

## CRITERION 8. INSTITUTIONAL SUPPORT

### A. Leadership

*Describe the leadership of the program and discuss its adequacy to ensure the quality and continuity of the program and how the leadership is involved in decisions that affect the program.*

The Bachelor of Science in Engineering Physics (EP) is offered jointly by the Department of Physics in the College of Arts and Sciences and the Departments of Chemical and Materials Engineering, Electrical and Computer Engineering, and Mechanical and Aerospace Engineering in the College of Engineering. Degrees are awarded by the College of Engineering, but EP students have their academic home in the Department of Physics. This organizational structure is similar to University of Colorado at Boulder, with the difference that the UC Boulder EP program is not seeking ABET accreditation.

This highly interdisciplinary degree has been approved by the NMSU Board of Regents and is supported by the central administration, which is very supportive of interdisciplinary programs and faculty engagement across departmental and college boundaries. Both colleges support the program and provide leadership and advice, for example through interactions with the external Engineering Physics External Advisory Board (EPEAB), with the Physics Department Head, and through the Engineering Physics Program Committee (described later).

At the departmental level, leadership of the BS in EP program is shared between the Physics Department Head (Dr. Stefan Zollner), the EP Program Head (Dr. Heinz Nakotte), and the EP Program Committee (Dr. Nakotte, Dr. Hearn, Dr. Pate, Dr. De Antonio, Dr. Vasiliev, Dr. Luo, Dr. Stochaj, Dr. Park). If the Department Head goes on sabbatical (probably during the 2018/19 academic year), the Dean of Arts and Sciences will appoint an interim department head (probably Dr. Nakotte). A similar temporary replacement will be made if the EP Program Head goes on sabbatical (probably in the 2019/20 academic year).

The Department Head attends all department head meetings (and similar events) in the College of Arts and Sciences and as many as possible in the College of Engineering. If engineering meetings conflict with his teaching schedule, the EP program head will attend on his behalf. When the Department Head is absent from campus, he appoints an acting department head. In cases of scheduling conflicts between both colleges, he is represented by the EP program head or a member of the EP Committee. This arrangement allows complete tie-in of the Department of Physics and the EP program in both colleges. The role of the academic department head is described in the NMSU Administrative Rules and Procedures, especially Section 6.72. The Physics Department Head serves at the discretion of the Dean of the College of Arts and Sciences, with the concurrence of the executive vice president and provost. The Physics Department Head is evaluated annually by the Dean of the College of Arts and Sciences, with a more detailed 360 degree review every three to five years. Items most relevant to the leadership of the EP program are described below.

Responsibilities of the Physics Department Head include the following: academic leadership in teaching, research, and outreach; departmental collegiality; managing the budget, meeting reporting requirements to the institution and both colleges; scheduling of courses to meet the requirements of students enrolled in undergraduate and graduate programs; recruiting of

undergraduate students and helping them get ready for their first semester; analysis of transfer credits from previous institutions; performance management of all staff, faculty, and teaching assistants in the Department of Physics (including mentoring and retention), assessment of the physics undergraduate and graduate programs in the College of Arts and Sciences, external representation of the department (college- and institution-wide, national societies, constituents, national laboratories, local industry, government agencies, alumni, donors, prospective students and their parents), ruling on academic and personnel appeals and grievances, assisting and advising of students, staff, and faculty in compliance with NMSU policies and procedures. The Department Head also performs all exit interviews with EP students and reports his findings to the EP Program Committee. He also seeks contact with program alumni.

Responsibilities of the EP Program Head include the following: assessment and accreditation of the EP program, coordination of EP student advising, leadership for the EP committee, representing the Physics Department Head when needed, recruiting and retention of EP students, new student registration in the College of Engineering.

The EP Committee is appointed by the Physics Department Head in consultation with the EP Program Head, the department heads of the participating engineering departments, and the Associate Dean for Academics in the College of Engineering. This committee is chaired by the EP Program Head. The Physics Department Head and the Associate Dean for Academics in the College of Engineering are *ex officio* members. The EP Committee has responsibility for the definition of the EP curricula and its concentrations. Its members assist with EP student advising (including degree checks and course substitutions), assessment and accreditation (continuous improvement of educational programs, courses, laboratory and computational facilities), recruiting, and retention. They update the advising documents, the EP degree pages in the catalog, the course descriptions, and the EP web pages. They also provide advice to other faculty in physics and in the participating engineering departments on their deliverables to the program (especially related to assessment of teaching effectiveness) and act as role models for other faculty.

The EP Program Committee works closely with other committees in the Department of Physics, especially the Curriculum Committee (chaired by Dr. Vasiliev), the Undergraduate Recruiting and Retention Committee (chaired by the Undergraduate Physics Program Head, Dr. Matthias Burkardt), the Computer Committee (chaired by Dr. Vasiliev), and the Laboratory Committee (chaired by Dr. Pate).

All departmental committees regularly update the entire physics faculty at departmental faculty meetings, which are held at least once a month. Special physics faculty meetings are held for important topics as needed, for example to review the Department's Promotion and Tenure and other governance documents, to discuss candidates interviewed for an open faculty position, to discuss continuous improvement of outcomes and objectives of educational programs, to plan the strategy of the department for future directions, to decide on committee assignments, or to review the progress of undergraduate and graduate students towards degree completion. Each semester, a few days before the first day of classes, a half-day department meeting is held to allow more in-depth discussion. For example, in the spring of 2018 there was a long discussion if the department should seek ABET accreditation through the ANSAC commission for its BS in Physics program.

Important strategic decisions are made collegially by the physics faculty and reported to the College of Arts and Sciences (or Engineering) by the Physics Department Head. Tactical and operational details are decided by the Department Head following established university, college, and departmental procedures, usually after consulting the relevant committee chair.

To improve the governance of the Department of Physics, the faculty meet once a year without the department head (for example as part of a retreat before the semester) to discuss their satisfaction with departmental governance. The purpose of this meeting is to communicate to the Department Head, which decisions should be made by the Department Head, by faculty committees, or by the entire faculty. The faculty will provide feedback on decisions made over the past year and guidance for the following year. At this meeting, the faculty members also review which committees the department should form, what their duties should be, and they propose which faculty members should serve on various departmental, college, and university committees.

This leadership model is complicated, but also adequate for the needs of the program. Since EP is highly interdisciplinary, our model ensures that members of all relevant disciplines contribute to the leadership of the program. On the other hand, there is also a clear chain of command: Issues related to courses are determined by the course department head and course dean. Issues related to EP students and degrees are determined by the Physics Department Head (who acts as a department head in the College of Engineering for the purposes of the EP program) and the Office of the Dean of Engineering. The EP Program Head often acts for the Physics Department Head, in case the latter has conflicting responsibilities in both colleges.

## **B. Program Budget and Financial Support**

*Describe the process used to establish the program's budget and provide evidence of continuity of institutional support for the program. Include the sources of financial support including both permanent (recurring) and temporary (one-time) funds.*

NMSU prepares annual budgets for current fund expenditures from unrestricted and restricted revenue sources. The annual cycle begins in November and coincides with the New Mexico

Higher Education Department (NMHED) submission of the higher education funding recommendation to the state legislature. Funding priorities are established through a review of mandated requirements and strategic investments. The budgets are presented to the Board of Regents (BOR) for approval, prior to submission to state authorities.

The budgeting process starts with developing campus budget guidelines that identify sources and uses; priorities are identified through a collaborative and iterative process that begins with upper administration and expands to include the university budget office, deans, and the broader campus community. Feedback from all participants is used to further vet institutional priorities, which are then provided to the University Budget Committee (UBC) and the administration for consideration. The Regents Financial Strategies, Performance and Budget Committee (RFSPBC) participates through regularly scheduled meetings. While state funding for the budget year is determined, the list of priority investments is aligned to match available resources including tuition and fee adjustments.

The RFSPBC votes (regents abstaining) on proposed guidelines (which include tuition and fees) before they are presented to the full BOR for approval, usually in April. The BOR has final authority to approve budget guidelines, which are used to create the campus operating budget. Budgets are due to the NMHED by May 1st and may be 'pending' final approval (no later than May 19) by the BOR. NMHED has one month to review and submit budgets to the NM Department of Finance and Administration (DFA). The DFA has one month to review and send approvals to institutions by July 1, the beginning of the fiscal year. Budget office staff continuously monitors current year financial performance against the approved budget, and a Fiscal Watch certification is submitted quarterly to the NMHED. Modifications to the approved budget are allowed throughout the year, using the Budget Adjustment Request (BAR) process. The BAR must pass through the BOR prior to NMHED submission.

NMSU's internal financial monitoring process includes a monthly review of budget exhibit fund balances and a comparison of current budget to actuals for revenue, expense and transfers on an aggregated basis for each established budget reporting unit. Colleges and departments are permitted to carry forward a percentage of unused funds from one fiscal year to the next, which provides a source of one-time funding to be used at the discretion of the College Dean or Vice President. If needed, individual units may be placed under fiscal watch for close monitoring, which includes periodic meetings between unit administrators, the Senior Vice President for Administration and Finance, and budget office staff to discuss budget status and other fiscal issues.

NMSU'S budgeted resources support the Institution's educational, research and service mission. In addition, NMSU has a strategic planning process that further aligns available resources with institutional priorities, expressed in five goals and operationalized through objectives and key performance indicators (KPIs). NMSU tracks use of centrally allocated resources to strategic goals, as does each college and major operational area.

In December of 2016, the BOR approved Six Pillars of Vision 2020, and eight key metrics associated with these pillars as a special focus of NMSU with regard to planning and budgeting. New investments in the 2018 budget are closely aligned with these pillars.

In 2013 NMSU introduced President's Performance Funding for short-term projects with potential for positive impact. Through a competitive application and hearing process, in January of 2014 the University Budget Committee (UBC) awarded \$750,000 to finance 19 independent

projects that supported various Vision 2020 objectives. Funding was renewed each year (for up to three years) based on milestone achievements. Current fiscal conditions prevent funding of additional projects, but all initiatives that met performance criteria were financed throughout the three years for which the initial award was intended. One of these funded projects was the Peer Learning Assistant (PLA) program, which provided undergraduate student peer mentors as PLAs for many undergraduate (especially STEM) courses. Embedding peer mentors in courses was very successful, but funding for the PLA program was not extended after the end of the three-year cycle and replacement funds could not be found.

NMSU engages in continuous processes to evaluate and improve operations at many levels. Such processes inform fiscal decisions and institutional planning. Examples include the Mercer and Deloitte studies, sustainability improvements and technology enhancements. Intensive efforts are also recognized through NMSU's Transforming exercises, which by Summer 2017 have resulted in real cost-savings to the university of \$2.7 million, with an overall estimated project cost-savings of \$9.7 million. The more recently developed Team 6 is focused on optimizing NMSU's academic structure to encourage collaboration and reduce administrative costs.

Other planning, budgeting and funding tied to assessment of student learning occurs at a more granular level. Colleges and departments may align resource allocation to student learning assessment outcomes. For example, in Fall 2014 the Engineering College revamped the core course for incoming engineering majors, ENGR 100. It is now paired with the freshman composition course (ENGL 111G), and in addition to regular assignments, special engineering design challenge assignments and multiple writing assignments are incorporated into the ENGL 111G class. Not only has fall-to-fall retention improved (from 62% prior to the intervention to an average of 76.8% over the last three years), it appears to be affecting greater retention of engineering students beyond the freshman to sophomore year.

Instructional funding such as faculty lines may be reallocated within the college at the discretion of the Dean with the approval of the Executive Vice President and Provost. Additionally, the Dean determines the new funding priorities for the College and presents the request to the Provost for consideration. The Provost may reallocate instructional funding among the Colleges or allocate any new funding in consultation with the Deans, Chancellor, and/or Administration and Finance.

The recurring total budget of the NMSU Department of Physics for the 2017/18 fiscal year (July 1st to June 30th) has four components, as listed below. The Department of Physics has six degree options, including BS and BA in Physics, BS in EP, MS in Physics, Ph.D. in Physics, and MS in Physics with a concentration in Space Physics. Expenditures towards these different degrees are not budgeted separately. The Department of Physics also teaches general education courses for about 1400 NMSU students each year.

The budget of the Department of Physics has been very stable (almost flat) for the past decade, indicating strong continuous institutional support considering the difficult financial situation of the university as a whole. Perhaps the institutional commitment to the Department reflects the fact that our student credit hour production has been stable and that our undergraduate headcount has grown significantly since 2010, while the same figures of merit have shrunk for the rest of the university. The biggest budgetary changes over the last six years are an increase in faculty salaries (to bring salaries of full professor to 90% of market salaries determined during a Mercer study) and an increase in teaching assistant stipends (since the cost of some benefits, especially

health insurance, had to be cut due to new IRS regulations and were instead paid out as increased graduate assistant stipends). Similarly, the decrease in our operational funds is due to an accounting change, where the cost of phone lines and internet connections was moved from the departmental budget to a central account. There was no significant decrease in our operational funds since 2011/12. Staff salaries are lower in the 2017/18 budget, because one staff line (administrative vacant) has been held vacant to reduce expenses. It is expected that this staff line will be filled in the spring 2018.

Students in the EP program take core courses in physics and in one engineering discipline. Usually, these courses have low enrollment and therefore no additional instructional expenses are needed to offer the EP program. The biggest budget item for EP is the cost of administration as a separate degree program. There is considerable synergy between the physics and EP programs. Only in this combination can a sufficient number of students be reached to offer upper-division physics courses. (10 or more students are usually needed to offer an undergraduate course.) Many EP students also indicate a stronger affinity with physics than with engineering. Therefore, these two degree programs should be housed in the same academic department. Since NMSU is a small institution, the two programs would not be viable as separate programs. (At Cornell University, a much larger institution, Physics and Engineering and Applied Physics are housed in two separate departments.)

#### **Recurring budget items in the Department of Physics:**

- The Instructional and General (I&G) budget, which consists of State of New Mexico funds, is currently at 1.70 M\$ per year (up from 1.59 M\$ in the 2011/12 fiscal year). The items in this budget contain the salaries of the Department Head and staff (213 k\$, down from 229 k\$ in 2011/12 because of an open staff line), the faculty salaries (1087 k\$, up from 985 k\$ due to pay raises), the graduate teaching assistant salary pools (337 k\$, up from 262 k\$ because of a benefits accounting change), and departmental operational funds (65 k\$, down from 80 k\$ in the the 2011/12 fiscal year due to an accounting change).
- Physics faculty members conduct research funded by external agencies (NSF, DoE, Army, Air Force, NASA, etc.) with annual expenditures of approximately 1.7 M\$, about 140 k\$ per tenured/tenure-track faculty member. These research funds mostly support the research and graduate education mission of the Department. In addition, some of these grants also support undergraduate research, which provide extracurricular learning opportunities for physics and EP undergraduate students. Some grants can be used to purchase equipment, which is available for both research and instructional laboratory use. The undergraduate research funds are supplemented with small grants and scholarships from the New Mexico Space Grant Consortium, the Louis Stokes Alliance for Minority Participation, the NMSU Vice President for Research, and the Colleges of Engineering and Arts and Sciences.
- A portion of the Facilities and Administration (F&A) costs charged to external research grants by the University is returned to the Department. After subtracting the departmental portion of startup commitments and cost share, the department received about 12 k\$ in 2016/17. This amount is unusually low because five recent tenure-track faculty hires lead to a large F&A subtraction for the department's F&A share. This portion of the budget is used to pay a graduate assistant to provide IT support for the department. It also pays for

other minor indirect costs, such as automobile insurance or relocation expenses for new hires.

- Finally, the Department of Physics receives about 90 k\$ per year in earnings from NMSU Foundation endowed accounts (totaling about 2.5 M\$). These funds are used to pay undergraduate student scholarships (scholarships of USD 500 to 3000 for about 20-30 students, totaling 55 k\$), hosting physics colloquium speakers, meal and entertainment expenses of candidates interviewing for faculty positions, banquets or picnics for students, faculty, and staff at the end of each semester, named research professorships (Gardiner Professorship), and summer research support for graduate students. A very generous alumnus (career NASA scientist) has donated nearly one million dollars over the past six years to establish a significant scholarship fund for undergraduate students. This donation, along with others solicited by a departmental newsletter and institutional and college-wide appeals, has significantly enhanced the departmental scholarships paid out each year. Since EP is a relatively new program, there is no endowment yet for scholarships in EP, only a very small current use fund. Deserving students in this program must often rely on engineering- or NMSU-wide scholarships or those funded with unrestricted gift funds, since no departmental scholarships are available to students in this program. Dr. Nakotte serves on the College of Engineering scholarship committee and thus can advocate for scholarships to be awarded to students in our program.

The Department of Physics I&G budget is established annually by the institution through the College of Arts and Sciences. Despite recent cuts in state support for the institution and changes in institutional priorities through reallocation of faculty and graduate teaching assistantship lines, the total I&G funds in the Department of Physics have grown by about 7% since 2011/12. See TABLE 8.1 for details. Despite overall budget pressures, the institution has continually supported the Department of Physics, for example by renovating Gardiner Hall, which houses the Department of Physics and the Geological Sciences Department, by hiring a new Academic Department Head, replacing the Administrative Assistant, providing additional funds for two College Professors (teaching faculty), promoting faculty to the next rank, supporting sabbaticals, and by approving a five new junior tenure-track faculty hire since 2011/12. Our undergraduate programs in physics and EP compare favorably in quality, enrollment, and graduation rates with others in the Rio Grande Valley (University of Texas at Brownsville, University of Texas – Pan American, University of Texas at El Paso, New Mexico Institute of Mining and Technology) or in rural West Texas (Texas Tech University, Texas A&M Kingsville, Angelo State University, West Texas A&M University, Abilene Christian University, McMurry University).

**Table 8.1.** Selected annual budget figures of the Department of Physics over the past decade. Estimates are indicated, where precise figures were not available.

Category	FY 01/02	FY 05/06	FY 08/09	FY 10/11	FY 11/12	FY 17/18
<b>Operational Funds</b>	76,270	76,270	80,379	80,649	80,649	65,484
<b>Faculty Salaries</b>	992,947	1,088,768	1,051,328	983,859	985,159	1,087,331
<b>Staff Salaries</b>	~250,000	~250,000	268,566	233,345	229,067	213,741
<b>Teaching Assistants</b>	242,607	265,728	297,401	262,413	262,413	337,485
<b>F&amp;A Return</b>	30,499	20,000	~15,000	~15,000	~15,000	
<b>Endowments</b>	~60,000	~60,000	~60,000	~60,000	~60,000	

Research expenditures and F&A returned to the department vary with the success of physics faculty in obtaining external research support and with the portion collected by the Arts and Sciences Research Center for commitments (faculty start-up or mandatory cost-share). The share returned to the Department of Physics was reduced from 24.5% to 16% in the 2004/05 fiscal year. Earnings from Foundation accounts are based on the 1.5 M\$ principal and can vary with the annual return on investments distributed by the Foundation.

In addition to these recurring funds, one-time funds are distributed to the Department of Physics by the institution and by the College of Arts and Sciences.

- The College of Arts & Sciences and the central administration (through enrollment management) provide funds for temporary instructors (including graduate teaching assistants) during the fall and spring semester and over the summer. Salary savings from faculty on one-year sabbaticals, on leave, or from research course buy-outs or joint faculty appointments with federal laboratories are returned to the College of Arts and Sciences. In the 2017/18 fiscal year, the Department of Physics returned 91 k\$ to the College of Arts & Sciences as salary savings and received 82 k\$ from the College for temporary instructors.
- Each spring, there is a call from the Associate Dean for Academics in Engineering for requests to distribute Student Fees. These funds can be used for equipment, software, maintenance, and supplies. Requests are routed from the Department of Physics through the College of Engineering to a committee of engineering students. Typical allocations to the Department of Physics have been around USD 15,000 per year recently.
- The physics faculty voted not to request approval for additional enrollment-based course fees for our physics laboratory from the central administration, to avoid additional financial burdens for our NMSU students. It seems more prudent to use an engineering-wide fee to pay for technology expenses rather than introducing specific course fees.

Recurring and one-time funds in the College of Engineering are used to pay the salaries of faculty and staff to teach courses in electrical, chemical, mechanical, and aerospace engineering. Similarly, College of Engineering facilities and supplies are used for these courses. College of Engineering faculty members also have had the primary responsibility to teach capstone design courses. With the introduction of an engineering-wide capstone program, capstone design courses in physics may become more common. The College of Engineering also supports EP ambassadors and recruiting and retention of EP students as well as student travel and awards.

*Describe how teaching is supported by the institution in terms of graders, teaching assistants, teaching workshops, etc.*

The University invests approximately \$10M annually in Graduate Assistantships for instructional support purposes in the classroom or lab setting to include graders and teaching assistants.

NMSU's Teaching Academy (<https://teaching.nmsu.edu/>) provides professional development to NMSU educators. While a variety of programming is provided, the recurring programs include:

- Teaching: evidence-based instructional practices, team-based learning, peer coaching, and classroom observations.
- Leadership: advancing leaders, department head academy, crucial conversation, and strengths finder training.



- Mentoring: team mentoring for faculty, one-on-one faculty mentoring, getting the edge in Academe.
- Scholarship: publish and flourish, writing groups, scholarly writing retreat.
- Career: promotion and tenure programs, new faculty orientation.

NMSU's Instructional Innovation and Quality (<https://instruction.nmsu.edu/>) provides support to faculty in delivering education via the non-traditional formats of ITV, blended, and online. This group provides faculty with in-depth professional development and training for best practices in online learning and course consultations ensures quality in blended and online course design, and workshops and consulting on how to effectively utilize the University's Learning Management System (CANVAS).

The Department of Physics had I&G funds of about 337 k\$ for 17.3 half-time equivalent Graduate Teaching Assistants in the 2017/18 fiscal year (fall and spring). Additional teaching assistants are hired from F&A return or one-time funds from the Provost, the Dean of Arts and Sciences, or the Graduate School, bring the total number of teaching assistants during the 2017/18 fiscal year to 19.3. Most of these teaching assistants are assigned to teach two or three general-education laboratory sections. Each semester, the Department of Physics teaches laboratory sections for about 650 students. Each teaching assistant also works in the physics tutoring center for about 2-3 hours per week to assist students with their general-education physics homework. All international students assigned as laboratory instructors have passed the International Teaching Assistant (ITA) screening administered by the Office of the Associate Provost of International and Border Programs. (Students who fail the ITA screening must successfully complete a semester-long 3-credit communication course before they can teach a lab section. To encourage quick academic progress, such students have to enroll in three physics courses and the communication course for a total of 12 credits. The Department of Physics pays 50% of the tuition for the communication course upon successful completion.) These graduate laboratory instructors are trained by the Department of Physics in an orientation session at the beginning of the semester. (The responsibility for hosting this session rests with the Graduate Physics Program Head, Dr. Papavassiliou). Day-to-day supervision for the lab TAs is provided by the Physics lab coordinator, Mr. Carreto-Parra, and by the faculty instructor of record.

International teaching assistants who failed the International TA screening exam (and must be enrolled in the communication course) are usually assigned as graders. Each TA has responsibility to grade for two or three courses, depending on enrollment and workload. In the spring of 2018, 2.5 half-time equivalent graders provided instructional grading support for a total of 8 courses. Since there are not enough graders for all undergraduate courses, some instructors are required to use an online homework system (usually Mastering Physics) in their large lower-division general-education courses.

The Department of Physics also hires undergraduate physics and EP students as learning assistants. They staff our tutoring room and assist with supplemental instruction in the lower-division courses for our physics majors. Sometimes, they also assist with the modern physics laboratory (PHYS 315L) or help to setup laboratory experiments for Mr. Carreto-Parra.

In the summer, general-education courses (PHYS 211G, 212G, and 215G) are usually taught by experienced graduate teaching assistants as lecturers. About four to six first-year graduate students are also hired each summer as laboratory teaching assistants. One of the more

demanding summer courses, PHYS 216G, has been taught by a faculty member (Dr. De Antonio or Dr. Nakotte) in recent years.

The institution supports good teaching and the enhancement of instructional skills through a number of on-campus programs, most importantly the Teaching Academy. Tenure-system faculty, College (teaching) faculty, and graduate assistants are all eligible to participate in Teaching Academy workshops free of charge to improve their instructional skills. Many physics faculty participate in Teaching Academy events each year. The College of Arts and Sciences and the College of Engineering encourage their faculty to participate in relevant Teaching Academy events. At least once or twice a year, the Department of Physics also invites established Physics Education Researchers as colloquium speakers to be informed about the latest trends in physics teaching.

Over the last six years, several changes were made to improve the support of teaching assistants and their engagement in the classroom:

- A new permanent instructional lab manager (Mr. Francisco-Parra, MS in Physics from UTEP) was hired. This position was upgraded to require an MS degree. A lab manager with a graduate degree can better relate to the graduate teaching assistants in the department. The new lab manager has excellent experimental and practical skills and has
- Sometimes, a first-year teaching assistant is paired with an experienced TA in one lab, allowing the new TA to learn by observing the senior TA.
- Responsibility for the lower-division instructional labs has moved from lab manager to a faculty member as instructor of record. This faculty member will teach one lab section, to be more involved and understand how the labs contribute to student learning in EP. This faculty member is expected to make improvements to at least one laboratory experiment each semester. (For example, new labs on projectile motion and oscilloscope operation were added recently.) The faculty member also chairs the weekly TA meetings on Friday afternoon to prepare for labs during the following week.
- The Department Head now teaches the first-year labs for physics and EP majors (together with a teaching assistant). This allows more one-on-one mentoring of the new students in a semi-formal environment.
- To address some severe cases of cheating, all TAs were trained on how to avoid cheating in instructional lab final exams and how to address cases of academic and non-academic dishonesty. Syllabi were revised to support TAs in their enforcement of academic integrity and classroom management.

*To the extent not described above, describe how resources are provided to acquire, maintain, and upgrade the infrastructures, facilities, and equipment used in the program.*

In addition to the overall budget process listed above, NMSU has various processes in place to provide one-time resources for infrastructure, facilities and equipment. One method, as part of the state appropriations funding, NMSU sets aside funds for Building Renewal & Replacement (BRR) and Equipment Renewal & Replacement (ERR). There is an established process used to consider outstanding requests and allocate funds on a prioritized basis, which is routed for review and approval through the University Budget Committee, the university administration, and the Regents Financial Strategies, Performance and Budget Committee. Available equipment

funds (from state appropriations, central funding, and student fee funding) are reviewed and allocated on an annual basis based upon requests from the colleges and departments, which are reviewed and recommended by the University Budget Committee and subsequently approved by the Chancellor. Additionally, available equipment funds are provided annually to colleges and departments based upon an allocation calculation taking into account existing equipment inventory at year end. Besides the routine processes that are in place as described, there are also opportunities for colleges and departments to submit proposals to the university administration for off-cycle funding requests. These requests are evaluated and considered in conjunction with a review of potential funding sources.

In recent years, the Department of Physics and the EP programs have not received BRR and ERR allocations or funds from the other sources mentioned in the preceding paragraph. Given the difficult budget situation, funds to acquire, maintain, and upgrade equipment used by the program must be paid by departmental operations funds, earnings from Foundation endowments, or from student fees, especially the Engineering Technology Fee charged to all students in the College of Engineering.

A two-year renovation of Gardiner Hall (home of the Department of Physics and the Geological Sciences Department) was concluded in the summer of 2010. This renovation included new furniture for faculty offices, classrooms, and student lounges. All classrooms were equipped with a computer, a ceiling-mounted projector, blackboards or white boards, a document camera, a DVD and VCR combo player, and a stereo sound system (standard NMSU smart-room design). One classroom was designed for studio-style and peer-instruction learning based on the latest results from physics education research. This PER classroom is used for supplemental instruction in lower-division courses. Each faculty and staff member received a new computer and printer. The classroom technology components were updated again more recently (around 2015) with high-definition projectors and computers. The key card entry system was replaced in 2017.

EP students have access to the building during evening and weekend hours with key cards. They often meet to study or work on homework problems in the EP student lounge (which is also used as our computational physics classroom a few times a week in the afternoon during the fall semesters). The renovation also provided high-quality space for research laboratories, but no laboratory equipment for instructional or research purposes.

The costs for infrastructure repairs (especially maintenance, supplies, and repairs for computer and audiovisual equipment, furniture, appliances, photocopier and printers) and minor facility improvements (such as new network drops, power outlets for laboratories, theft prevention devices, etc) are paid from the departmental operations budget, except for technology improvements in centrally scheduled classrooms (GN 229, 230, 218A), which are paid centrally by ICT.

*Assess the adequacy of the resources described in this section with respect to the students in the program being able to attain the student outcomes.*

The resources described above are sufficient to meet the stated Program Outcomes and Educational Objectives of the EP program. We have outstanding world-class physicists and engineers as instructors, who are passionate about undergraduate instruction. All physics courses required for graduation are scheduled at least once per year and are taught by a faculty member with a Ph.D. in physics. Occasionally, the College of Arts and Sciences will allow us to teach a course below the minimum enrollment threshold of ten students. (Since physics and EP students

are pooled into the same courses, this happens at most once per academic year.) Scheduling conflicts for students are resolved by individual meetings with students outside of the regular classroom hours or by setting up independent-study courses, which are taught by physics faculty as an overload without pay. Physics and engineering courses do not usually fill up. Students are advised as early as possible to find room in required calculus courses during the preregistration period. Therefore, out students can graduate in eight semesters, provided they are ready for calculus in their first semester at NMSU.

While the departmental operating and equipment budgets are small, the resources are sufficient to provide adequate instructional laboratory and computational facilities for our students. Capstone and upper-division laboratory courses are sometimes linked to faculty research projects, which allow us to leverage our significant external research expenditures for EP instruction. Our operational funds are sufficient to hire undergraduate students as learning assistants, to purchase materials and supplies for lower-division general-education laboratories, and for clerical expenses such as photocopies. We also provide a desk and a computer for every graduate and some undergraduate students.

In exit interviews, students generally express satisfaction with our institutional resources dedicated to EP.

### **C. Staffing**

*Describe the adequacy of the staff (administrative, instructional, and technical) and institutional services provided to the program. Discuss methods used to retain and train staff.*

The Department of Physics currently has ten full-time tenured faculty members, including the Physics Department Head. At present (spring 2018), there are also four tenure-track faculty members. The Physics Department Head teaches one half of the average teaching load for the department, reducing the number of tenured/tenure-track faculty instructors to 13.5 FTE. There are also two half-time College-track (teaching) faculty members. Some faculty members have reduced teaching loads due to research course buy-outs, sabbatical and other leaves, increased service loads, or because they are in the first year of their appointment. Other faculty members whose research productivity has declined have an increased teaching load. When combined, these 14.5 FTE faculty instructors provide adequate teaching, advising, and assessment support for the EP program. Required courses are offered at least once per year and our students can graduate in four years, provided they are ready for calculus in their first semester.

The Department of Physics also has two full-time staff members on campus. Rosa Christensen is the (non-exempt) Administrative Assistant and Fiscal Assistant. Her responsibilities include faculty and student hiring, I-9 forms and E-Verify, student records, student relations, travel arrangements and reimbursements, campus activities, scholarships, and administration of experimental research grants at the departmental level. She also supervises spending of departmental I&G funds. A second Administrative Assistant position is currently open and should be filled in the spring of 2018. Finally, Mr. Carreto-Parra is the (exempt) instructional lab manager. Since the Department of Physics has lost several faculty lines in recent years and because of many research buyouts and bridged faculty positions, we no longer have a sufficient number of faculty members to teach all courses. Therefore, some lower-division general-education courses, including instructional laboratories, are often taught by qualified graduate students with an MS degree in physics on a case-by-case basis.

One great shortcoming that has often been mentioned, especially in reports by our EP Advisory Board, is that this program does not have an administrative assistant specifically for the EP program. Therefore, many clerical and administrative tasks burden the faculty, who therefore have less time for scholarship and supervision of students. Adding a program coordinator is highly desirable, but not likely given the present financial situation in the College of Engineering.

Research faculty and staff members hired entirely for research through external grants and contracts are not mentioned here, since their interaction with the EP program has been minimal over the past five years. Potentially, such research staff might offer an EP capstone design project.

NMSU exempt and non-exempt staff did not have a pay raise since 2012. A 2% pay raise was under consideration of the state legislature in February 2018. The previous pay raise in 2012 was also 2%. (The Administrative Assistant received a reclassification increase of \$2000 annually since her duties significantly exceeded the previous job classification.) The lack of raises has made staff morale a challenge. Nevertheless, we have outstanding staff in the Department of Physics. The Department Head supports the staff by promoting a collegial climate in the department. While staff pay is generally low (even for Southern New Mexico), NMSU benefits (medical, dental, retirement, etc) are excellent in comparison with the private sector.

Training for the non-exempt staff members (Administrative Assistant and Fiscal Monitor) on NMSU business procedures (hiring procedures, record retention, general employee safety, etc) is made available by the institution. The instructional lab manager sometimes traveled to the American Physical Society March meeting over the past six years, paid by the Department of Physics operational budget. Such travel allows them to visit lab equipment vendors in the conference exhibit, attend sessions on physics education research, and general physics talks of interest. NMSU also waives tuition for regular employees to enroll in a limited number of courses with permission of the supervisor, which enables employees to continuously improve their skills. The Administrative and Fiscal Assistant currently pursues a Master's degree in Educational Leadership in the College of Education.

#### **D. Faculty Hiring and Retention**

*Describe the process for hiring of new faculty.*

Faculty lines that become vacant through retirements or resignations are returned to the Office of the Executive Vice President and Provost. Once a year, early in the spring semester, the academic departments submit requests for faculty lines to their college. (The Department of Physics submits such requests to the College of Arts & Sciences.) The colleges collect all requests and submit some of them to the Provost's Office for approval. Departments are notified during the summer if their line requests have been approved. When the departments request new faculty lines, they also request start-up funds, usually around 190 K\$. Typically, the start-up expenses for physics faculty (graduate student support, faculty summer salary, equipment, supplies, and travel) are shared by the Vice President for Research (50%), the College of Arts & Sciences (33%), and the Department of Physics (17%). The Department of Physics share of start-up expenses (17%) consumes most of the F&A (indirect costs) of external research returned to the Department. Vacant faculty lines approved for rehire by the central administration are filled at the Assistant Professor level. The institution budgets new positions at the median of a salary study performed by the institution's Human Resources department. Recent starting salaries for

assistant professors have been around 65 k\$, significantly lower than at our peer institutions. Nevertheless, we have been able to make five excellent hires recently.

After the approval for a new faculty line has been received from the Office of the Executive Vice President and Provost through the College of Arts and Sciences, the Department of Physics submits a position request form to the Office of the Provost through the College of Arts and Sciences. Attached to this form are a copy of the proposed ad and a description of the position. The Physics Department Head and the proposed chair of the search committee also meet with the Vice President for Research and the Associate Dean for Research in the College of Arts and Sciences to sign a firm commitment for start-up for the new faculty member. For the most recent hire to start in January 2018, an agreement was reached for a start-up of 190 k\$. After the position request form has been fully approved, advertising can begin and a search committee is appointed by the Physics Department Head with concurrence of the Dean of Arts and Sciences. Typically, a search committee will have about 5 members, including one member from a different department and one member from a subfield of physics different from the new faculty member being sought.

The advertisement for the position, approved by Human Resources, is distributed as both a print ad (in Physics Today, typically) and as an online ad (in Physics Today online, and in a variety of jobs databases and email list-servers relevant to the field in question). Applicants are asked to provide a full CV, a statement of research interests, a statement of teaching philosophy, and a list of at least three references. The search committee reviews the applications and selects the best 3-4 candidates for interview. This short list is presented to the Physics Faculty, the Dean, and the Office of Institutional Equity for approval. During the interviews, each candidate will meet with the Dean (or an Associate Dean), the Vice President for Research, and small groups of faculty; present a Colloquium to the whole Department of Physics; teach a lower-division lecture; and present a “pizza seminar” to a group of graduate students – the graduate students make written comments about each candidate. Subsequent to the interviews, the search committee will meet and formulate a set of conclusions about the candidates based on their own experiences in the interviews, informal discussions with other faculty members, and the written comments of the graduate students. These conclusions are presented to a meeting of the Department of Physics faculty, and based on the outcome of that meeting a memo is written to the Dean expressing the conclusions of the Department and describing the strengths and weaknesses of each candidate, without giving a ranked ordering. The Dean then makes the final decision about whom to make an offer.

*Describe strategies used to retain current qualified faculty.*

The department head and college administration strive to sustain a challenging and rewarding professional work environment, so that faculty members remain enthusiastic about remaining with the department. Junior faculty members are provided with opportunities for formal and informal mentoring toward facilitating career success. They are also encouraged to develop areas within departmental academic programs that are of specific interest to them. Numerous professional development courses and workshops are offered on campus at no cost, through the Teaching Academy and the Advance Program, for instance. Faculty and their family members are eligible to take a limited number of NMSU courses free of charge (tuition benefits).

The College of Arts and Sciences also has a comprehensive awards program, including awards to stimulate research and to reward outstanding teaching and service. Such awards are available to

junior faculty, tenured faculty, and College Faculty. Details can be found at the NMSU Arts and Sciences web page under the “Faculty & Staff” menu item. Some awards are funds for research (which can include summer salary), course buy-outs, or funds for development such as travel. There are also awards in the Department of Physics (Gardiner Professorship, most recently awarded to Dr. Michael Engelhardt) and from the institution as a whole (such as the Distinguished Achievement Professorship awarded to Dr. Matthias Burkardt). Dr. Ni and Dr. Zollner were recognized by the NMSU President and/or Provost with a Research Discovery Award at a commercial time-out at mid-court at a basketball game. Dr. Pate and the nuclear physics research group and Dr. Zollner were recognized by the Vice President for Research with a research rally. There is also a Regents Professor program at NMSU, but the Physics Department has not had a Regents Professor since 2009.

If a faculty member with a strong record of performance receives an offer from another institution, NMSU will make an effort to retain this faculty member. The faculty member presents a written offer from another institution to the Department Head, who will make a recommendation to the Dean about retaining the faculty member. Retention incentives can include an increase in base salary; retention commitment (similar to start-up commitment) for students, summer salary, travel, equipment, supplies, etc; accommodation of a spouse or partner. The financial burden for such retention incentives is borne entirely by the College of Arts and Sciences. For increases in base salary, the College will typically leave a faculty line vacant and use the funds instead for salary increases to retain qualified faculty members. Retention commitments are paid out of the F&A portion from external research grants paid to the College of Arts and Sciences and the Department of Physics.

It is not yet clear (February 2018) how the 2% pay increase will be distributed among faculty and staff. It is expected that there will be a base adjustment for everybody, with additional increases based on performance. To evaluate faculty performance, the faculty elect two tenured faculty members to consult with the Department Head about performance ratings (exceeds, meets, or does not meet expectations) in the areas of teaching, research, service, and outreach (if applicable). The overall performance rating, once approved by the Dean of the College of Arts and Sciences, will perhaps be considered in determining raises and other reward system elements. For example, in a previous salary increase cycle in 2012, all faculty members with satisfactory performance over the past three years received an across-the-board 1% pay increase. In addition, a 0.85% raise pool was made available to the Department for performance-based raises. The faculty approved a simple formula on how to distribute the additional 0.85% at a faculty meeting. The raises were then implemented by the Department Head, pending approval by the Dean of the College of Arts and Sciences and the Executive Vice President and Provost

## **E. Support of Faculty Professional Development**

*Describe the adequacy of support for faculty professional development, how such activities such as sabbaticals, travel, workshops, seminars, etc., are planned and supported.*

All tenured faculty members are eligible for sabbaticals as described in NMSU Administrative Rules and Procedures (ARP) Section 8.54. “The purpose of a sabbatical leave is to promote professional growth.” After at least 12 semesters of full-time service, faculty members apply for a sabbatical during the spring semester, requiring approval from the Department Head, the Dean

of Arts and Sciences, and the Executive Vice President and Provost. Sabbatical leaves are for one semester at no reduction in salary or for a year at 60% of salary. (The other 40% of salary plus travel expenses are often covered, at least in part, by a host institution visited by the faculty member on sabbatical, such as Los Alamos National Laboratory, University of New Mexico, or Jefferson Laboratory, Sandia National Laboratories, or Fermilab in recent history).

The Department of Physics has a vibrant weekly colloquium speaker series. Typically, about two thirds of colloquium speakers are external. In addition to giving a colloquium about their research, the colloquium speakers also meet individually with faculty and students throughout the day to exchange ideas about topics of common interest (teaching, research, service). Both the colloquium and the individual meetings contribute to faculty development. The speakers often meet with undergraduate students to talk about employment, graduate school, and internship options at their home institution.

Most tenured and tenure-track physics faculty members (all except three) have significant external research grants (in excess of typically 100 k\$ per year per faculty member). Their research grants typically contain funds for travel to conferences or other institutions. While primarily for research (and to update faculty knowledge in their area of specialty), conferences such as the general or March meetings of the American Physical Society usually also have sessions contributing to professional development in physics education, which are attended by our faculty members.

The Department of Physics (from its operational I&G funds) and the College of Arts and Sciences provide travel support for College Faculty (i.e., non-tenured lecturers) to attend a regional or national meeting on Physics Education (such as the annual meeting of the American Society of Engineering Education or the American Association of Physics Teachers). Sometimes, such attendance is also supported by the conference organizers. The Department Head and other departmental leaders attend physics leadership conferences, such as the biennial physics department chair conference (organized by APS and AAPT) and meetings intended to increase STEM education and enrollment or physics teacher education. The Department Head shares learning obtained at such conferences and workshops with relevant physics faculty members. New faculty members attend workshops for new faculty organized by AAPT. The EP external advisory board and the Physics external advisory board also provide valuable information, advice, and recommendations to the physics faculty, both in their reports and also in meetings with individual faculty or with groups of faculty.

While NMSU is a minority-serving institution with very limited funds for professional development, there are nevertheless ample opportunities to achieve this aim. Typically, all physics faculty members travel at least once per year, many of them more often. Therefore, institutional support for faculty development appears adequate.