Please attach a narrative (not to exceed 4 pages, excluding appendices) addressing the following:

☐ What are the student learning outcomes? Please provide a numbered list.

1. Graduates of the program are expected to be successful in pursuing careers in the direct practice of physics or further education in more advanced programs in physics or related fields.

2. Graduates of the program are ready to be team contributors or leaders, capable of collaboration and thinking independently.

3. Graduates of the program are trained to be effective communicators (both orally and in the written word) professionally and socially.

4. Graduates of the program are prepared through coursework and cutting-edge research to be professional problem solvers, leaders in their fields, and analytical thinkers.
Graduates are expected to possess the ability to work in the laboratory, understand how to take and analyze experimental data and/or generate theoretical data, and to have familiarity with practical laboratory equipment such as oscilloscopes, voltmeters, and spectrometers and computers.

- Which learning outcomes were assessed? **All outcomes were assessed (1-5).**

- How were they assessed? (Programs must use at least one direct assessment of student learning.) **Our primary tools of assessment lie in the thesis requirement. The masters candidate presents his/her thesis work in written form (the thesis) and in oral form (the defense). Outcomes 1-5 are assessed during this time. We also conduct an exit interview with all of our students to partially-assess outcome 1 and via subsequent contact with the students after graduation.**

Undergraduate programs should assess at least one University Undergraduate Learning Outcome (UULO) each year, which may or may not overlap with a program learning outcome. **Not applicable as this is a graduate degree.**

Graduate programs should assess at least one outcome related to one of the following graduate level requirements each year:

6. student engagement in research, scholarship, creative expression and/or appropriate high-level professional practice.
7. activities requiring originality, critical analysis and expertise.
8. the development of extensive knowledge in the field under study.

For the doctor of philosophy in physics degree, we assess outcome 6 in particular and, to a lesser extent, outcomes 7 and 8.

Though students are not required to publish peer-reviewed papers for their thesis, we strongly encourage it. With few exceptions that I am aware of, most of our students do publish at least some of their work in peer-reviewed science journals (e.g. Physical Review and Journal of Chemical Physics). Ph.D students are also strongly encouraged to present their research at various local, regional, national and international conferences. Graduate students also participated in various summer schools/workshops as well as were awarded research internships at Los Alamos and Lawrence Livermore National Laboratories (LANL and LLNL). These experiences are intended to aid the students in developing their thesis projects, improving their research skills, and exposing them to US Department of Energy facilities and research challenges that are worked on by these facilities.

During the student's career, they are expected to hold yearly meetings with their thesis committee and discuss progress (both course-related and thesis-related) by giving a presentation discussing their progress. The student's progress is judged during these meetings by private conversations amongst the committee members.

Finally, our department has also instituted a policy (agreed upon formally by the Department during the Fall of 2015) to have the Assessment Coordinator interview all graduating undergraduates one-by-one. Questions from a standard template are asked and recorded.

The Physics and Astronomy department requires its Ph.D.-seeking students to pass a written/qualifying exam. They are allowed two attempts to pass the exam. If they do not, they are asked to leave the program.

What was learned from the assessment results?

From the exit interview data gathered, students have complained about the lack of offerings of important graduate courses that they need to graduate. This is in part due to a paucity of physics professors as a number have either retired (e.g. John...
Farley) or have passed away (e.g. Prof. Lon Spight and Jim Selser). There was also some criticism of the varying level of teaching and supervisory quality with some professors (allegedly) leaving class early (e.g.). As result, some students didn’t feel that they learned as much as they should have for some classes. Some students explained that they like professors who teach via the blackboard/whiteboard rather than powerpoint and use clickers which do not teach students the nuts and bolts of problem solving but rather bullet points/concepts. Some courses used math which some of students explained that they had not formally studied yet. Various textbooks were criticized as being too outdated. There were some issues pertaining to high drop out rate in certain courses taught by certain professors. In these courses, there can be (according to the students) arbitrary and spontaneous rules set by the professor in question beyond what was stated in the syllabus to such an extent that they were totally unaware of their current grade (e.g. before the drop date) leading to great stress, confusion, uncertainty, and eventually many dropping the class in question. Some of them asked for other professors (including myself) to teach the required upper-division courses in question. Prof. Pravica spoke with the Chair (Stephen Lepp) about the students’ concerns and from his (Lepp’s) point of view, maintaining standards for our department was of critical importance and for the courses in question, he felt that the instructors were well suited to maintain those standards. He nevertheless agreed that it would be helpful to rotate faculty in some of the upper division required courses from time to time.

On the positive side, students in general felt that by having significant research experience and exposure as an graduate student and writing a thesis, they were well prepared for pursuing further graduate studies (i.e. Ph.D. level) and lifelong learning. All students interviewed felt that their UNLV physics graduate education would help them succeed. In general, the students felt that their UNLV physics graduate education was excellent and were all largely satisfied. We also are developing a tremendous track record of having our students continue on to further their studies via graduate school (both here at UNLV and elsewhere) and/or other training.

The High Pressure Science and Engineering Center (HiPSEC) enabled many of our students regularly travel to national and international laboratories such as the Advanced Photon Source (APS), Advanced Light Source (ALS), the National Synchrotron Light Source II, and the Canadian Light Source (CLS) during 2018. Faculty members were explicitly encouraged to bring students with them to conduct experiments.

Unfortunately, HiPSEC’s funding was not renewed and the center is defunct. This has been a great loss to the department. Our department has had meetings to discuss the anticipated difficulties and challenges associated with the loss of this major funding. Some members of the department are also aggressively seeking alternative funding sources to supplant those lost from HiPSEC to continue student research in condensed matter physics at UNLV. This March (2019), Los Alamos scientist and new director of the High Pressure Collaborative Access Team (HP-CAT) at the Advanced Photon Source will visit the physics department to engage in discussions which we anticipate will lead to financial support from the Department of Energy and guaranteed access to HP-CAT x-ray beamlines or our graduate and undergraduate students at UNLV as it given us in the past.

We have also learned that more often than not, students who graduated in physics from UNLV as undergraduates generally pass the qualifying Ph.D. exam whereas students from other schools often do not (at least on the first time that they take the exam). This is an important issue for us as we have recently achieved Carnegie “High Research Activity” status and are seeking to attract and accept higher quality graduate students.
How did the program respond to what was learned?

The Assessment coordinator has met with the Chair to discuss results of the exit interviews. We are seeking to hire at least two new faculty: one in experimental condensed matter physics and one in experimental atomic and molecular optics (AMO). These hires were instituted to replace retired or deceased faculty and help ease the burden for teaching graduate-level courses and afford more avenues/opportunities for our Ph.D.-level physics graduate students.

Most faculty members who are supervising students conduct weekly group meetings with their students (and meet with students separately as well). This is very important as it maintains an avenue of communication between the advisor and students and can afford an opportunity for the advisor to offer guidance and assess the student's progress toward successful completion of their thesis.

The department continues to debate the best means to formally train graduate students on public speaking and the process of researching, reading and digesting peer-reviewed papers. The late Prof. Lon Spight taught a one credit graduate-level seminar in the past but has since passed away. Prof. Ashkan Salamat organizes a "Condensed Coffee" for students (mostly from his research group) where the latest state-of-the-art research papers are presented by one of the students (including graduate students) once a week and discussed. Prof. Jason Steffen has organized a similar astrophysics chat for the astrophysics students. HiPSEC organized a weekly seminar every week where, barring an invited speaker, one student talks about a paper or topic during 2018. The problem with these efforts is that they are voluntary and often students don’t participate. We are actively discussing means to encourage student participation in these types of educational events which may include making a new seminar course for credit.

Most (if not all) of our students who successfully receive their Ph.D. degrees in physics at UNLV have taken faculty/staff member (Brian Hostermann) or postdoctoral positions (e.g. Jason Baker) in academia, industry and government laboratories after graduation.