

**REPORT OF THE MONTANA STATE UNIVERSITY
DEPARTMENT OF PHYSICS REVIEW COMMITTEE
April 26-27, 2010**

The review team included:

- Dr. A Gordon Emslie, Associate VP for Research and Dean of the Graduate College, Oklahoma State University
- Dr. Richard C. Powell, Emeritus VP for Research, Graduate Studies, and Economic Development, University of Arizona
- Dr. Thomas Hughes, Head, Department of Cell Biology and Neurosciences, Montana State University
- Dr. Russ Walker, Department of Mathematical Sciences, Montana State University

The review team studied the MSU Physics Department Self-Study and Strategic Plan and conducted interviews with the faculty, head, staff, undergraduate students, and graduate students of the department as well as with key university administrators (Dean of Letters and Sciences, Provost, Vice Provost for Graduate Education, and the Vice President for Research, Creativity, and Technology Transfer). Below are the observations and conclusions drawn from these activities.

GENERAL OVERVIEW OF THE DEPARTMENT

The Montana State University (MSU) Department of Physics is outstanding! All of the metrics documented in their self-study, plus the attitudes of faculty and students exhibited in the interviews, verify that this department is excellent in all areas of performance and rates in the top tier of sister departments in land-grant institutions of similar size. The university should be proud and supportive of their Physics Department and should consider using some of the practices found there as “best practices” for developing and strengthening other departments on campus.

The Department of Physics has done an excellent job of strategic planning as reflected in their well-prepared and documented Self-Study. Their 10 strategic goals for the next seven years are all commendable and the committee strongly urges the university to support the department as necessary to achieve these goals.

One issue that concerned the committee was the lack of a clear university vision and strategic plan to provide a context for a definition of the role and expectations for the Physics Department. Without this university perspective it was difficult for the committee to evaluate the success of the department in achieving institutional goals. **The committee recommends that the university articulate a shared vision for the institution and the role they expect the Physics Department to play in implementing this vision. In turn, the administration should work with the department to facilitate their articulation of their long term goals and plans to accomplish them.**

The committee perceived a major communication problem between the university administration and faculty members in the Physics Department. The prime example of this was in the lack of understanding about the distribution, and use of, indirect cost (IDC) return funds from grants and contracts. Until recently MSU has used a distributed model in which a substantial fraction of the IDC returns are sent back to the departments, along with many accounting and staffing responsibilities. The recent changes in IDC distributions do not appear to have been made within the context of a clear discussion about changes in these responsibilities. **The committee recommends that the Vice President for Research, Dean, and Department Head work together to articulate very clearly to the faculty exactly how the IDC is distributed and the associated responsibilities for paying the each of the items traditionally covered by IDC.** The committee also heard from support staff about numerous changes in policy and procedures implemented by central administration without input from or communication to the departmental staff responsible for implementing the changes. **The committee recommends that the central university offices involve the departmental staff in decision making and that they communicate any changes in a clear and timely manner.**

The Physics Department has self-organized itself into 5 subdisciplines plus a group of support facilities. Each of these is making a major contribution to the operation of the department. This type of focus is very helpful in building critical masses in order to make a major impact on each targeted area of physics, and they have succeeded in this endeavor. This department has successfully avoided problems that can occur with this type of departmental organization, including competition between different subareas and lack of coverage of the broad discipline of physics. In meeting with personnel of each of these subgroups it was clear that they all feel a loyalty to the department as a whole and that they are very supportive of the needs of colleagues in other subdisciplines. The focus areas of this department in astrophysics, solar physics, condensed matter physics, optics, and physics education provide a breadth that allows all of the key areas of physics to be covered in the curriculum. Further, there is a good overall balance between theory and experiment. However, this balance does not extend to each subdiscipline area – for example, the Astrophysics group cited the need for an observer/data analyst. If additional positions should become available, there are additional subdisciplines such as elementary particle physics and solid state theory that would expand and strengthen the department. However, the committee did not see this as a priority for the department at this time.

Since the Department of Physics at MSU covers both the disciplines of physics and astronomy, with considerable depth in each area, the committee believes that this should be recognized more explicitly. The committee does not recommend that a new degree program in astronomy be started; however it supports the recent move to give certain courses an ASTR prefix to make this department strength clearer to students. Further, **the committee recommends that the department and university explore changing the name of the department to the Department of Physics and Astronomy.**

RESEARCH

Each of the 5 focus areas of the department has highly productive research programs. The physics teaching focus could be even more productive if the participants had more time available for professional activities. (This is discussed further in the next section.) The other areas of solar physics, gravitational physics, condensed matter physics, and optics are all well funded with grants and contracts. The faculty are productive in publishing in peer reviewed journals and in participating as speakers in international meetings. They frequently allow their students to participate in such meetings. **The committee recommends that the faculty in each of these focus areas look for opportunities to expand their activities through competing for major centers of excellence and through interdisciplinary collaborations.**

STAFFING AND PERSONNEL

One major strength of the department is an outstanding faculty dedicated to all aspects of their profession: teaching, research and outreach. However, they have only 17 FTE lines in tenure track positions and one of these has moved into central administration. This is a relatively low number for the productivity of the department and it is a number that has not changed for a significant number of years. The department has addressed this issue through hiring in non-tenure-line positions, adjuncts for teaching and research faculty to support research. This highly leveraged position on non-tenure-line positions has worked well in allowing the department to grow its teaching, research and outreach programs but creates a tenuous position with several concerns and significantly limits the ability for the program to continue to grow. **The committee recommends that the university increase the number of state-funded FTE faculty positions in the Department of Physics to 20.** This could be accomplished in several ways, including reassignment of existing adjunct positions or committing new positions to the proposed National Solar Telescope Institute, both of which are discussed below.

One of the critical personnel issues in the Physics Department is the use of adjunct assistant professors to cover a significant amount of the undergraduate teaching. The people currently in these positions are doing an outstanding job and play an important role in the educational mission of the department. However, the uncertainty of year-to-year appointments leads to a potential instability that could lead to the loss of these faculty members that would be devastating to the life of the department. In the current situation, the people in these positions have little or no time to pursue their professional interest and keep current in physics. This will eventually erode the quality of the teaching they provide. **The committee recommends that the Physics Department work with the Dean's Office to redefine these adjunct appointments in a way that provides them with stability and opportunities for professional growth. Very small investments in buyouts for research and professional development coupled with, for example, three-year rolling contracts could have significant rewards for the faculty, the department, and the institution.**

The Physics Department was referred to as “the University’s poster child” in regards to the very positive way they treat research scientists and research professors. The department should be commended for their policies of evaluating and rewarding research track personnel. However, concern was expressed to the committee that post-docs were unable to act as Principal Investigator on contracts and grants, and this was (somewhat erroneously) perceived as limiting their development toward research faculty status. It would be very helpful if the department’s policy and procedures for research track advancement from post-doctoral, to research scientist, to research professor levels were given to every person in these categories when they are first hired.

The Physics Department is fortunate to have an excellent support staff in all areas. The office staff is very small considering the departmental activities and the addition of another position would alleviate a major work load issue (especially when someone is out sick or on vacation). A critical area, considering the department’s heavy involvement in research, is the grant monitoring function, which is currently under the responsibility of a single individual. Another area that might benefit from additional staffing is the support for undergraduate laboratories and lecture demonstrations, which is also currently handled by one person. The department should analyze the work load in this area to determine if it would benefit from an additional position.

SPACE

The Department of Physics is located in high-quality space. However, their programs are currently space-limited. There is a potential safety problem in some of the crowded laboratories with high power lasers. There are areas like the student satellite laboratory that does not have enough work space for all of the participating students. As new students and post-docs are hired there is no place to put them. There is no place to add new offices or laboratories for program expansion. **The committee recommends that the university conduct a space utilization analysis of buildings near to the Physics Department to identify underutilized space that might be reassigned to Physics and to consider the formation of a local space committee for the EPS building.** If this is not successful, other solutions to the space problem should be sought.

CURRICULUM

The department supports a standard undergraduate physics curriculum and core graduate curriculum with appropriate elective courses for the focus areas of the departmental program. Because of faculty size limitations, some of the elective courses can not be offered often enough to meet the student demand. Many students remarked that the one-hour PH 331 course did not provide a sufficient exposure to the computer programming skills necessary for future success. **The committee recommends that the department consider expanding their computational physics course to at least a 2 credit hour course and review the course content to make sure it is meeting the needs of the students. In addition, the committee recommends that the freshman general physics course PH137 “From Quarks to the Cosmos” be continued as an opportunity to showcase the benefits of a physics education to a large audience.**

STUDENTS

The Physics Department has been able to attract good undergraduate majors and excellent graduate students. The graduate students in particular genuinely love the department and feel like part of the Physics Department family. They feel they are getting a good education and mentoring from their faculty advisors. The graduates of the program have been able to get good jobs in their fields. Most graduate students are supported by faculty grants and contracts. While this is commendable, the high proportion of domestic students suggests strongly that **the department encourage their graduate students to apply for more national fellowships. The committee also recommends that all the tuition waiver policy be revised so that all graduate teaching and research assistants are treated the same without regard to whether or not they come from Montana.** The current policy of not waiving the out-of-state portion of tuition for non-Montana students causes problems for first year enrollment and support on research contracts, making it harder to recruit the best possible students regardless of origin. Given that the waiver of the out-of-state portion is applicable only if it is billed in the first place, implementing such a waiver is clearly revenue-neutral and requires only adjustments in university accounting practices.

The committee commends the department for implementing the policy of having graduate students who have passed qualifying exams meet with their dissertation committee each year to monitor their progress. It is suggested that the committees and advisors mentor the students use these meetings to help them define a thesis project as early as feasible. The timing of these committee meetings should also be scheduled so they do not conflict with other departmental activities such as oral exams.

OUTREACH

Outreach is an important activity for a land grant institution such as MSU. The Department has developed strong outreach activities in a variety of areas.

In the area of research, the Department of Physics has been successful in developing intellectual property and transferring this to Montana companies. This has resulted in both new start-up companies and the enhancement of established companies. The result has been a major positive impact on economic development in the state. The best example for this is the area of optics. Bozeman has become a hot bed of companies producing optical materials, devices, and systems. This dramatic growth has been a direct result of the optics research program of the MSU Department of Physics. This should be used by the university as an example of how they are benefiting the state in areas other than undergraduate education.

In the area of education, the Department of Physics has several very active outreach programs that involve K-12 students and teachers as well as tribal colleges and other small educational institutions. These programs include the NASA Space Grant and

NASA EPSCOR Programs and physics teaching support. This type of outreach provides MSU with a high degree of visibility in the state and should be encouraged and supported.

SUPPORT

The Department of Physics benefits from having excellent support facilities including machine and electronics shops. In addition there are facilities such as the ICALS user laboratory that support the research program, the Student Satellite Laboratory that supports the teaching program, and the Spectrum Laboratory that acts as an incubator to support the tech transfer outreach program. All of these are critical to the life of the department. ICALS and the Student Satellite Laboratory are both in need of additional space as discussed above. ICALS is playing a critical role in the department's outreach to local industry since they have access to the facility. Also Spectrum Laboratory has been successful in spinning off several new start-up companies. As noted above, this type of outreach has had a major impact on local economic development.

It is important that the university provide the support required to run a major research/outreach program. The committee heard concerns about the university's Office of Technology Transfer and their lack of support of moving intellectual property out of the laboratory and into practice. Concerns were also raised about support needed from the university's Physical Plant Division to maintain laboratory facilities and safety. **The committee recommends that the university appoint a committee to assess the support of research and outreach activities on campus and make recommendations for changes.**

SUMMARY

The issues and observations discussed above can be best summarized as a SWOT analysis.

Strengths

- The department has an outstanding faculty of physicists dedicated to excellence in teaching, research, and outreach in physics.
- The department has high quality undergraduate and outstanding graduate students who are very happy with their educational experience at MSU.

Weaknesses

- The department does not know where it fits in to the university's strategic plan and priorities.
- The university has not fostered a culture appropriate to a unit that is so prominent in research in both national and international arenas. It needs appropriate policies, procedures and support infrastructure focused on helping faculty operate at their fullest potential in teaching, research, and outreach.

Opportunities

- The committee believes that the department is well-positioned to be successful in being awarded the new National Solar Telescope Institute. This transformational opportunity would take MSU to the next level of reputation and visibility in the international science community. It will, however, require a very substantial investment by the university as a whole, and the committee encourages such an investment.
- The very strong research programs in condensed matter, optics, solar and gravitational physics should allow the department to be successful in competing for large centers of excellence in each of these areas.
- Current scientific advancement is occurring at the intersections of scientific disciplines. This provides a tremendous opportunity for developing interdisciplinary research and academic programs. Examples include biophysics, applied physics with engineering, and energy research on fuel cells and photovoltaics with chemistry and engineering.

Threats

- Loss of personnel. If key faculty should retire or leave, the program could be devastated overnight. The College should be alert to such potential threats and address them at the outset to preserve the strength of the department.
- Loss of help from the university for infrastructure needs, space, IDC return or any other support could cause the program to deteriorate. The university needs to maintain an awareness of the level of support necessary to appropriately nurture this jewel of a department.