

The department has an external group of stakeholders with which the department maintains in contact on a formal and informal basis. This advisory group, along with members of the Physics faculty, identified challenges that help direct strategic planning. Going forward, a close working relationship with this advisory group is encouraged.

The department may also want to explore potential relationships with other "external" communities, viz., programs in other departments in the College of Science or the College of Engineering, Applied Science and Technology. For example, the department might explore cross disciplinary programs in materials science and/or engineering physics. Another potential option might be a 3 + 2 program in which students earn a BS in Physics plus a MS in Electrical Engineering. These cross disciplinary programs have the potential to significantly increase the enrollments in and graduation rates from the department.