



## College of Arts and Sciences

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### MEMO

**TO:** Kate Miller  
Provost/VPAA

**FROM:** Paula M. Lutz  
Dean, Arts and Sciences

**RE:** Program Review for Physics B.S.—Dean's recommendation

The B.S. in Physics has produced forty-five graduates in the past five years. These are strong students, with an average ACT of 27-28 (>90<sup>th</sup> percentile). The recent emphasis on undergraduate research has further strengthened the quality of the graduates, many of whom attend graduate or professional school. The faculty are strong in terms of innovative teaching (leading the way in active learning in the sciences at UW) and research output (publications and grant activity). The department provides more USP courses (11) than any other STEM program on campus, as well as teaching key foundational courses for a variety of majors ranging from engineering to elementary education.

The previous round of program reviews considered the B.S. in Astronomy. As stated in that review memo, the B.S. degrees in this department fit well with campus initiatives such as the Science Initiative, SER, and computational sciences. The Physics B.S. curriculum shares 111 of 122 credit hours with the Astronomy B.S., and these are taught in the most economical way possible—over a biennium.

Based on the strength and high visibility, and the very minimal cost, **it is the recommendation of the Dean that the B.S. in Physics be maintained.**

**Academic Program Review  
August 2016**

Bachelors of Science in Physics  
Undergraduate bachelors degree  
Department of Physics & Astronomy, College of Arts & Sciences  
Department Head: Daniel Dale – 307-703-4455 – [ddale@uwyo.edu](mailto:ddale@uwyo.edu)

1. Program Demand

- a. Bachelors degrees in Physics over 2010-2015: 45
- b. Enrollment in Physics over 2010-2016:

Fall 2010	45
Fall 2011	45
Fall 2012	48
Fall 2013	46
Fall 2014	46
Fall 2015	39
Fall 2016	43

2. Program quality:

- a. Program accreditation
  - i. n/a
  - ii. n/a
  - iii. n/a

b. Credentials of faculty

Faculty	Degree	Field	Ethnicity	Sex
Mike Brotherton	PhD	Astronomy	W	M
TeYu Chien	PhD	Physics	A	M
Yuri Dahnovsky	PhD	Physics	W	M
Daniel Dale	PhD	Physics	W	M
Hannah Jang-Condell	PhD	Astronomy	A	F
Chip Kobulnicky	PhD	Astrophysics	W	M
Rudi Michalek	PhD	Physics	W	M
Adam Myers	PhD	Astronomy	W	M
Mike Pierce	PhD	Astronomy	W	M
Bill Rice	PhD	Physics	W	M
Jinke Tang	PhD	Physics	A	M
David Thayer	PhD	Physics	W	M
Wenyong Wang	PhD	Physics	A	M

iii. Grants awarded:

2004-05	\$2,736,000
2005-06	\$1,541,000
2006-07	\$1,192,000
2007-08	\$1,268,972
2008-09	\$2,002,231
2009-10	\$1,877,005
2010-11	\$4,130,000
2011-12	\$2,124,644
2012-13	\$1,783,417
2013-14	\$ 735,941
2014-15	\$1,526,62

iv. Grants submitted: over \$10M requested per year

v. Publications (refereed only):

Y P e u a b r s	Pubs/faculty
2 4 0 0 1 1	4.0
2 5 0 7 1 2	4.7
2 7 0 2 1 3	7.2
2 4 0 5 1 4	4.1
2 5 0 6 1 5	4.7

Dale & Myers have respectively averaged 11.0 and 16.2 refereed papers/year since 2011.

vi. National/international awards: Dale is an NSF CAREER awardee

vii. Two Ellbogen award winners (Dale and Kobulnicky). Three of the five most prolific scholars among the five Science Initiative departments (Myers, Dale, Tang; according to a Fall 2015

Academic Affairs analysis). Three of the top five spots (Brotherton, Dale, Kobulnicky) for "Faculty who have generated the most grant dollars since 2001" (Fall 2010 A&S newsletter). The highest extramural funding level per faculty in A&S since the Department began rebuilding in 2001: \$201k/faculty/year. Kobulnicky and Myers are PIE (promoting intellectual engagement) winners.

c. Program reputation – physics undergraduate programs are not nationally ranked

Physics majors are some of the strongest, best-prepared students on campus, as judged by the composite ACT scores. Our majors exceed the college average by >3.5 points.

Year	ACT Dept. Average	ACT College Average
2010	27.3	24.0
2011	27.6	24.1
2012	27.9	24.0
2013	28.3	24.0
2014	27.6	24.1
2015	27.8	24.1

d. Curriculum

PHYS 1310 College Physics I  
 PHYS 1320 College Physics II  
 PHYS 2310 Physics III: Waves and Optics  
 PHYS 2320 Physics IV: Modern Physics  
 PHYS 3640 Modern Electronics and Experimental Techniques  
 PHYS 3650 Advanced Lab in Modern Physics and Electronics  
 PHYS 4210 Classical Mechanics  
 PHYS 4310 Quantum Mechanics  
 PHYS 4410 Electricity and Magnetism I  
 PHYS 4420 Electricity and Magnetism II  
 PHYS 4510 Thermodynamics and Statistical Mechanics  
 PHYS 4840 Mathematical and Computational Physics  
 MATH 2200 Calculus I  
 MATH 2205 Calculus II  
 MATH 2210 Calculus III  
 MATH 2250 Elementary Linear Algebra  
 MATH 2310 Applied Differential Equations I  
 MATH 4440 Partial Differential Equations I  
 MATH 4230 Complex Analysis  
 CHEM 1020 General Chemistry  
 COSC 1010 Introduction to Computer Science

e. Distance delivery

Delivery is all on-campus

f. Quality of assessment plan

Our annual assessment covers formative and summative assessments of 2-3 key upper division courses. One observation from the 2015-2016 assessment cycle is that students involved in research projects with faculty score more highly than the general population of majors in terms of ability to use advanced laboratory equipment and understanding of the scientific process. Encouraging

more students to take advantage of paid research opportunities (EPSCoR, NASA SpaceGrant, Wyoming Research Scholars Program) should promote increasingly higher levels of understanding.

g. Strategic Plan

Construction of a new astronomical observatory is included in Phase II of the UW Science Initiative. The Studio Physics format for active learning is now ramping up given the new space allocated to Studio Physics in the Enzi STEM facility.

3. Mission Centrality

a. The Physics B.S. is a degree very similar to its counterparts in chemistry or engineering. Students learn technical skills in computational and analytical areas that are central to the University's emphasis on computational sciences. Many undergraduates do energy research funded by SER. Physics is featured as part of UW's Science Initiative and several of its faculty have played key roles on the Science Initiative Leadership Team.

b. Physics provides more USP courses (11) than any other STEM program on campus. Physics provides key foundational courses for many majors on campus, including all engineering programs, kinesiology, zoology/physiology, chemistry, geology, pre-med, elementary education, ...

c. A sampling of recent Physics B.S. graduates and their employment status:

<b>Name</b>	<b>Year</b>	<b>Outcome</b>
Thomas Rochais	2016	U. Penn graduate program in physics
Tyler Ellis	2015	Doctoral program, Louisiana State U.
Sam Nissim	2015	Technical civilian employee of the U.S. Army
Austin Gager	2015	High school physics teacher, Cherry Creek, Colorado
Jared Wheeler	2015	Optical engineer
Rachel Smullen	2014	Doctoral program, U. Arizona
Eric Cameron	2014	Medical Physics grad school (Purdue)
Charles Torrence	2014	Software engineer, Austin, TX
Andrew Hellquist	2014	Nordstrom
Mika Moriwaki	2014	Molecular Medicine program (U. Utah)
Nick Prudhomme	2014	SEAKR Engineering
Corbin Haugen	2014	SciApps, Inc.
Amy Miller	2014	SciApps, Inc.
Tyler Yeik	2014	Engineer at Quasar Federal Systems
Jyoti Pandey	2013	Happy Jack software
Roy Oursler	2013	Math grad school (ASU)
Walter Wilson	2013	Officer, US Air Force
Stuart Smith	2013	Physics grad school (RPI)
Ryan Smith	2013	Colorado Energy Research Technologies

Steven Bagley	2013	Math grad school (U. Utah)
Shane Allison	2013	TriHydro
Jessie Cotney	2013	Lowe's
Tim Hall	2013	Snowy Range Instruments

d. There are no other physics or similar programs in Wyoming.

#### 4. Cost

a. SCH averaged over FY11-FY15 is 8387. Average Faculty+APL FTE over FY11-FY15 is 13. So average SCH per academic FTE is ~645.

b. i. Cost per SCH is \$251 for FY11-FY15 based on 18 August 2016 report from A&S Ad Hoc Budget Advisory Committee.

b. ii. Cost per degree awarded FY14 & FY15 is \$101k, based on 18 August 2016 report from A&S Ad Hoc Budget Advisory Committee.

b. iii. State operating expenses in FY16 was \$145k, so per 14 academic FTE is ~\$11k.

c. i. Classes below university minima: Fall16 0, Spring16 4, Fall15 2, Spring15 0, Fall14 4

c. ii. Lower-division classes below university minima: Fall16 0, Spring16 1, Fall15 2, Spring15 0, Fall14 4

d. i. Our large service courses regularly meet their capacities. We have in fact had to add an additional section of PHYS1220 in order to meet the burgeoning population of engineering majors. Our upper-division courses could accommodate more students.

d. ii. The DFW rate for our largest 1000-level courses varies between 15% and 35%, with an average of ~25%. The percentage is significantly lower for 2000-level and higher courses.

d. iii. Curricular complexity. PHYS3640 and PHYS3650 are our two advanced labs, and as such require a fair amount of financial and technical support.

d. iv. The faculty course load for T/TT faculty varies from one course per semester to three courses per semester, depending on job description.

e. Research expenditures per tenure/tenure-track FTE:  $\$1,882,181 / 14 = \$134,441$

#### Additional points:

The Department of Physics & Astronomy has made huge strides after being nearly killed in the late 90s (the faculty ranks shrank from 17 to 3 after the moratorium on the grad program was instituted). Since 2001 we have brought in the highest extramural funding per T/TT faculty in the College. Our student population has consistently grown over the rebuilding period. We have the only Ellbogen award winners from the Physical Sciences over the past dozen years. Our students have ACT scores >3.5 points above the College average. We have three of the five most prolific researchers in the five Science Initiative departments. We rank #7 in A&S for SCH taught.

Academic Program Review: **Physics, BS**

**Section 8 – Cost**

a) Ratio of student credit hours per FTE (AY 2014/15): **247.6**

b) Direct instructional expenditures (FY 2015): **\$2,614,904**

i) Per student FTE: **\$9,523**

ii) Per total degrees awarded: **\$108,954**

iii) Non-personnel expenditures / total academic FTE: **\$15,831**

c) Course enrollment (AY 2014/15)

i) Classes falling under university minimums: **11**

ii) Lower-division courses falling under university minimums: **1**

e) Research expenditure per tenure-track FTE (FY 2015): **\$153,817**