



## College of Arts and Sciences

Dept. 3254 • 1000 E. University Avenue • Room 114, A&S Building • Laramie, WY 82071  
Phone (307) 766-4106 • fax (307) 766-2697 • e-mail: asdean@uwyo.edu • www.uwyo.edu/as

29 July 2016

### MEMO

**TO:** Kate Miller  
Provost/VPAA

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

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

The B.S. in Astronomy has had only thirteen graduates in the past five years, but has seen an enrollment jump in FY13 and again in FY16 (38 majors for FY17). These are strong students, with an average ACT of 27-28 (A&S average = 24). This is in large part due to the fact that these students are almost all graduate school-bound; jobs for those with only a B.S. are very few.

There is high visibility for our Astronomy program at present, with the Jelm Mountain Observatory as well as the solar eclipse which will occur in the summer of 2017. A new observatory is in Phase II of the Science Initiative. This degree fits well with campus initiatives such as the SI and computational sciences. Development work on the part of the DH has led to a complete renovation for our planetarium (with a naming opportunity for the donor) which has a strong outreach and K-12 connections.

The IPR makes the statement that there is very minimal cost to the program. The dean agrees. The curriculum shares 111 of 122 credit hours with the Physics B.S. Those eleven hours 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. be maintained.

**Academic Review  
May, 2016**

1. Bachelors of Science in Astronomy
2. Undergraduate bachelors degree
3. Department of Physics & Astronomy, College of Arts & Sciences
4. Department Head: Danny Dale – 307-766-6150 – [ddale@uwyo.edu](mailto:ddale@uwyo.edu)
5. Program Productivity
  - a. Bachelors degrees in Astronomy granted 2010-2014: 13
  - b. New first-time Enrollment : declared Astronomy B.S. majors
    - 2010-2011: 10
    - 2011-2012: 11
    - 2012-2013: 23
    - 2013-2014: 22
    - 2014-2015: 23
    - 2015-2016: 30
    - 2016-2017: 38

6. Program quality:
  - a. Program accreditation – no astronomy programs in the U.S. are accredited

b. Credentials of faculty

Faculty	Degree	Field	Ethnicity	Sex
Mike Brotherton	PhD	Astronomy	W	M
Te Yu Chien	PhD	Physics	A	M
Yuri Dahnovsky	PhD	Physics	W	M
Daniel Dale	PhD	Physics	W	M
Hannah Jang-Condell	PhD	Astronomy	A	F
Paul Johnson	PhD	Physics	W	M
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

Our astronomy faculty feature two Ellbogen award winners (Dale and Kobulnicky). Kobulnicky and Myers are PIE (promoting intellectual engagement) winners. Astronomers comprise three of the seven most prolific scholars among the five core A&S departments participating in the Science Initiative (Myers, Dale, Brotherton; according to the Academic Affairs analysis in the fall of 2015). According to the Fall 2010 issue of the Dean of Arts & Sciences newsletter, astronomers (Brotherton, Dale, Kobulnicky) took three of the top five spots in the College under the heading, "Faculty who have generated the most grant dollars since 2001". Astronomer Hannah Jang-Condell is the only female faculty member in the Department.

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

c. Program reputation

Undergraduate programs in astronomy are not ranked by any organization.

d. Curriculum

ASTR 2310 General Astronomy I  
ASTR 2320 General Astronomy II  
ASTR 4610 Introduction to Astrophysics  
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  
COSC 1010 Introduction to Computer Science

e. Distance delivery

Delivery is all on-campus

f. Quality of assessment plan

The Astronomy B.S. is assessed jointly with the Physics B.S. because astronomy shares 111 out of 122 credit hours with that degree. Our annual assessment report this year will cover formative and summative assessments of 2-3 key upper division courses. Physics & Astronomy 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	Dept. Average	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

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.

7. Mission Centrality

a. The Astronomy B.S. is a degree very similar to its counterparts in physics or engineering. Students learn technical skills in computational and analytical areas that are central to the University's emphasis on computational sciences. Astronomy 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. The two 23xx-level astronomy classes offered as part of the major have enjoyed strong enrollment from engineering majors and other science majors each time they are offered. Enrollment in ASTR classes by year:

Year	Enrollment	Completion rate
ASTR2320 – Spring 2015	10	10/10 (100%)
ASTR4610 – Spring 2015	11	10/11 (91%)
ASTR2310 – Spring 2014	10	9/10 (90%)
ASTR2320 – Spring 2013	13	11/13 (85%)
ASTR4610 – Fall 2012	8	6/8 (75%)
ASTR2310 – Spring 2012	25	20/25 (80%)
ASTR2310 – Spring 2010	15	11/15 (73%)
ASTR4610 – Fall 2010	5	5/5 (100%)

c. Recent astronomy B.S. graduates and their career paths:

Name	Year	Outcome
Tyler Ellis	'15	Doctoral program, Louisiana State U.
Sam Nissim	'15	Medical Physics master's program, U. Penn
Austin Gager	'15	Secondary teacher certification program '16 → high school physics teacher, Cherry Creek, Colorado
Rachel Smullen	'14	Doctoral program, U. Arizona (A&S top 20 graduate)
Adam King	'14	unknown
Charles Torrence	'14	Software engineer, Austin, TX
Andrew Hellquist	'14	Nordstrom
Amy Miller	'14	SciApps, Inc.
Garrett Long	'13	unknown
Jyoti Pandey	'13	UW grad school → software company
Susan Robison	'12	Gillette Planetarium
Jacob Pedrett	'12	unknown
Heather Choi	'11	Salt Lake community college instructor

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

## 8. Cost

a. Ratio of student credit hours per FTE: There are 11 credit hours of astronomy offered every biennium. This equates to significantly less than one full time faculty member required to teach these classes....call this 0.5 FTE for purposes of subsequent calculations. With an average of 11 credit hours \* 22 students per biennium = 242 student credit hours per biennium.

b. i. 0.5 FTE equates to approximately \$120,000 per biennium.  $\$120,000/242$  student credit hours equals \$495 per student credit hour.

b. ii.  $\$120,000$  per biennium/ $2.6$  degrees per biennium = \$46,153 per degree.

b. iii. Non-personnel expenditures per FY for the entire department is \$229,971 in FY2014. The fraction of this devoted to the astronomy major can be reasonably estimated by the number of astronomy student credit hours (242 per biennium) divided by the total department credit hours (13,000 per biennium) = 0.018, or 1.8%.

c. i. Classes falling under minimums: ASTR4610 fell below 10 students in Fall 2012 and Fall 2010. Enrollments in ASTR2310 and ASTR2320 have not been less than 10 any semester.

c. ii. None

d. i. Section fill rates: ASTR2310 and ASTR2320 regularly approach the section cap of 18 students. ASTR4610 has not approached any meaningful capacity.

d. ii. Course completion rates are listed in the above table along with enrollment.

d. iii. Curricular complexity. ASTR 2310 and 2320 require Math 2200 (calculus I) and Physics

1210 (Engineering Physics) as pre-requisites. As such, they are technical, demanding classes. ASTR4610 requires completion of four semesters of physics (1210, 1220, 2310, 2320) and 3 semesters of calculus (2200, 2205, 2210) as pre-requisites.

d. iv. The faculty course load for Physics & Astronomy faculty varies from one course per semester to three courses per semester, depending on job description.

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

#### Summary Statement:

Maintaining the Astronomy B.S. requires only 11 credits per biennium, or about 0.5 FTE. Having the major draws quality students to campus at the rate of about 20-30 NEW declared astronomy majors per year, even though most of these don't complete the major. Yet, the number of declared astronomy majors seems to be increasing, reaching an all-time high of 38 new majors for Fall 2016! Physics & Astronomy students have ACT scores >3.5 points above the College average, so clearly these are quality students that come to UW because of the existence of the major. Astronomy faculty are among the most prolific scholars and award-winning teachers in the College.

Academic Program Review: **Astronomy, 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**