

## Seven-Year Program Review Physics Department

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### Reviewers

- Dana Longcope, Montana State University
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### Program Description

The Physics Department strives to advance the university's mission through excellence in research, teaching, and service. The department's active research faculty routinely engage undergraduate and graduate students in diverse research projects, and all physics majors gain hands-on research experience through the department's capstone course, PHYS 4900: Research in Physics. In addition to integrating research opportunities into the curriculum, physics programs prepare students for graduate school and the workforce.

The Physics Department offers several bachelor degree tracks: BS in physics, BS in physics with professional emphasis, BS in physics with applied emphasis, and a BA in physics. In conjunction with the College of Education, two teaching degrees are also offered: BS in composite teaching and a BS in physics teaching. The department's graduate program engages masters and PhD students in a variety of research disciplines including: mathematical physics, gravitation and field theory, atmospheric and space physics, surface and materials physics, and ultra-fast laser spectroscopy. The average time from a bachelor's degree to a PhD is 6.4 years.

Recognized for the size and quality of its service teaching, the Physics Department provides large sections of introductory physics, general physics, and astronomy courses required for pre-professional degrees in engineering, teaching, and medicine. These high-quality introductory courses incorporate creative class activities and innovative laboratory experiences to effectively serve many students with varied educational goals.

Physics programs are supported by 15 tenured and two non-tenured faculty members. These devoted educators, productive scholars, and exceptional researchers are frequently recognized with prestigious awards, and their space physics, plasma physics, and field theory research efforts are internationally recognized and respected. USU physics students win competitive fellowships and national awards at rates comparable to the most selective universities in the country, and the department is home to a thriving Society of Physics Students (SPS) chapter—named Outstanding Chapter for 11 consecutive years.

As the following data table illustrates, the number of physics graduates has remained constant or grown during the last five years.

## Data Form

Physics Department					
	Year	Year	Year	Year	Year
	2011-12	2012-13	2013-14	2014-15	2015-16
<b>Faculty</b>					
Headcount	19	19	18	17	17
With Doctoral Degrees	18	17	17	16	16
Full-time Tenured	14	14	15	15	15
Full-time Non-Tenured	4	3	2	1	1
Part-time	0	1	0	0	0
With Master's Degrees	1	1	1	1	1
Full-time Tenured	0	0	0	0	0
Full-time Non-Tenured	1	1	1	1	1
Part-time	0	0	0	0	0
With Bachelor's Degrees	0	0	0	0	0
Full-time Tenured	0	0	0	0	0
Full-time Non-Tenured	0	0	0	0	0
Part-time	0	0	0	0	0
Other	0	0	0	0	0
Full-time Tenured	0	0	0	0	0
Full-time Non-Tenured	0	0	0	0	0
Part-time	0	0	0	0	0
<b>Total Headcount Faculty</b>	<b>19</b>	<b>19</b>	<b>18</b>	<b>17</b>	<b>17</b>
Full-time Tenured	14	14	15	15	15
Full-time Non-Tenured	5	4	3	2	2
Part-time	0	1	0	0	0
<b>FTE (A-1/S-11/Cost Study Definition)</b>					
Full-time (Salaried)	16.11	14.77	14.63	13.62	16.34
Teaching Assistants	0	0	0	0	0
Part-time (May include TAs)	0.58	0.8	0	0	0.1
<b>Total Faculty FTE</b>	<b>16.69</b>	<b>15.57</b>	<b>14.63</b>	<b>13.62</b>	<b>16.44</b>
<b>Number of Graduates</b>					
Certificates	0	0	0	0	0
Associate Degrees	0	0	0	0	0
Bachelor's Degrees	15	16	15	30	19
Master's Degrees	1	2	2	1	1
Doctoral Degrees	1	6	3	2	2

Number of Students—(Data Based on Fall Third Week)					
Total # of Declared Majors	121	146	145	145	150
Total Department FTE*	459.8	480.1	466.2	523.2	548.7
Total Department SCH*	6834	7115	6938	7781	8158
*Per Department Designator Prefix					

409.4667    456.9685    474.231    571.2922    496.2287

Student FTE per Total Faculty FTE	27.5	30.8	31.9	38.4	33.4
<b>Cost (Cost Study Definitions)</b>					
Direct Instructional Expenditures	2,372,431	2,362,259	2,401,947	2,433,220	2,704,098
Cost Per Student FTE	\$ 5,160	\$ 4,920	\$ 5,152	\$ 4,651	\$ 4,928
<b>Funding</b>					
Appropriated Fund	2,545,096	2,573,114	2,596,361	2,687,951	2,873,926
Other:					
Special Legislative Appropriation					
Special Fees/Differential Tuition					
<b>Total</b>	2,545,096	2,573,114	2,596,361	2,687,951	2,873,926
Grants & Contracts	3,312,152	2,913,454	2,899,891	2,105,699	2,868,436

## **Program Assessment**

The review committee was provided with the department's self-study one month prior to its two-day site visit which occurred on April 12 and 13, 2017. During the site visit, the committee met with the dean, department head, and associate department head as well as faculty, staff, and students. In addition to meeting with department stakeholders, the committee toured its instructional and research facilities.

Overall, the committee found a healthy and vibrant department that faces a few challenges. Specific strengths and challenges noted by the committee are outlined in the following sections.

### ***Strengths***

The committee report notes a strong, cohesive department that is substantially more productive than most peer institutions. The curriculum achieves balance by providing majors with a rigorous and thorough background without discouraging potential majors. Innovative graduate course scheduling maintains enrollment while economizing teaching loads, and graduate students report feeling supported in their academic progress. The department's unique lab facilities afford USU a leading position in research and serve the larger USU community by providing an essential tool for graduate student training. An active research program with distinctive sub-disciplines and profitable niches brings positive, international visibility to USU.

Additional noted strengths include

- Carefully designed and streamlined curriculum
- High quality introductory courses
- Creative and engaged classroom activities
- Valuable integration of research into the curriculum vis Physics 4900 capstone class
- Innovative laboratory program
- Clear and useful assessment methodology
- Exceptionally talented faculty
- Outstanding advising support
- Students very competitive for national fellowships and awards
- Recent graduates all found satisfactory positions
- Very engaged outreach efforts
- Strong support for the department head

### ***Challenges***

The review committee indicated the department's high quality introductory courses could be even better if they had the resources considered standard at most Association of Public Land Grant Universities (APLU). The number of graduate teaching assistants available per lab is around half the norm of large public universities. All hands on deck in the labs prevents use of GTAs in active classroom learning and grading. In addition to less than ideal GTA resources, the committee expressed concern about the large student/faculty ratio and dependence on a small number of exceptionally talented faculty for continued success of introductory courses. They note retirements and inability to recruit top faculty given high workloads as long term concerns for introductory physics courses.

Although the committee found the graduate program as a whole operates well and serves students effectively, they expressed concern about insufficient graduate student support. Teaching assistant numbers are not sufficient to support a healthy graduate program or active instructional practices in service courses. The committee recommends that continued increase in service course enrollment be met with an increase in GTA positions and an increase in GTA positions be matched with an increase in other lines of graduate support to provide more research-focused opportunities. The committee noted that students feel uninformed about fellowship opportunities and recommended appointment of a graduate student advisor who will maintain a list of fellowship opportunities, requirements, and deadlines.

Another concern expressed by the committee is the small faculty with many members who could retire at any time.

### ***Review committee recommendations***

The review committee provided these recommendations

1. The committee strongly recommends an increase in the number of centrally funded GTA lines to at least 15, and if possible, 20.
2. The department should plan for increased enrollment, and the university should recognize the need for additional resources in undergraduate labs, instruction, and advising if growth continues.
3. The department would be well served by appointing a graduate advisor to address student concerns and broaden the graduate admissions process.
4. The university needs to maintain support for the department's successful research program by facilitating and expediting new hires as they are proposed to replace expected retirements. Given the high student/faculty ratio and strong research program, the committee recommends serious consideration of increasing the faculty size.
5. The committee commends the department's plans to hire experimental physicists and urges continuation toward obtaining departmental consensus for a defined hiring plan.

### **Institution's Response**

The Physics Department staff has reviewed the committee's report. The committee's analysis of the department's salient strengths, weaknesses, and challenges is accurate, insightful, and helpful. We respond to the committee's recommendations point by point below.

1. We concur with the teaching and programmatic challenges presented by an inadequate pool of graduate teaching assistants. We support the increase in number of centrally funded GTA lines. This also provides important resources for graduate recruitment.
2. We concur that the department must continue to adjust to increasing enrollment. This will require additional GTA lines, as mentioned in point 1. It may require additional resources for instructors. It also will require strategic planning in future faculty hires (see 4 and 5 below). Pressure on our advising system may require us to dedicate our current advisor to undergraduates only and create a graduate student only advisor position (see 3, below).
3. We will create a graduate admissions committee led by a faculty member who will be responsible for graduate student advising.

4. We concur with the need to proactively deal with increasing faculty turnover in order to maintain our research excellence. Based on the high student faculty ratio and the continuing pressure of increased enrollment we also concur with the need to increase the department's size.

5. We are pleased that the committee agrees with our plans to support experimental research in future hires. Our upcoming faculty meetings will be devoted to building a consensus on hiring strategies.

We recognize that the bulk of the committee's recommendations hinge upon an increase of resources to the Physics Department from the university. We are optimistic that this can be achieved.