Purdue University Department of Physics

Strategic Plan 2009-2014

May 1, 2009

Preamble

Physics is a core discipline for the College of Science and the University. It is a central subject for engineering and science curricula, impacting many students at Purdue. Physics contributes to interdisciplinary endeavors in Discovery Park and in many of the research initiatives on campus such as nanoscience and nanotechnology (including the Birck Nanotechnology Center), the life sciences (including the Bindley Bioscience Center and the Cancer Center), and science education (and the Discovery Learning Center). Physics also plays a major role in engagement, working to foster and promote science learning at the K-12 levels and in informal settings and in entrepreneurial efforts. Physics is at the core of the University and College missions in the areas of learning, discovery, and engagement – a strong and vibrant Department of Physics is essential for the success of the University and College. This strategic plan for the Department of Physics recognizes the Department's responsibilities and charts a course to address these missions.

The discussions leading to this strategic plan began in fall 2007, as the Department prepared for the external review held in April, 2008. Four working groups were formed to address Department plans in the areas of discovery, learning, engagement, and staff and facilities. (Working group members are listed in Appendix A.) The working groups solicited wide input from faculty, staff, and students, and issued draft reports on major goals for the Department for the coming five years. These reports were endorsed by the faculty and were presented to the external review committee. The review committee endorsed these plans and also added new ideas and suggestions that, together with the working group reports, form the basis of this strategic plan. This new plan also includes input from the University and College strategic plans that were adopted in 2008. The final draft of the Department plan was composed in early 2009 and was endorsed by the faculty in spring 2009.

The priorities and major initiatives in the Physics strategic plan are guided by the University and the College plans, and these connections will be discussed throughout this document. We also note that the goals, strategies, and metrics in the Department plan are typically more detailed and at a "lower level" than those of the University and College plans.

History

The Department of Physics has grown and progressed considerably during the period covered by the University's 2001-07 strategic plan. A total of 22 new faculty (19.5 FTE) have been hired since 2001, as the faculty size has grown from 39 FTE in 2004 to 52.5 FTE in 2009. Both the undergraduate and graduate programs have also grown since 2001, with increases in the student populations of about 20% (undergraduate) and 40% (graduate) during this period. At the same time, our service teaching load has also increased by more than 10% (as measured in terms of credit hours).

The growth in faculty size has enabled many new initiatives and improvements, including: (1) The creation of new groups in astrophysics and biophysics. (2) The strengthening of several important core groups, including the condensed matter group, which now has a major focus in nanoscience, and the high energy group. These core groups have also established strong connections to the biophysics and astrophysics groups, in part through the hiring of faculty that bridge traditional interdisciplinary boundaries. (3) Important improvements in our undergraduate programs for both the physics majors' curriculum and service courses. Much of this work has been led by a newly formed physics education group. (4) The enhancement of the graduate

program through the development of many new “specialty” courses focused on forefront physics in all areas.

All of these changes give the Department of Physics a strong foundation on which to build for the future.

Mission

The mission of the Department of Physics is to serve the citizens of Indiana, the United States, and the world through discovery that expands knowledge in the field of physics and closely related sciences, through conveyance of this knowledge to our students in an excellent learning environment, and through engagement in which we share our skills, knowledge, and enthusiasm with diverse communities beyond the University.

Vision

The Department of Physics at Purdue University will be recognized for the distinction of its faculty, the pioneering research they and their students perform, and the excellence of the education provided to all of our students. We will focus on core areas in which the finest minds engage in the discovery process and integrate the process of discovery, and the discoveries, into the education of our students. Discoveries in pure science will expand our knowledge and give a new and ever changing understanding of the physical Universe. We will also provide the expertise and understanding of physical systems and related biological systems that are required, and essential, for interdisciplinary partnerships. We will engage our colleagues in the Colleges of Science, Engineering, Education, and others at Purdue University and elsewhere to jointly advance our understanding and application of science to provide the benefits of science to society. We will have a student body of both undergraduate majors and graduate doctoral students of superior intellect and accomplishment from within Indiana, across the United States, and around the world. We will engage diverse populations of learners and develop innovative education initiatives and services. Our department will welcome women, minorities, and individuals from all cultures to form an enriching and diverse community of physicists. We will give high priority to the education of students from other disciplines by creating innovative curricula to match their requirements and, we will educate them to the full extent of their abilities. The students we serve will have the best professors, the finest educational technology available, and a stimulating physical environment for their classes. The Department of Physics will be highly ranked with respect to the group of peer institutions and be an essential element in the University achieving pre eminence. We will produce physics research at the forefront of science, physics degree students of the highest rank, and, through education and outreach, a more science-literate society.

Guiding Principles

Our vision is guided by a set of principles that are essential to meeting our goals:

- Faculty and staff excellence. A diverse faculty and staff of the highest quality are essential ingredients of a first rate department.
- Investment in core focus areas. The department will develop and maintain world leadership in core areas of physics, leading to the creation of specialized centers for research and discovery.
- Investment in interdisciplinary research. The department recognizes the growing importance of research that cuts across traditional disciplinary boundaries and will invest its resources in initiatives in multi- and interdisciplinary opportunities.
- Excellence in education. We are committed to giving all of our students the highest quality education, with emphasis on critical thinking and analysis, conceptual understanding, problem solving and ethical issues related to science in general and physics in particular.
- Integration of research and education. We will strive for the continual integration of research and discovery into the educational experience.
- State-of-the-art facilities. Forefront and cutting edge physical facilities and an excellent support staff are essential to meeting our research and educational objectives.
- Commitment to mutual respect. We are a department committed to fostering an environment that promotes freedom of expression and tolerance for individuals having differing points of view and cultural backgrounds.
- Engagement. Our faculty, staff and students will enthusiastically share their knowledge of physics with the greater community, including K-12 students and teachers of Indiana, our alumni, and the general public.

Resources and Funding

The implementation of our vision, in which Physics will play a central role in the University and College of Science Strategic plans, will require a significant increase in resources, as well as reallocation of existing resources, to provide the personnel and physical facilities necessary to achieve our goals. We are moving into an era in which there will be a new funding paradigm, characterized by new sources and a high level of competition for these resources. We envisage funding from a partnership involving the University, the Federal Government and private fund raising. We expect to compete for such funding by matching our needs and vision with appropriate funding sources. We expect support from the University that will result in increased Federal funding. Additionally, we will ask alumni and friends who share our vision for the future to take an active role in making it reality. We will give high priority to the funding of chaired professorships, undergraduate research, graduate fellowships, and the creation of research and educational centers.

Discovery

The Department of Physics has strong research programs in a number of areas. The largest research groups are in high energy physics and condensed matter physics, each with currently about 14 faculty members. Other highly active areas of research include astrophysics, biophysics, nuclear physics, applied physics, geophysics, and physics education, with many faculty active in two or more or these areas. The total funding for all of these research groups in 2006-07 was approximately $7.3M. Precise comparisons with peer institutions are difficult, especially since many of these peers have separate departments of astronomy and/or astrophysics, while we do not. Nevertheless, comparisons with our peers indicates that research funding at other Physics Departments in the Big Ten was significantly higher, with a median of about $14.5M in 2006-07. This comparison suggests that our funding level lags significantly with respect to that of our peers. Other measures also lag. For example, the number of graduate students supported as research assistants in our Department in 2006-07 was 44.5, while the median for our peers was about 80. These numbers are not, of course, direct measures of research quality, but they do strongly suggest that there is much room for growth in our Department. They also give some context in setting appropriate goals and metrics in this area.

Goal 1: Have two major research areas rated in the top ten and three in top 15 within ten years.

One way to increase our Department's external visibility and reputation is by having preeminent programs in a few selected research programs. Having such programs will improve our overall Departmental ranking, aid in faculty recruiting, and help us attract the best graduate students.

Strategies

- Support (e.g., through additional faculty hires) research groups that initiate collaborative and interdisciplinary group projects.
- Identify research areas that are best coupled to state and national needs, and provide support through faculty hiring.
- Hire senior faculty leaders in selected research areas.
- Achieve a faculty size of 57 FTE by 2014. While our faculty size has grown significantly during the period of the last strategic plan, we are still smaller than our peer departments. The median faculty size for the Departments of Physics and Astronomy at our peers in 2006-07 was 65. To be competitive we should target a comparable faculty size. Reaching this target will take time. Our best leverage for increasing our faculty size is the importance of the Physics Department in many of the interdisciplinary initiatives on campus. Increasing our research funding (see Goal 2) will also demonstrate that our Department is a good "investment" for the University.
- Department preeminence can only be achieved with the best faculty, which in turn requires that we aggressively recruit from underrepresented groups. We will partner with other Departments in the College in this recruiting.
- Maintain and enhance strength of core physics research areas. We will form a faculty hiring committee to advise the Head on which areas are of greatest priority, given the goals of the strategic plan.

- Improve mentoring of young faculty. Young faculty are key to the future success of the Department, and we must be sure that they are given timely and effective mentoring. We will make mentoring a higher priority for senior faculty. Clear expectations will be set for mentors and the Head will guarantee that these expectations are met.

Metrics

- Rankings of research groups as determined by U.S. News and World Report or by the Department's External Review Committee.
- Faculty size compared to peer departments.
- Numbers of faculty from underrepresented groups.
- Success of junior faculty as measured by research funding and promotion rates.

Goal 2: Increase research funding.

Research funding is not an end in itself, but is one measure of the success of our Department. In view of our current research funding compared to our peers, a significant increase in research funding is needed to make us competitive. Our overall goal during the period of this strategic plan is to bring our external funding up to the median level of our peer physics departments. This will require that we approximately double our external funding by 2014, which is also the general target set by the University strategic plan.

Strategies

- It is important for faculty to be informed as early as possible about pending funding opportunities. Assistance in identifying potential collaborators, especially from other departments or Colleges at Purdue is also essential. We will therefore form a research funding committee to keep in close touch with funding agencies (e.g., through the office of the Purdue Vice-President for Research) and to facilitate grant applications.
- Provide incentives for faculty who lead large multi-investigator proposals and projects, and also for faculty who achieve noteworthy funding success through single investigator projects. These incentives could be additional administrative support, appropriate teaching assignments, or other mechanisms.
- Many of the most important scientific problems are now at the boundaries between traditional disciplines. Moreover, the scale of such problems also requires multi-investigator teams. We will therefore place particular emphasis on such interdisciplinary/group funding opportunities.

Metrics

- Number of grant applications and funded proposals
- Number of group/interdisciplinary grant applications and funded proposals.
- Total research funding.
- Number of graduate students supported as research assistants.
- Ranking of total research funding with respect to peer departments.

Goal 3: Increase the quality, diversity, and size of the graduate student program.

The goal of improving both the total research funding and the research ranking of the Department is closely tied to the success of the graduate program. Our total number of research assistants is, as noted above, low compared to our peers. Improving both the quantity and quality of our RAs is thus an important goal. At the same time, we must also strive to recruit greater numbers of women and other underrepresented minorities to our graduate program. At present our percentages of graduate students in these categories are close to the national averages, but there is much room for increasing these numbers. This goal and the associated strategies overlap with those in the area of Learning in this strategic plan.

Strategies

- Increase number graduate students with externally funded RA positions (available as research funding grows) and fellowships.
- Compete for training grants and other means of graduate student support.
- Place new emphasis on graduate student recruiting. Develop relationships with minority institutions (e.g., HBCUs) to encourage their students to attend Purdue.

Metrics

- Number of students supported by RA positions. Aim to reach median numbers of peer institutions by 2014.
- Number of women and underrepresented minorities in graduate program.
- Success rates for graduate students.

Learning

Undergraduate Program

The Department strives to create vibrant learning experiences and environments for the undergraduate physics majors. Our aim is to provide education and training essential to produce thoughtful, creative, and knowledgeable leaders who have the advanced skills necessary to succeed in today's highly technological society and who will continue to be lifelong learners. Physics majors are exposed to forefront research and receive a thorough grounding in a broad spectrum of physics, including modern interdisciplinary approaches, on their way to becoming skilled and knowledgeable scientists.

It is our utmost concern to advance this endeavor. In particular, our most critical areas of focus are (1) recruitment and retention, (2) curriculum, including courses and advising, (3) supporting resources and research opportunities, and (4) learning climate especially with regard to diversity and ethics in academics. For all of the goals listed below, suitable surveys of the students themselves will always serve as an additional metric.

Goal 1: Improve the overall quality of the physics undergraduate program.

Strategies

- Complete the implementation of the new undergraduate curriculum that was approved in May 2008.
- Continue to develop advanced specialty courses accessible to undergraduates.
- Provide undergraduate students with information on the numerous career options during their years in the program and follow-up with them in later years. We will accomplish this by improving the quality of academic advising and career counseling, by providing student-alumni contact as a means of developing their future career interests, and by implementing a more formal student-to-student mentoring program.
- Increase the undergraduate student involvement in research in the department. We will accomplish this by exposing and incorporating more students in the ongoing research in the Department. We will also work to obtain more funding to expand and supplement existing undergraduate research programs such as the Gianni Ascarelli Student Award. Stronger, more inclusive undergraduate research programs will enable the Department to recruit new students with the potential for high achievement in science.
- Increase the physics undergraduate student retention rate by developing new courses and academic support programs for students. These opportunities will target students as early as possible in their academic career. In addition, we will monitor the reasons students give for leaving the physics undergraduate program and address any trends as necessary.

Metrics

- Number of courses undergoing modernization.
- Number of new specialty courses developed.
- Frequency of advising contact with students made by academic advisor, faculty, and student mentors.
- Quality and variety of career paths taken by our graduates.
- Funds raised for undergraduate research awards.
- Number of awards made per year.
- Publications and presentations arising from undergraduate research.
- Retention rate of undergraduate physics majors.
- Number of students participating in academic support programs.

Graduate Program

The Department aspires to attract and retain top graduate students and provide them with an education in physics that has both breadth and depth. We strive to expose our graduate students to the excitement of original research at the forefront of science in a wide variety of physics sub-disciplines and interdisciplinary areas with physics components. We strive to transform our graduate students into first-rate scientists who have originality and expertise in areas relevant to today's world and who are life-long learners in constantly changing fields of science. The Department aims to accomplish these goals in a timely manner.

Goal 2: Improve the quality of the Physics graduate program.

Strategies

- We will emphasize graduate student recruiting by developing relationships with minority institutions (e.g., HBCUs) to encourage their students to attend Purdue, and by increasing faculty involvement in the recruiting process.
- The Department will strive to increase the number and value of graduate student fellowships and secure more funding for Research Assistantships (RAs). Fellowships will be increased through private donations and a greater awareness of corporate, foundation, and government opportunities. The number of RAs will increase as a matter of course as we work toward our goal of doubling external research funding (Discovery Goal 2). The consequence of these additional resources for graduate students will be a larger pool of applicants and presumably a greater acceptance rate of offers by prospective students.
- Improve graduate student success rate and reduce time to degree completion. We will accomplish this by providing opportunities to assist students in preparing for the Department Qualifying Examination. We will also implement a more formal student-to-student mentor program to assist students in navigating Department procedures and quality of life issues that all graduate students face.
- Provide a broader selection of advanced graduate courses. We will leverage expanded faculty numbers (Discovery Goal 1) to enhance our ability to develop new specialty courses. We will provide resources for curriculum development such as administrative support, short-term teaching release, etc.
- Professional masters programs are rapidly becoming popular as alternative career paths for post-baccalaureate studies. Thus, the department will explore the demand and requirements for creating a professional physics master's degree that specifically trains students in necessary professional skills including communication, project management, and commercialization.

Metrics

- Average GRE scores and undergraduate GPA of incoming graduate students.
- Number and quality of incoming underrepresented minority or female graduate students.
- Number of RA positions or fellowships awarded to new graduate students.
- Student enrollments in Qualifying Examination preparation offerings.

- Passing rate of the Qualifying Examination.
- Mean and median lengths to a Ph.D. degree.
- Rate of those leaving without a degree.
- Number of fellowships awarded to incoming and continuing graduate students.
- Average compensation from a fellowship.
- Number and areas of specialty graduate courses.
- Enrollment in specialty graduate courses.

Service Courses

The Department teaches in excess of 6,000 non-physics majors each year. Our overall goal in teaching these students is to share with them the excitement of doing science and enable them to gain the aptitude to understand and appreciate the physical universe.

Goal 3: Improve the content and delivery of undergraduate service courses.

Strategies

- Continue to develop and implement innovative approaches to service course operations and continue to refine and improve all service course curricula, including the use of technology.
- We will improve the delivery of service course content through enhanced training of graduate teaching staff and by assigning our best large-lecture instructors to service courses. Training for graduate students is available through courses such as PHYS 605, Pedagogical Methods for Physics Graduate Students, and through campus-wide facilities such as the Center for Instructional Excellence.
- The Department will increase student success rates in service courses by enhancing support mechanisms such as help centers and other settings. We will accomplish this by more closely coupling outside the classroom programs (i.e., help centers and supplementary instruction) with formal in-class curricula and providing the best available teaching staff in these settings. In addition, we will establish feedback mechanisms with our client Departments and Colleges to ensure their students are learning the physics necessary for them to excel in their chosen major.

Metrics

- Percentage of students receiving C-minus or better (D/F/W rate).
- Pre- and post-instruction testing of students using established assessment instruments.
- Number of teaching staff available in help centers.
- Number of hours the help center is available.
- Usage of the help center and other supplementary instruction by students.
- Number of graduate student participants in training programs.

Goal 4: Enhance and promote a diverse learning environment within the Department.

The Department is committed to creating a dynamic learning environment that promotes success among students of all backgrounds. Implicit in this commitment is the recognition of the role cultural, gender, socio-economic, and ideological diversity plays in the experience of students, faculty, and staff. Awareness of diversity issues can only enhance our ability to recruit top quality undergraduate and graduate students as physics majors and to ensure the success of all Purdue University students who enroll in our courses.

Strategies

- Enhance and support the diversity within the Department. We will accomplish this by expanding our Women in Physics program and supporting other groups such as the National Society of Black Physicists, National Society of Hispanic Physicists, and Society for Advancement of Chicanos/Latinos and Native Americans in Science. In addition, we will increase the number of physicists from underrepresented groups who visit our department as colloquium speakers. We anticipate that efforts such as these will increase our recruitment and retention of underrepresented groups in physics and improve the overall quality of life in the Department.
- We will improve the quality and diversity of physics major recruits by enhancing relationships with area and state high schools to increase enrollment of Indiana students. We will work closely with the College of Science undergraduate recruiting coordinator to identify students with the potential to excel as physics majors. The Department will also implement an Advance Physics Course program for high achieving students in Indiana high schools.

Metrics

- Retention rate of minorities and women.
- Participation in the Women in Physics (WIP) program and the Women in Science Program (WISP).
- Number of seminars and visits by minority and women scientists.
- Number of minorities and women among physics majors.
- Number of seminars and other events targeted in part for diversity.
- Graduation rate of minority and women physics majors.

Engagement

The Physics Department will engage diverse populations of learners by developing innovative education initiatives and services and by actively engaging our alumni, friends, and the state of Indiana in mutually beneficial relationships related to 4 main areas:

1) Teacher professional development;

As noted in the 2007 National Academy of Sciences report, Rising Above the Gathering Storm, improvements in K-12 science teaching have an enormous amplifying effect. Over the last 5 years the Department has made a significant effort to impact Indiana K-12 science teachers. Examples of successful programs include Quarknet (supported by NSF and DOE), Research Experience for Teachers (NSF), Building Excellence in Science Teaching through Inquiry (INDOE), National Center for Learning and Teaching in Nanoscale Science and Engineering (NSF), and Focus on Science. The positive response to these efforts has established the Physics Department as a major resource for K-12 science teachers throughout Indiana.

2) Public demonstrations and shows;

The Physics Department's high national visibility results in large part from our public shows and demonstrations (e.g., Physics on the Road, Physics FunFest, Hands on Physics). These efforts have a broad impact that strengthens the general public opinion of science and physics and of Purdue and the Department of Physics. A high and positive visibility will aid in student recruitment and in the development efforts of the Department and the College of Science. Most importantly, public shows and demonstrations provide a starting point for more focused engagement efforts in K-12 education.

3) Entrepreneurial efforts;

New discoveries lead to applications of physics that address the critical challenges facing society. In many cases it is appropriate to encourage faculty, staff, and students to file patent applications and to create start-up companies for creating and protecting new intellectual properties (IP's). IP based in the Department raises the profile of the Department in the local, state and global business community and also provides additional revenue back to the Department and the inventor.

4) Alumni relations

Creating a strong alumni support network is essential for the Department to pursue the many of the priorities listed in this plan. Our alumni play a key role by providing leadership, guidance, and assistance in the intellectual and financial development of the Department.

Goal 1: Engage the Department within the University and with Indiana's K-12 science teachers to build a stronger pipeline of future scientists and scientifically literate citizens.

Strategies

- Maintain established sustained contact professional development programs and use lessons learned in their implementation to develop new programs.
- Improve connections with the College of Education, the Discovery Learning Center, and the Center for Research and Engagement in Science and Mathematics Education to strengthen the design, implementation, and assessment of professional development experiences.
- Coordinate an effort, in partnership with other constituents at Purdue and other state institutions, to develop an appropriate assessment instrument to measure the effectiveness of professional development.
- Target specific schools and districts in need of assistance to improve performance in the science portion of the Indiana Statewide Testing for Educational Progress-Plus test.
- Provide opportunities for pre-service teachers to participate in professional development programs and service learning.
- Work with the Registrar and University administration to allow course credit for professional development experiences through a simplified enrollment process and at a significantly reduced cost.
- Continue and promote service learning courses tied to research in professional development and K-12 science education.

Metrics

- Number of K-12 in-service and pre-service teachers participating in (or completing) professional development programs
- Number of faculty, staff, and graduate students involved in Engagement activities
- Total external funding
- Number of proposals and funded projects with a professional development component
- Number of BS in Physics with Specialization in Physics Teaching awarded
- Total number of credit hours awarded for professional development programs
- School- or district-wide ISTEP science scores for program participants
- Number of and enrollment in service learning courses

Goal 2: Promote public lectures and demonstrations to foster an interest in science among K-12 students and the general public.

Strategies

- Host periodic public lectures for general audiences on exciting developments in physics, including physics at the interface of other disciplines
- Perform science-oriented shows for large K-12 audiences and leverage the short-term impact to promote teacher professional development and direct classroom impact.
- Leverage improvements in the Department's course demonstration equipment to create an inventory of "dual-purpose" demonstration equipment that is appropriate to formal and informal educational and engagement activities.
- Develop web-based engagement efforts such as podcasts to promote a guided independent learning experience for a diverse community of learners.

Metrics

- Number of and attendance at public lectures
- Number of and attendance at K-12 schools visited
- Teachers at K-12 visits who later enroll in professional development programs
- Total funding for public lectures and demonstrations.

Goal 3: Create new intellectual properties (IP's) and start-up companies.

Strategies

- Encourage the creation of new intellectual properties, inventions, patents, and start-up companies. We will accomplish this through providing incentives to faculty, staff and students whose entrepreneurial success benefits the Department, Purdue University, and society. These incentives could include additional administrative support, appropriate teaching assignments, graduate student support, or other mechanisms.

Metrics

- Number of patent applications.
- Number of start-up companies created.
- Department income from intellectual property.

Goal 4: Develop and maintain a strong physics alumni network.

Physics alumni play a key role in the Department by providing leadership and counsel, and facilitating the acquisition of intellectual and financial resources. We rely on our alumni to provide advice and an outside perspective to faculty, staff, and students on a variety of topics including funding sources, student life, and departmental facilities. Alumni are also invaluable in their role as ambassadors for the Department among their professional associates and in their communities. We will therefore place particular emphasis on activities that cultivate our relationships with alumni.

Strategies

- Systematically track and maintain contact with our students after graduation.
- Establish social networking presence such as on Facebook or MySpace.
- Make alumni awards regularly and bring awardees to West Lafayette.

Metrics

- Number of alumni contacts, visits, and awards.
- Creation and usage of social networking sites.

Staff and Facilities

High quality instructional space, research laboratories, office space, and meeting areas are essential elements of a successful academic department. In terms of size, the Physics Building is large, and in principle could accommodate growth of educational and research programs. Unfortunately, renovation of these older buildings has lagged and much of the space is in need of updating. The heavily utilized and large classrooms (112 and 114) have not been updated for years. Our meeting areas are inadequate, laboratories are in need of updating, and we have a critical shortage of office space for graduate students, post-docs, and faculty. It is unfortunate that the Physics Building has not been periodically updated over the years; we are now in a situation where the capital expenditures needed to make this a modern facility are likely beyond the University's means in the near-term. One exception to this has been the instructional labs associated with PHYS 172 and PHYS 272. Experimentation with non-traditional teaching methods, in particular smaller instructional groups, requires flexible instructional laboratories. In recent years we have converted traditional instructional space into more flexible laboratories that serve for tutorials, recitations, or other small group learning activities. At the present time we can only accommodate PHYS 172 and PHYS 272 in this modernized setting. We do not have room to accommodate non-traditional teaching methods involving smaller groups for other freshman and sophomore courses, in particular the algebra-based physics courses. There is a daunting list of renovations that could be undertaken, however, we intend to focus our efforts in a few key areas for the next several years.

Goal 1: Continue to upgrade instructional laboratories.

Strategies

- We cannot hope to update all the instructional laboratories in the Physics Building over a short period of time. Priorities will be established by the Learning Strategies listed earlier in the plan. In instances where the lack of instructional laboratories is an impediment we will seek University Funding for capital improvements.

Metrics

- Amount of space renovated
- Funds directed toward instructional space renovation
- Usage of renovated space (credit hours, student enrollments, etc.)

Goal 2: Renovation to improve quality of research space.

Strategies

- As we grow we will need to commit new space to new faculty members. The lack of State of Indiana Renovation and Repair funds has negatively impacted the quality of our laboratories that new faculty are offered. The only means by which these older laboratories can be updated is with large "start-up" packages. While this strategy has the unfortunate inevitable side-effect of inflating the cost of hiring new faculty it is the only option we have available at this time. Consequently, the quality of research space in the Department is often cited as a factor in faculty retention matters.
- A critical need in the Physics Department is the renovation of existing space, that is to say, space that has been occupied by a research group for some years. To update these facilities we will aggressively pursue donor gifts. Last year the University offered a program for renovation of research space if the departments offered matching funds. The Physics Department was not in a position to capitalize on this opportunity. At the present time this is the only viable means (outside of start-up or retention funds) that research space can be modernized. We anticipate that the University will continue to allocate funds for renovation if matching department funds are available. We will endeavor to find donors to provide these funds. Our laboratory renovation needs range from modest projects, involving upgrading of utilities in single laboratories, to more expansive projects in which considerable new research space could be created from under-utilized space.

Metrics

- Amount of space renovated.
- External funds raised for renovation.

Goal 3: More efficient use of existing space through reallocation of space and other mechanisms.

Strategies

- As the faculty grows there in increased demand on laboratory space. The luxury we can no longer afford is under-utilized space. It is unfortunate that we have had little success in reallocating space that is highly underutilized in the Physics Department. To succeed we must be more flexible in our use of this space. While one option is for unilateral action, a more desirable option is to achieve a broad-based dynamic for the reallocation of laboratory space. Toward that goal we have established a faculty space committee. This committee will make recommendations to the head and the PAC regarding reallocation of space in the Physics Department.

Metrics

- Amount of research space used in externally funded projects

Goal 4: Explore utilization of interdisciplinary research space across the campus (e.g., Birck, Bindley, and newly planned buildings).

Strategies

- We will aggressively pursue collaborations with other research units, particularly those in Discovery Park. The availability of shared facilities in Discovery Park eliminates the need in some instances of Physics faculty establishing duplicate facilities within Physics.

Metrics

- Number of collaborations with Discovery Park Centers.
- Number of joint grants, research papers, and funds transferred across the Physics-Discovery Park boundary.

Goal 5: Optimize use of existing support staff and facilities through consolidation and partnering with other units on campus.

Strategies

- Historically, each Department in the College of Science has supported its own facilities (e.g., copy center, glass shop, machine shop, or electrical shop) needed to accomplish its goals. While in some instances significant facilities within departments could be wholly justified in other instances these facilities were underutilized. In the worst cases, Departments within the College could have under-utilized duplicated facilities. Our goal in the near-term is to work together with other Departments within the College and identify areas of common interest. In the near-term we will work with the Chemistry Department and review our facility needs, with the goal of pooling our resources to build facilities that serve multiple units.

Metrics

- Number of Physics Department facilities supported by funds from multiple Departments in the University.
- Amount of Physics Department general and research funds spent in campus support facilities outside of the Department.

Going Forward 2009-2014

During the period of the Physics Department's last strategic plan, faculty hiring was guided by target faculty sizes for the various research groups. Those target sizes were largely met, due mainly to an accurate estimate of the overall growth of the Department (which was, in turn, an integral part of the University and College Strategic plans). The outlook for faculty growth is now much less predictable, especially in light of current economic difficulties. This does not mean that we should abandon plans to grow as a Department – rather, it means that we must be more flexible in setting hiring goals. We will therefore form a faculty hiring committee to advise the Head on hiring priorities. This committee will be appointed by the Head, and composed of Senior faculty from all research groups. The hiring committee will be guided by goals in the Discovery section of this strategic plan. With input from the hiring committee, the Head will decide on hiring priorities spanning multiyear periods. These priorities will be reviewed each year and revised as necessary.

While the Head and hiring committee will thus set the hiring priorities, there are several immediate needs that must be addressed in the next few years. (1) Accelerator mass spectrometry (AMS). There is a need to add a faculty member whose research is connected with the PrimeLab AMS facility. This search was postponed in 2008 due to budget concerns at the College level, but should be continued in 2009. This position may, depending on the candidate, be a joint hire with the Department of Earth and Atmospheric Sciences. (2) High energy physics. The demographics of the experimental high energy physics group demands that we make at least one hire in this area in the next few years. This is a thriving group that will likely need further hiring during the course of this strategic plan. (3) Astro-particle physics. This is a new and emerging area of physics, and we are well-positioned to build a strong effort in this area, based on our present astrophysics and high energy groups. (4) Biophysics. This is another important and relatively new group for our department, to which we should add at least one more faculty member, probably in the later years of this plan. (5) Physics education. This is an increasingly active research area in the department, which has benefited greatly by a joint hire with the College of Education. Assuming the College of Education is agreeable, we will aim to add at least one more faculty member in science education with a joint appointment in the College of Education.

The new hires described here would be part of an aggressive hiring plan during the coming years, with additional hires in areas of opportunity identified by the hiring committee and the Head. The number of new hires will, of course, be determined ultimately by priorities of the higher administration. The quality of our recent faculty hires has been excellent, and this quest for excellence in research will continue to guide our hiring choices. However, overall faculty size is also crucial. Comparisons with peer departments suggest that an approximately 10% increase in faculty size (a growth by five FTE) is needed to bring us in line with our peers, and that is one of our goals in this strategic plan.

Appendix A: List of all the faculty and staff who were on our strategic plan working groups.

1. **Discovery** (faculty hiring / research)
   - Bortoletto, Nolte, Ritchie, Wang, Giuliani, Giordano, Cui, Khlebnikov, Shipsey, Koltick

2. **Learning** (academic affairs, undergraduate and graduate programs)
   - Nakanishi, Haugan, Finley, Clark, Love, Carlson, Ramdas, Savikhin

3. **Staff and Facilities**
   - Caffee, Lister, Neumeister, Pyrak-Nolte, Rokhinson

4. **Engagement** (outreach and external relations)
   - Fishbach, Jones, Durbin, Hirsch, Bryan, Miller, Giordano
   - Conlon, Yeazell