UNLV

UNIVERSITY OF NEVADA, LAS VEGAS

Program Review Self-Study

Program Reviewed: Astronomy

Degrees: M.S.

Program Chair or Director: Dr. Stephen Lepp

Dean: Dr. Eric Chronister

Date of Report: March 2019

GENERAL INSTRUCTIONS

1. **Please complete the program review self-study using this template**.
2. If this review is covering several degree levels, please be sure to address ***each level*** in your responses to the questions.
   - Dr. Rainier Spencer, Vice Provost for Academic Affairs: rainier.spencer@unlv.edu, 702-895-5833.
   - Nora Carroll, Academic Programs Analyst, eleonora.carroll@unlv.edu, 702-895-1888.
3. **Self-study submission:**
   - Send completed self-study electronically to rainier.spencer@unlv.edu and eleonora.carroll@unlv.edu.

I. Program Description

A. College/Department/Program

1. College or School: College of Sciences
2. Unit: Web Address: http://physics.unlv.edu/
3. Program being reviewed: M.S. Astronomy
   a) Degrees and their abbreviations: M.S. Astronomy

B. Primary individual completing this worksheet

1. Name: Stephen Lepp
2. Title: Chair of Physics and Astronomy
3. Date of self-study: 2/1/19
4. Campus phone number: 895-4455
5. Mail stop: 14
6. E-mail: lepp@physics.unlv.edu
7. Fax number: 895-0804

C. Other faculty involved in writing this report:

D. Catalog Description

Please insert the most recent catalog description(s) of the program(s). Due to display complications, the description must be typed into this form and not pasted from the catalog.

The purpose of the Astronomy M.S. and Ph.D. degrees are to prepare students for a career in Astronomy or Astrophysics Research or in education at the university level. The program achieves this with a custom program for each student set up by their advisor and their advising committee. At the M.S. level we have two options. A coursework M.S., wherein students take classes at the graduate level in Astronomy and pass an exam. We also have a thesis option where students will learn to formulate, conduct and report on research.

1. Is this description correct? If not, what needs to be changed? Yes.

II. Centrality to Mission

A. Department/Program Mission

What is the program's mission statement (or the department's if the program does not have one)?

The mission of the Department of Physics and Astronomy is to provide programs of the highest possible quality in instruction, research, advising and service in the disciplines of Physics and Astronomy. We strive to provide and environment emphasizing the importance of coherent and integrated approach to teaching, research and service. In this friendly environment both students and faculty can foster and develop the broad base of scientific knowledge, skills, principles and competence which enable students to implement the technological problem solving skills needed

in industrial, academic and governmental research careers in physics or astronomy. The department's mission is reflected in the degree programs it offers: B.S. Physics, M.S. Physics, M.S. Astronomy, Ph.D. Physics and Ph.D. Astronomy.

B. Department/Program Mission Alignment

Briefly describe how this program is aligned to the mission of the University as described in the most recent mission statement, UNLV Mission https://www.unlv.edu/toptier/vision, and how it supports achievement of the institution's mission:

The mission of the Department of Physics and Astronomy aligns with the universities particularly fulfilling traditional area of studies with research at national and international levels. The programs also fulfill the university mission by preparing students for graduate studies and producing graduates ready to enter the workforce.

C. Core Themes

Briefly describe how this program supports UNLV's Core Themes (the core themes can be found at: https://www.unlv.edu/provost/nwccu/core-themes):

The department is fully involved in in expressing the mission through the core themes, particularly those of Student Learning and Success and of Research, Scholarship, and Creative Activity. The department is one of the most research active on campus and we strive to include our students in these activities.

D. Excellence

List and briefly describe five highlights or areas of excellence of the program:

Our department has many high quality research programs as is shown in publications and grants. A publication list is attached to this report and it is one of the best in the university. In the last 10 years our department has brought in approximately two million dollars per year in grant money.

We encourage students as part of their learning to engage and interact with other research activities through group meetings, journal clubs and departmental seminars.

We have several recent hires who have shown to be very high quality, productive researchers. These include Rebecca Martin, Jason Steffen, and Zhaohuan Zhu, with research in astronomy, as well as Ashkan Salamat and Qiang Zhu with research in condensed matter physics. These tenure-track professors have brought a new young active contingent to the department and have been very productive in publishing and obtaining grants. Zhaohuan Zhu, one of our tenure-track faculty won a Sloan Fellowship, the first such winner in the state of Nevada.

We have been successful at getting our students research jobs as postdocs and some of our students are currently faculty or have positions at national labs.

We have produced several books on subjects such as cosmology, computational physics, gamma ray bursts and quantum computing and information.

III. External Demand for Program

A. Stakeholders

1. Who are the main local and regional stakeholders of your educational programs, i.e., employers and entities benefiting from these programs, hiring the graduates, or admitting them to graduate and/or professional programs?

There is a need for physics and astronomy graduates at the test site and for teaching within the Las Vegas valley, but the market for physics and astronomy graduates is primarily national and our graduates end up all over the country. A significant fraction of our MS graduates continue in graduate school and this also is a national market.

2. What are specific stakeholder needs for graduates?

To have graduates need a basic understanding of Astronomy and the tools used in astronomical research, the ability to formulate and solve problems and to think independently.

B. Needs for Graduates and Future Plans

1. What are the anticipated needs for program graduates over the next 3-5 years? Please cite sources of information.

The Bureau of Labor Statistics Occupational Outlook Handbook states, "Overall employment of physicists and astronomers is projected to grow 14 percent from 2016 to 2026, faster than the average for all occupations". Note: The growth projected for all occupations is 7%, so this is double the average.

2. What changes to the program will those require?

We will have to prepare for additional students.

C. Success of Graduates

1. What steps does the department take to facilitate the success of graduates (e.g., internships, career fairs, employment talks, etc.)?

Only informally, each student is assigned an advisor and advisory committee in the department.

2. Discuss the placements of recent graduates:

We have only anecdotal information, our graduates seem to be successful at continuing in graduate school or finding a job.

3. If the department or program does not have placement information on graduates, what is the plan to implement gathering that information?

We conduct an exit interview with each of our graduates. We will add a question to the exit interview to ask for contact information from our graduates (their UNLV email gets disabled when they graduate). This will allow us to do a systematic study on how our graduates are doing.

4. Do placements match stakeholder needs as identified above in A of this section?

We have no reason not to think so, our stakeholders are people who want people trained in physics and astronomy, a market which is expected to grow.

5. If not, please explain:

6. Does the program assess whether the graduates are meeting employer's needs?

We don't currently.

7. If not, what will the program do to place this NSHE-required assessment in place and by what date?

Again with contact information from our graduates, we will be in a better position to assess this.

Additional comments

IV. Program Resources

A. Faculty Time

1. Faculty and GA Resources

	Fall 2015	Spring 2016	Fall 2016	Spring 2017	Fall 2017	Spring 2018
Number of Full Time Faculty	18	18	18	17	17	16
Number of State-Supported GA lines	18	18	17	17	18	18

Number of PTIs	7	7	10	9	8	6
Number of FIRS & Visiting Faculty	1	1	1	1	2	2

	Fall 2015	Spring 2016	Fall 2016	Spring 2017	Fall 2017	Spring 2018
Percent of Classes Taught by Full Time Faculty	100%	92%	100%	86%	100%	92%
Percent of Classes Taught by Number of State-Supported GA lines	0%	0%	0%	0%	0%	0%
Percent of Classes Taught by Number of PTIs	0%	0%	0%	0%	0%	0%
Percent of Classes Taught by Number of FIRS & Visiting Faculty	0%	8%	0%	14%	0%	8%

	Fall 2015	Spring 2016	Fall 2016	Spring 2017	Fall 2017	Spring 2018
Student Credit Hours Taught by Full Time Faculty	18	3	33	36	9	36
Student Credit Hours Taught by Number of State-Supported GA lines	0	0	0	0	0	0
Student Credit Hours Taught by Number of PTIs	0	0	0	0	0	0
Student Credit Hours Taught by Number of FIRS & Visiting Faculty	0	3	0	6	0	3

2. For other non-major courses – e .g., upper division for the college or university, estimate the unit's resources allocated to them:

B. Budget

1. Please fill in the table with three years of financial expenditures to be used to respond to questions 2 and 3 below.

Budget category	FY 15–16	FY 16–17	FY 17–18
State Operating (2101)	$96,110.72	$104,968.02	$90,557.62
Student Fees	$32,639.77	$31,484.52	$28,953.99
Indirect Cost Recovery	$50,061.76	$39,151.26	$23,569.91
Self-supporting	$	$	$
Total Allocations	$178,812.25	$175,603.80	$143,081.52
Number of Graduate Assistantships (including GAs on grants)	21	32	31

2. Are these resources sufficient to meet the degree program's instructional and scholarship needs?

Through retirements and administrative assignments, we are currently down four faculty from a few years ago. This has stretched our ability to offer all of our courses and programs in the department. In particular, we do not currently have sufficient resources to offer as many graduate elective courses as would be optimal, or as the students would like. This will be alleviated as we hire replacement faculty for those who left.

3. If not, approximately what line items and amounts would be needed?

C. General Education

1. If your program or unit offers General Education courses, please estimate what portion of the unit's resources are allocated to this area:

   About 20% of our course offerings are for General Education and approximately 50% for Service courses for other programs.

2. Does the combined load from A and B above affect your unit's ability to offer courses for its major? If so, please describe:

   Our main challenge now in offering courses for our majors has been recent retirements. The fact that Service and General Education courses must be offered, indirectly affects our ability to offer our major courses, especially electives.

D. Other Funding and Resources

1. Is funding from other sources sufficient to assist the program in achieving its outcomes? Other sources to be considered include: differential tuition, grants and contracts, endowment income, and one-time gifts for student scholarships, other one-time gifts.

   The Department of Physics and Astronomy receives a significant portion of its funding from federal grants. We have been very successful at bringing in outside funding, with a funding level of approximately 2 million dollars a year over the last 10 years. Unfortunately, a significant fraction of this funding came from a single grant, the High Pressure Science and Engineering Center, which we were notified last year would not be renewed. A challenge for the department over the next few years will be replacing this funding. Fortunately, we still have a large number of smaller grants in the department.

2. If not, which funding streams could most reasonably be increased to help the program attain its outcomes?

3. Has any new donor revenue been generated since the last program review?

   We have had some donor revenue since the last review. We have funding for a "Russell Frank Astronomy Lecture Series" as well as a Russell Frank Scholarship.

4. Has the unit engaged in fundraising activities to support the program over the last 5 years? If no, please explain why not:

   In addition to his direct donations, Russell Frank has been trying to find additional donors for the department, but beyond that the department does not engage in significant fundraising activities

5. What has been the result of these fundraising activities?

   None.

6. Review the space data for your department and comment on its amount and quality. These data will need to be accessed by an individual with Archibus® access.

   The space in the department may be divided into three categories: Teaching Space, Laboratory Space, and Office Space. Teaching Space is adequate for our current needs, we occasionally need to schedule labs on weekends, but are able to offer all needed sections. Laboratory Space is

adequate for our current needs. All active researchers have some lab space and we have additional space earmarked for our current hires. It is desirable to have more lab space, but our current amount is sufficient for current needs. It will be challenging for the department to find space as we make future hires, though. Office space is a bit less then what is needed. Currently, we have several postdocs who need to double and triple up in offices, which is not ideal. We are currently able to house all our faculty, postdocs and students, but with continued growth it will be challenging for the department to find space for them.

7. Is the quality and quantity of available consumable materials and supplies (e.g., office supplies or lab supplies) adequate and if not, explain why not:
   Yes.
8. Is the quality and quantity of available technology resources, such as computers adequate and if not, explain why not:
   Yes.
9. Is the quality and quantity of available equipment (other than computing) adequate and if not, explain why not:
   Yes.
10. Is the quality and quantity of available library and information resources adequate and if not, explain why not:
    Yes.
11. Staffing
    a) Are available department staff resources sufficient to attain the program's outcomes?
       Yes.
    b) If not, what additional staff resources are needed and how would they be funded?

12. Additional comments:

V. Size of Program

1. Below are headcount, course enrollment, and degrees conferred data from Decision Support.

Academic Level Key	
Undergraduate (UGRD):	Graduate (GRAD):
10 – Freshman	GR - Graduate
20 – Sophomore	PHD – PhD
30 – Junior	
40 – Senior	
50 – Post Bacc Undergrad	

Headcount:
Headcount declared majors in Astronomy MS

Plan code 'ASTMS'

Term	Graduate
Spring 2012	1
Fall 2012	1
Spring 2013	1

Plan code 'ASTMS'

Term	Graduate
Fall 2013	1
Spring 2014	1
Fall 2016	3
Spring 2017	3
Fall 2017	2
Spring 2018	2

Source: PeopleSoft Table PS_LV_CNR_STDNT_CR
PS_LV_CNR_STDNT_CP
Office of Decision Support, July 2018

Course Enrollments:
Department of Physics and Astronomy enrollments by course subject

Enrollments in **PHYS** lecture courses by course level

Term	Level - 600	Level - 700
Fall 2010	1	41
Spring 2011	12	34
Fall 2011	2	24
Spring 2012	3	22
Fall 2012	4	22
Spring 2013	8	20
Fall 2013	4	44
Spring 2014	16	41
Fall 2014	6	52
Spring 2015	10	49
Fall 2015	3	53
Spring 2016	13	45
Fall 2016	6	50
Spring 2017	15	64
Fall 2017	4	49
Spring 2018	14	60

Source: PeopleSoft Table PS_LV_CNR_ENRL
Office of Decision Support, July 2018

Enrollments in **PHYS** lecture courses by course level

Term	Level - 600	Level - 700

Enrollments in **AST** lecture courses by course level

Term	Level - 700
Fall 2010	11
Spring 2011	14
Fall 2011	5
Spring 2012	6
Fall 2012	7
Spring 2013	3
Fall 2013	9
Spring 2014	11
Fall 2014	5
Spring 2015	2
Fall 2016	13
Spring 2017	5
Fall 2017	14

Source: PeopleSoft Table PS_LV_CNR_ENRL
Office of Decision Support, July 2018

Degrees Conferred:
Degrees Conferred by Academic Year (July to June)

Degrees conferred by Academic Year

Plan code 'ASTMS'

Academic Year	Degree Count
2009-10	3
2014-15	1

Source: PeopleSoft Table PS_LV_CNR_DEGREES
Office of Decision Support, July 2018

2. Discuss the headcounts from the last five years, i.e., are the trends in line with projections in your unit's strategic plan?
   The head counts in the Astronomy MS program are small, but this is really just a degree offered as part of our Astronomy PhD program. The PhD is the degree professional astronomers are expected to have and some get an MS degree along the way, or stop at the MS if they are unable to complete the PhD, but there are very few students seeking a terminal MS degree.
3. If not, why not?

4. Does your program's enrollment trend differ from national trends?
   Very small numbers make it hard to draw significant conclusions.
5. If yes, please discuss the reasons why:

6. Additional comments:

VI. Retention, Progression, Completion

A. Major Course Offerings

1. Are enough courses offered to meet enrollment demands?
   Yes.
2. How many major courses have been added or eliminated in the last 5 years?
   ___1__Added _____Eliminated

3. Why were the actions taken?
   We added a solar system formation course as an elective.

4. After reviewing the program, what additional actions should be taken to improve retention, progression and completion?
   None.
5. Are there any courses that students routinely have difficulty getting enrolled in, that slow progression and/or graduation? If so, please identify them:
   None.
6. If last question was answered yes, what steps can be taken to reduce "bottle-necks" in these courses. Please indicate *both* financially-based and non-financially-based solutions.

7. Can any changes in sequencing of courses be made to facilitate graduations?

B. Curriculum

1. Is the program's curriculum aligned with current developments in the field?
   Yes.
2. If not, what needs to be done to make the curriculum current?

C. Graduation Rates

Program graduation numbers and rates are summarized below.

Graduation Rates:
Graduation rates for Fall Cohorts

New Graduate Student Cohorts declaring Astronomy MS and graduating within 5 years

Plan code 'ASTMS'

Fall	Size	Yr 2 rate (%)	Yr 3 rate (%)	Yr 4 rate (%)	Yr 5 rate (%)
2016	3	33.3	NA	33.3	33.3
2017	1	NA	NA	0.0	0.0

Source: PeopleSoft Table PS_LV_CNR_DEGREES
PS_LV_CNR_CP
PS_LV_CNR_CR
Office of Decision Support, July 2018

Using the data in the tables above, please answer the following questions:

1. Are trends in 6-year cohort graduation close to the University's goals (UNLV's undergrad goal is 50%)?
   Small numbers, but students appear to be graduating in reasonable time.
2. If not, what is being done to reach the goal?

3. Discuss how and why the graduation rate is changing.
   Too small numbers for this analysis.
4. Additional comments:

VII. Relationship to Other Programs

1. What relationship does your program have to other programs (e.g. articulation, transfers, collaborations, partnerships) in the NSHE system?
   Very little.
2. What the relationship does this program have to other programs at UNLV (e.g., collaborations, partnerships, affiliated faculty, General Education requirements, etc.)?
   This department provides service courses for every department in the College of Sciences, every department in College of Engineering, as well as many other departments throughout the University.

3. Additional comments:

VIII. Impact

1. What impact has this program had or will have in the following areas:
   a) University
      The Physics and Astronomy department impacts the University through the conduct of high quality research, service, and production of high quality graduates in fields with increasing worldwide demand.

   b) Community
      The unit provides many outreach efforts to the community, including public lectures and school visits.
   c) Field
      The department provides other educational institutions with well-qualified research active faculty. We also contribute graduates at the undergraduate and graduate levels to corporations in private industry and to government agencies seeking well trained scientific and technical individuals.
2. What are the benefits to the institution of offering this program?
   The Department of Physics and Astronomy provides UNLV with a department doing high quality basic and applies research in important strategic fields, as well as educating the next generation of students in Physics and Astronomy. We also provide both service activities and substantial general education courses for the university.
3. Provide examples of the integration of teaching, research, and service (e.g., faculty mentoring leading to student presentations at conferences, service learning classes, community service activities involving students, or other student activities and/or achievements that you think are noteworthy).
   M.S students typically are utilized as graduate assistants early in their careers at UNLV. This may involve teaching, teaching assistance or grading for various courses. These students are also heavily engaged in original research projects under the supervision of their faculty advisor, except in the specific case

of a small number on non-thesis M.S. students. The also regularly present research results at national and international conferences as needed.

4. Additional comments:

IX. Productivity

1. Please provide an indication of faculty productivity appropriate for your unit (lists of publications by type, grants by type, performances by type, installations by type, etc.):
   A partial list of publications and a partial list of grants is listed are listed in the appendix. The lists are incomplete in that they only capture publications and grants from current members of the department and not people who have left. The Department of Physics and Astronomy is one of the most productive departments at UNLV both in publications and grants.
2. Additional comments:

X. Quality

A. Admission and graduation requirements

1. Please insert program admission requirements from the current UNLV catalog. Due to display complications, this description must be typed into this form and **not** pasted from the Catalog.
   The admissions requirements for the Astronomy MS program are as follows. 1) A BS degree in Physics, Astronomy or related area. 2) applicants must have minimum GPA of 2.75 for all undergraduate work and 3.00 GPA for last two years of undergraduate work. 3) Applicants must have completed at least 18 credits of upper division undergraduate physics with a minimum GPA of 2.75 in all upper division physics courses.
2. Are there any updates that need to be made to the catalog and if so, what are they?

3. How many full-time advisors are available at the college level?
   Each student is assigned an advisor and advisory committee in the physics and astronomy department.

B. Outcomes and Assessment

1. Student Learning Outcomes and Program Assessment Plans and Reports by program concentration are listed at http://provost.unlv.edu/Assessment/plans.html. Please attach the most recent assessment report in the Appendix.
   The most recent assessment report is included in the appendix.
2. Describe specific program changes made based on the program's evaluation of its assessment reports:
   Our major change based on assessment was to institute an "exit interview" with each student graduating. Going forward we plan to use this interview to collect contact information to help us contact our graduates for systematic study of their success.
3. Has the program revised its curriculum such as changing prerequisites, adding or eliminating required or elective courses, or co-curricular experiences for the degree(s) in the last 5 years?
   No.
   a) If yes, what changes were made and why?

4. Has the program revised course content or instructional approaches (pedagogy, technology) in the last 5 years? None
   a) If yes, what changes were made and why?

5. Describe any other changes made in the last 5 years (for example, advising) based on assessment reports: None.

6. List and describe two specific improvements in student learning outcomes and why they represent forward movement.

7. Additional comments:

XI. Conclusions, Self-Assessment

A. Faculty Review of self-study

1. On what date did the program and/or department faculty review this self-study?
   3/8/19
2. What were the results of the faculty review?
   The faculty approved the self study with minor revisions.
3. What are the top 3 priorities and/or needs for the future development of the program?
   a. More faculty. Currently we are down four faculty with retirements and administrative assignments, and additional faculty will lead to additional research supervisors, additional elective courses (both undergraduate and graduate) and the ability to offer alternate tracks of some bottleneck courses in the undergraduate program. More faculty would allow us to grow the program to expected needs for a field for which job grown is expected to be 14%, double the average over the next ten years.
   b. More GA's. The physics department currently uses most of its GA's to teach laboratory classes for the undergraduate program. Most physics departments do both laboratory and recitation sections for their service courses. This helps in both retention (more people passing these courses) and it would allow us to accept more students. Currently our number of applications is up significantly and many are high quality students.
   c. More Space. As we get more faculty and more students we will start to run out of space for our programs. The department will need more space, both office and laboratory, going forward.
4. What are the strengths of the program?
   High quality faculty, working with high quality students to produce high quality research.
5. What are the challenges facing the program?
   One of our biggest challenges is to increase the research funding in the department, particularly from federal grants. The department has been very successful at bringing in research money, but must continue to pursue this funding. It is a particular challenge going forward, as we have lost one of our big grants (the HiPSEC grant lost at the end of 2017), but we have already started to fill in the loss with over a million dollars in new grants starting in 2018.
6. What recent additions, corrections, or other changes have been made to the program that reflect changes or developments in the field?
   The programs in physics and astronomy are very stable and have changed little over time. We have updated our teaching methods and experimented with online courses. We have also introduced new courses at both the undergraduate and graduate level in climate change, in quantum computing and information and at the graduate level in solar system formation.

B. Other comments

1. Is there anything else you would like to discuss about the program?