

2010 Academic Program Review
Department of Physics and Astronomy, UNM
Departmental Response to Review Team Report & Proposed Action Plan
June 2010

The Department thanks the external review team for their thoughtful report and their useful recommendations. Below is the departmental response and proposed action plan. We are addressing the review team's recommendations roughly in the order in which they are listed in their report, but also structured in accordance with the major sections of our departmental self-study and long-range plan. It is worth pointing out that since the team's site visit (and in some cases even before the visit) we have already been addressing the majority of the issues raised by the review committee. This is a consequence of our recent tradition of successfully assessing ourselves from time to time, in fact twice over the last decade.

1) Overall Academic State of the Department:

Since the review team was "*very pleased*" with the quality of our programs, we do not intend to make major changes to our academic programs as a result of this APR, neither to the undergraduate nor to the graduate program. Specific points and suggested minor changes will be addressed in the respective sections below.

One of the first recommendations is of particular importance and concern to us, and is therefore reproduced here in its entirety: "*The current teaching load of the faculty is appropriate and should not increase, as it would start to jeopardize the research enterprise. The teaching load is comparable to that at similar state universities.*" Needless to say, we are in complete agreement with our review team and endorse this recommendation wholeheartedly.

2) Undergraduate Issues:

The review team recommended the development of an undergraduate course in biological physics. We have already been able to offer occasionally a course in biophysics, including this past spring semester, although the focus of the course has varied with instructor. We are aware of the advantages of having a regular offering, however. Therefore, prior to the team visit we had already established an ad-hoc committee to look into a biophysics curriculum. By the end of the summer or early this fall semester this committee will report to our faculty with specific recommendations for two biophysics courses, for both undergraduate and graduate students.

There was a recommendation to offer some "21st century experiments" in our lab classes. This is an interesting suggestion that we will consider in the future. At the same time we feel we must keep in mind the balance between teaching the fundamentals and teaching the latest trends when thinking about such changes.

Among the service courses for non-majors it was recommended to consider offering one on the increasingly important topic of energy. We believe this is a good idea. Our existing core service course "Physics and Society" (P105) already devotes significant

time to this issue. In addition, the topic is addressed in our general introductory P102 course.

Out of their meeting with our majors, the APR committee recommended that we list on our undergraduate webpages announcements of courses in other departments that may be interesting or relevant to our majors. We tend to deal with this issue on a more direct and personal level during advising, and we find that each major (and probably each advisor) has a different idea of what classes outside the department would best benefit them. We believe that it is best to handle this issue on a case-by-case basis.

Four issues arose during our discussion with the APR committee that we felt could lead to more substantial and beneficial changes to our major program than the issues listed in the report. First is the general issue of the application of math to physics classes. We find that our majors are often unable to apply concepts they have learned in their math classes to physics contexts, and do not acquire all the math skills they need in those classes. We are also concerned that they spend time on other topics in the required classes that are not really necessary for the physics/astrophysics curriculum. The suggestion that resulted from the APR meeting was to create a focused math class taught by physics (and probably engineering) faculty that would replace, say, two of the currently required math classes. We are pursuing this possibility now, led by Sudhakar Prasad. He is developing a syllabus for a course that would include the relevant aspects of linear algebra, partial differential equations (PDEs), Fourier analysis, probability and statistics, and other topics. It will replace two currently required math classes on PDEs and linear algebra, thus possibly freeing up space for a physics or astrophysics or interdepartmental elective. The School of Engineering has been supportive in this effort, as the class may be advantageous to their majors too. We will discuss this with the Math department, as they will be impacted by the change.

Second, we discussed the issue of making the one-hour problems sessions that accompany the 160 series lectures a requirement for our majors, or possibly for all students in the series. We feel this change would improve students' problem-solving skills, which is an issue by the time they reach 300-400 level classes. We are also discussing this with Engineering, as most students in the 160 series are Engineering majors, and again they are supportive. This issue will be discussed more in the coming academic year.

Third, we discussed whether our major programs were underloaded, overloaded or about right, and whether they should be "modernized" in any way. One suggestion from the APR committee was to teach quantum mechanics in the junior year, leaving the senior year open for more modern physics topics. This is apparently relatively common. The Undergraduate Committee is addressing these broad issues, and has carried out a limited comparison of our requirements with those of comparable departments. Ours do indeed seem on the heavy side, but we have not yet reached a consensus on whether changes should be made or not.

Finally, the issue of undergraduate research and its visibility was discussed. We are reasonably satisfied with the percentage of our majors who do carry out research (we estimate it is about 50% or somewhat higher). However, we could do more to advertise

the large amount of such research carried out here to various audiences. Possibilities include requiring of majors doing research that they make a poster, which can then be used in, for example, our annual Open House, and which could lead to increased participation in UNM's undergraduate research showcases. The website could also feature such research more prominently to aid in recruitment. Another possibility is to allow research credit hours to count towards required elective credits. We stopped doing this several years ago for reasons to do with oversight that are not worth describing here, but we will consider this matter again.

3) Graduate Issues:

Early on the review team comments that our basic graduate curriculum has been organized "with a realistic approach to overcome deficiencies in the undergraduate preparation of the graduate students". As already indicated, we therefore plan no fundamental changes to our graduate curriculum.

As already mentioned, the suggestion to regularly offer a graduate course in biophysics is currently being tackled by an ad-hoc committee, and will be discussed and evaluated by our faculty early in the upcoming fall semester.

One of our specific questions to the review team, and something they discussed with the Dean and the Associate Deans, was the importance of electives (at both undergraduate and graduate level) and our difficulty of offering enough of them because they are often officially under-enrolled. We appreciate the expressed willingness by the College to facilitate offering such electives, and therefore we will continue to try and offer them at a frequency that is both realistic and useful to the students. In this context our Graduate Committee will conduct a department-wide reassessment of the advanced graduate specialized course offerings required for each subfield, beginning this fall. Strategies, including team-teaching and mini-courses, will be explored to provide our students with essential information and make the best use of our faculty's expertise.

Where new ethical conduct of research training will be required by funding agencies for graduate students (and possibly postdocs) we plan to make use of offerings being developed by OVPR, i.e. rely on central university-wide handling of this issue.

A member or subcommittee of the Graduate Committee will explore fellowship development with local industry and philanthropic sponsors.

Of particular note in graduate education is the APR recommendation to revise the administration of our Preliminary Examination. This was motivated by a variety of concerns including

- The time to complete the examination.
- The impact of the exam on recruitment of new graduate students.
- The manner in which the exam is used as a diagnostic.

To understand our Preliminary Examination structure, it is important to describe its history. The current exam is the result of a study conducted by the Graduate Committee

in 2004 on the prior Comprehensive Exam, based on graduate level subject matter. It was determined that a solid foundation in undergraduate physics is critical for success of students in our program. Given our pool of applicants, many of our new students have substantial holes in their education, but we feel they have strong potential to succeed. We take it as our job to help these students reach their potential and fill in these holes. For those students who have strong foundations, they can (and do) pass out of the Prelims on the first sitting, before the first week of classes begins. Students with the weakest foundation can take up to three years to come up to speed at the level we deem to be at our standards. After experimenting with a more demanding schedule, we found that this three-year grace period to move through the prelims was necessary in order to capture all of those students we hope to retain. We see our system as successful. Many students graduate with a much stronger academic foundation than otherwise. Moreover, the overall time to graduation (6.5 years) is about average for PhD programs in physics and our prelim system does not cause undue delays, other than the delay to begin dissertation research. This delay, however, is necessary for those students who just aren't fully prepared. We have not seen the Prelim as negatively impacting our recruitment of graduate student. In fact, the generous time frame in which we allow the students to finish the exam is seen to be as fair as is achievable. If we were to reduce the time to complete the exam without reducing our standard, we would inevitably terminate many more students and this would be a real negative for the morale of the students and ultimately our recruitment. Finally, contrary to the opinion expressed in the APR report, we do "test to teach". That is, the results of the Prelim exam are used to advise students and move them into upper-division undergraduate courses. We do not, however, require the exam in the first sitting as a diagnostic. Doing so would be truly intimidating if our students, upon entering, had to take a test on day-one, even before classes begin. Again, we believe this would negatively impact morale and recruitment.

The most substantial recommendation on this subject is the suggestion to substitute the Prelim Exam with the Physics GRE. The GRE is a potential resource that could allow us to achieve all of the goals discussed above. To decide whether this is viable approach, we are studying the correlation between Physics Subject GRE scores and various measures of graduate academic success for our current graduate students including, GPA in core graduate course, and performance on our Prelim. With this information and further research, we will determine how the GRE might be used as a qualifying examination.

4) Our Facilities and a New Building:

The department is of course not surprised that the review team agrees with us on the urgent (some might call it desperate) need for a new, state-of-the-art building. To partially quote from the review team's report: "*...very serious problems that jeopardize the high-class research currently under way....completely inadequate....researchers have made heroic accommodations to deal with this....building is not energy efficient, a cost to the university that will only increase....urge the university to move as fast as possible on the design and construction of a new building...*"

The need for a new building also arose in the context of how to better attract good graduate students, something that is a clear priority for us. We do think that at this point our need for a new building has been more than properly and sufficiently documented and demonstrated. As outlined in our self-study, this is and remains our one overarching goal. The next action item is clearly an unequivocal sign by UNM's upper administration that this state's flagship research university is committed to supporting a first-rate physics program. Without such a sign, i.e. without stepping up to design and construction of a new building, the slow but steady demise of this program is all but guaranteed.

5) Departmental Website:

The importance of paying constant attention to our website shows up several times in the team's report. We strongly agree, of course, which is why this issue is also listed in our self-study document as a continuing objective. In November 2009 we had already established an ad-hoc IT/Web Committee, consisting of faculty and staff. This committee has spearheaded the effort of completely overhauling and enhancing our entire website. Currently more and more of the new modified web pages are being made live, in a format that is much more consistent with the general layout of UNM's web pages. This effort will continue as rapidly as possible. The IT/Web committee will become a standing departmental committee in 2010/11 in order to continue the oversight over this project and to monitor the effort so that the website remains as up to date as possible, for all departmental functions and audiences.

6) Science, i.e. Departmental Research Programs:

In their comments about our self-study document the review team expresses support for our choices and priorities for essential new faculty hires. Therefore we of course plan to proceed with our outlined faculty hiring plan as quickly as possible, given budget realities, anticipated retirements, etc.

Among their comments and recommendations on specific departmental research areas, it is worthwhile to re-iterate a couple points. The LWA (Long Wavelength Array, a radio-astronomy project) needs and deserves renewed, continued support by UNM. For Quantum Information "...*every effort should be made to maintain and grow in this area.*" Our Optical Science and Engineering (OSE) graduate program had its own separate Academic Program Review about one month after the one for Physics & Astronomy, and the corresponding recommendations are now being acted upon in parallel. A new support and administrative structure for OSE is being implemented. Our review team emphasized that the Optics group has been directly affected by the problems of our old building. In Biophysics their recommendation is to further accentuate our Optics – Biophysics collaborations and contacts with our National Labs. With respect to Condensed Matter and Statistical Physics the recommendation is "*It is vital to build on the strength of this group, which could have intellectual affinity with the Quantum Information group.*" This is consistent with and overlaps with the Complex Systems Theorist of our hiring plan.

7) Miscellaneous Recommendations and Answers to our Specific Questions that have not been addressed yet:

A coordinated mentoring program for all departmental postdocs is recommended. We plan to look into this as new requirements from funding agencies will be published. On the issue of diversity the review team recommended to contact the American Physical Society (APS) to arrange a visit to analyze the climate for women and minorities. We will indeed contact APS to find out what they can offer.

The review team expressed strong support for retaining both of our shops (electronic and machine) with professional people. To us it therefore seems imperative that we somehow overcome the current pause & hold on replacing our electronics engineer as quickly as possible. Enough damage to our experimental research effort and to our reputation with collaborators has already been done, as the Chair tried to point out last year already.

On our question of merit raises the review team seemed happy enough with our current procedure, which we therefore plan to leave in place for the time being. We do however also intend to re-visit the issue of a more equitable faculty workload during the upcoming academic year.

Finally, the review team recommended strengthening connections with our National Labs. This is obviously in our interest, and is something we are already pursuing aggressively and with some considerable success. For instance we just hired a new theorist (Assistant Professor), in close collaboration with the Theory Group at LANL, and initially supported via a joint grant from the US Department of Energy. In addition, several of our subatomic faculty members are collaborating very closely with LANL colleagues (and have for years) on several experiments such as miniCLEAN and PHENIX. At the same time, Sandia National Lab has a strong new focus in the area of Quantum Information and considerable interest in collaborating with our QI group at various levels. This is clearly a great target of opportunity for us and for UNM, which needs the immediate attention and support by our upper administration.