

CRITERION 7. FACILITIES

A. Offices, Classrooms and Laboratories

Summarize each of the program's facilities in terms of their ability to support the attainment of the student outcomes and to provide an atmosphere conducive to learning.

Offices (such as administrative, faculty, clerical, and teaching assistants) and any associated equipment that is typically available there.

The Department of Physics office is located in Room GN 221 Gardiner Hall, in close proximity to classrooms and faculty offices. This office has three separate areas for the administrative assistant (GN 221), the fiscal assistant (GN 222) and the department head (GN 223). The office has a small seating area (for student waiting for appointments with the department head), a refrigerator, a microwave oven, and a coffee machine (which is often used by the students). This office area welcomes students seeking assistance from the department head or clerical staff, especially in matters relating to academic and career advising, entrance and exit interviews, course registration, and substitutions and waivers for degree certification. Next door (GN 224) is the mailroom with individual mail slots for all faculty, staff, and graduate students. This room also has a high-volume duplex photocopier and scanner and a fax machine.

Physics faculty and two technical (exempt) staff members have individual offices in Gardiner Hall, on the 2nd and 3rd floors. Each office is about 190 sq. ft. After the recent renovation of Gardiner Hall, all offices have modern furniture, thermostatically controlled HVAC, hardwired internet, and multi-function telephones with teleconferencing, messaging, call-forwarding, etc.

Graduate students (including teaching and research assistants) have offices either in large office suites broken up into cubicles, or they share smaller faculty-sized offices in various locations in the building. Occasionally, office space is also provided to undergraduate students who are particularly engaged in the department through undergraduate research, capstone projects, outreach, or clerical or technical work.

Student Societies: The Department of Physics has two very active chapters of the Society of Engineering and Physics (SEPh) and the Society of Physics Students (SPS), a national organization operated by the American Institute of Physics. The SPS chapter has been recognized as an "Outstanding Chapter" several times in recent years by the national parent organization. Although independent, the two societies interact with each other, and both have dedicated rooms in Gardiner Hall, where they hold meetings, study groups, and other social functions. The student society rooms have refrigerators, microwave ovens, toasters, and coffee machines. They also have an A-frame whiteboard for student societies to announce their activities and a blackboard, where students collaborate in solving their homework problems. All physics and EP students have key card access to these two rooms.

Classrooms and associated equipment that are typically available where the program courses are taught.

The Department of Physics conducts almost all of its lecture classes in four classrooms in Gardiner Hall. All four classrooms have multi-media capabilities, including ceiling-mounted projectors, very large screens, CD players, and document cameras. Physics students and faculty still prefer blackboards and chalk over whiteboards. Such blackboards are available in all

regularly used classrooms and instructional laboratories and other areas of the building.

The largest classroom, Gardiner 230, seats about 110 students; this classroom is used for the large engineering classes, such as PHYS 215G and 216G. The next largest, Gardiner 229, seats about 65 students; this is used for the smaller more intensive classes PHYS 213, 214, 217, and 315. Gardiner 218A, which seats about 24 students, is used for upper-division classes like PHYS 454, 455, 461, 462, 480, 489, etc. Gardiner 218 is a highly flexible multi-media classroom with circular tables and multiple PC displays, more suited for a workshop atmosphere and remote instruction, and it is used for instructional seminars and other somewhat informal instructional support functions. The Geological Sciences Department (also located in Gardiner Hall) rarely uses these classrooms. They are therefore available to for physics courses on a priority basis. At other times (when the rooms are needed for physics or geology courses), these classrooms are available to other departments in the university.

Laboratory facilities including those containing computers (describe available hardware and software) and the associated tools and equipment that support instruction. Include those facilities used by students in the program even if they are not dedicated to the program and state the times they are available to students. Complete Appendix C containing a listing of the major pieces of equipment used by the program in support of instruction.

The Department of Physics supports a variety of instructional laboratories. Four large labs, Gardiner 104, 108, 204, and 206 (each about 900-1000 sq. ft., providing space for 20-24 students per section in groups of 2-3) are used for the Introductory Laboratory classes PHYS 213L, 214L, 215GL, 216GL, and 217L. The Modern Physics Laboratory, PHYS 315L, is run in a dedicated lab space with two rooms, Gardiner 131 and 132, which are about 800 sq. ft. in size. The Advanced Physics Laboratory, PHYS 475, is operated in several laboratory spaces throughout Gardiner Hall (some of which are also research laboratories) as well as in central university facilities, such as the Central University Research Resource Laboratory (CURRL) operated by the Vice President for Research with a dedicated staff scientist. In the advanced PHYS 315L and 475 labs, the students are required to do some experimental design work, after they have become familiar with the apparatus available. We also have dedicated space for Outreach and Physics Demonstrations (Gardiner 142), which can also be used as a laboratory for a capstone project for EP majors.

Table 7.1 provides a detailed list of all rooms (except for storage facilities) of the Department of Physics in Gardiner Hall. Their primary purpose (office space, research, teaching, etc) is also indicated.

Table 7.1. Department of Physics rooms in Gardiner Hall; allocation, occupant(s), number of computer stations, room size and primary purpose. GA, RA and TA indicate graduate, research and teaching assistants, respectively.

Office Number	Room Allocation	Occupant Name	Capacity	Size (sq.ft.)	Primary Purpose
050	Materials Science Lab	Dr. Bruce	0	224	Research
054	Department Wet Lab	Dr. Zollner	0	186	Research

055	Res. Assist. Office	6 RAs	6	382	Office
057	Research Lab	Dr. Cooper	0	188	Research
058	Materials Science Lab	Dr. Urquidi	0	157	Research
060	X-RAY Lab	Dr. Urquidi	0	1559	Research
062	Experimental Lab	Dr. Urquidi	0	92	Research
063	Faculty Office	Dr. Urquidi	1	93	Office
065	Adv. Phys. Lab		10	367	Teaching Lab
065A	Radioactive Storage	Dr. Pate	0	70	Support
066	Adv. Phys. Lab		10	682	Teaching Lab
069	Materials Science Lab	Dr. Urquidi	0	183	Research
102	Emeritus Faculty Office	Dr. Goedecke	1	160	Office
103	Materials Science Lab	Dr. Bruce	1	119	Office
104	Physics Teaching Lab		20	885	Teaching Lab
106	Class Lab Storage		0	368	Teaching Lab
108	Physics Teaching Lab		20	1050	Teaching Lab
125	Student Society Room	SPS	2	283	Office
131	Physics Teaching Lab		20	496	Teaching Lab
132	Modern Physics Lab		3	286	Teaching Lab
132A	Modern Physics Lab		7	309	Teaching Lab
132B	Modern Physics Lab		0	97	Teaching Lab
142	Outreach		0	428	Outreach
201	Grad Assistant Office	4 TAs	1	151	Office
202	Grad Assistant Office	4 TAs	1	160	Office
203	Adjunct Faculty Office	Dr. Wagner	2	119	Office
204	Physics Teaching Lab		22	986	Teaching Lab

205	Class Lab Storage		0	332	Teaching Lab
206	Physics Teaching Lab		20	998	Teaching Lab
207	Dept. Technician	Mr. Carreto-Parra	1	181	Office
209	Class Lab Storage		2	237	Teaching Lab
216	Grad Assistant Offices	12 GAs	12	524	Office
218	Physics Teaching Lab		24	493	Teaching Lab
218A	Classroom		24	489	Classroom
221	Department Office	(vacant)	1	332	Office
222	Res. Acc. Office	Ms. Christensen	1	123	Office
223	Dep. Head Office	Dr. Zollner	5	212	Office
225	Tutoring Room		0	317	Open Lab
229	Lecture Hall		65	897	Classroom
230	Lecture Hall		110	1409	Classroom
231	Class Storage		0	291	Classroom
250	College Faculty Office	Dr. De Antonio	1	130	Office
250A	Closet		0	31	Office
251	College Faculty Office	Dr. Mi. Burkardt	1	130	Office
254	Faculty Office	Dr. Zollner	1	183	Office
255	Faculty Office	Dr. Urquidi	1	189	Office
256	Emeritus Faculty Office	Dr. Gibbs, Dr. Kanim	1	193	Office
256A	Faculty Office	Dr. Engelhardt	1	185	Office
258	Faculty Office	Dr. Waszek	1	193	Office
258A	Faculty Office	Dr. Ma. Burkardt	1	185	Office
259	Faculty Office	Dr. Vasiliev	1	187	Office
259A	Atmospheric Optics	Dr. Bruce	1	187	Office

259B	Faculty Office	Dr. Bruce	1	177	Office
260	Atmosph. Optics Lab	Dr. Bruce	0	561	Research
261	Conf. Room & Library		20	835	Office
264	Computer lab & SEPh		14	835	Teaching Lab
265	Optics Research Lab		0	747	Research
266	Office Storage		0	181	Support
267	Post Doc Office	Dr. Jelinek	1	131	Office
268	Emeritus Faculty Office	Dr. Ni	1	141	Office
352B	Faculty Office	Dr. Schlegel	1	196	Office
353	Faculty Office	Dr. Hearn	1	193	Office
354	Faculty Office	Dr. Kiefer	1	194	Office
355	Faculty Office	Dr. Papavassiliou	1	194	Office
356	Faculty Office	Dr. Pate	1	192	Office
357	Faculty Office	Dr. Nakotte	1	194	Office
358	Faculty Office	Dr. Cooper	1	193	Office
359	Technician Office	Mr. Hossain	1	167	Office
361	Grad Assistant Office	6 RAs	6	573	Office
362	Research Lab	Dr. Nakotte	0	568	Research
363	Grad Assistant Office	6 RAs	6	568	Office
364	Nuclear Physics Lab	Dr. Pate	0	761	Research
365	Geophysics Res. Lab	Dr. Waszek	0	571	Research
366	Geophysics Res. Lab	Dr. Hearn	0	165	Research

B. Computing Resources

Describe any computing resources (workstations, servers, storage, networks including software) in addition to those described in the laboratories in Part A, which are used by the students in the program. Include a discussion of the accessibility of university-wide computing resources available to all students via various locations such as student housing, library, student union, off-campus, etc. State the hours the various computing facilities are open to students. Assess the

adequacy of these facilities to support the scholarly and professional activities of the students and faculty in the program.

The Department of Physics has 19 computer workstations in our computer laboratory, most with the Linux-operating system but several with the Windows-operating system. All of these computers run MATLAB through a campus license. Some also have specialized software like Origin (for preparation of publication-quality figures) or an x-ray data analysis suite. These computers are used in support of the PHYS 150 and PHYS 476 computational physics courses. Physics and EP majors can have accounts on these computers for use in other projects. For example, students in the PHYS 315L advanced lab are expected to use a variety of computing tools to collect and analyze data. Access to this physics computer laboratory is given around the clock to students and staff associated with the physics department. This room also serves as the home for the student Society of Engineering and Physics (SEPh). Except when in use as a classroom (two afternoons in the fall semester), there is no competition for access to these computers and there are no wait times.

Apart from departmental computing resources, it should be noted that wireless access is available throughout Gardiner Hall as well as most the NMSU campus and students can have access to many other computer laboratories across campus, see Table 7.2.

Table 7.2: *Public and semi-public computer laboratories across the NMSU Main campus, showing computers available to students.*

Lab	Type	Department	# of Computers
Academic Research Building (ARB B 106)	Departmental/ Semi-public	Training Central	13
Academic Research Building (ARC B 101)	Departmental/ Semi-public	Training Central	12
Breland (BR) 175 (GAS)	Departmental/ Semi-public	Arts & Sciences	31
Breland (BR) 192 (Geography)	Departmental/ Semi-public	Arts & Sciences	10
Breland Lobby (BRLOB)	Public	Information & Communication Technologies	6
Business Lab (BC 309)	Departmental/ Semi-public	Business	62
Clara Belle Williams (EN) 102	Departmental/ Semi-public	Arts & Sciences	16
Clara Belle Williams (EN) 121	Departmental/ Semi-public	Arts & Sciences	27
Computer Center Hallway (Cnhal)(ICT Building)	Public	Information & Communication Technologies	10

Corbett Center, 1st Floor (CCL)	Public	Information & Communication Technologies	8
Corbett Center, Pete's Place Lab (Petes), 2nd Floor	Public	Information & Communication Technologies	43
ECII 125	Departmental/ Semi-public	Engineering	28
ECIII 134	Departmental/ Semi-public	Engineering	10
Frenger Food Court	Public	Information & Communication Technologies	3
Fulton (FAC) 148	Departmental/ Semi-public	Athletics	17
Fulton (FAC) 149	Departmental/ Semi-public	Athletics	9
Gerald Thomas (Aggie Snack Bar/Old Blakes Lot-A-Burger)	Public	Information & Communication Technologies	3
Hardman & Jacobs (HJLC) 101, 1st Floor	Public	Information & Communication Technologies	49
Hardman & Jacobs (HJLC) 128, Student Success Center	Public	Student Success Center	15
Hardman & Jacobs (HJLC) 206, Training/Classroom Lab	Public	Information & Communication Technologies	24
Health & Social Services (HSS) Cantina	Public	Information & Communication Technologies	3
Knox Hall Lab (KN), West Entrance	Public	Information & Communication Technologies	18
Math Success (Walden Hall)	Public	Arts & Sciences	13
Milton Hall (MH) 154, Journalism (Photo Journalism)	Departmental/ Semi-public	Arts & Sciences	19
Milton Hall (MH) 154A, Journalism (Jour)	Departmental/ Semi-public	Arts & Sciences	16
Milton Hall (MH) 157, Journalism (Jour)	Departmental/ Semi-public	Arts & Sciences	21
O'Donnell Hall (OH) 033	Departmental/ Semi-public	Education	26

O'Donnell Hall (OH) 041	Departmental/ Semi-public	Education	25
Speech (SP) 315	Departmental/ Semi-public	Arts & Sciences	24
TB 202	Departmental/ Semi-public	Engineering	22
TB 203	Departmental/ Semi-public	Engineering	22
Vista Del Monte (VDM) Lab	Public	Information & Communication Technologies	8
Williams Annex 106a	Departmental/ Semi-public	Arts & Sciences	21
Zuhl Library - Student Success	Public	Library	16

C. Guidance

Describe how students in the program are provided appropriate guidance regarding the use of the tools, equipment, computing resources, and laboratories.

Students, who take any of the instructional laboratories in the Department of Physics, will be given instructions and training on the proper and safe way to use the equipment, whenever it is deemed necessary and appropriate. Such instructions may be given at the beginning of each lab session (especially for the lower-division general-education laboratory courses) or at the beginning of the semester (for upper-division labs). While there are typically negligible (or only minor) safety concerns within the introductory 200-level laboratories, the higher-level laboratories (PHYS 315L and PHYS475) do require special instructions to protect the student from possible injury. For example, some of the experiments in PHYS 315L and 475 utilize ionizing radiation, such as X-rays. In general, students will be given specialized training and safety material on the proper and safe way to use potentially harmful equipment.

NMSU's Environmental Health Safety & Risk Management (ESH&R) office (17 staff members) offers various safety training programs, publishes safety policies, and reviews safety procedures for all campus facilities, including research and instructional laboratories. Standard training courses are offered on a periodic schedule, while customized safety training sessions for a specific course can be offered by ESH&R personnel in the classroom at the regularly scheduled class time. For laboratories that pose potential safety hazards, students are required to review the safety materials, obey with the safety requirements (e.g. safety glasses are a 'must' for any of the Chemistry labs) and take a separate training course, if needed. Documentation and other information from NMSU's ESH&R office can be reviewed at <http://www.nmsu.edu/safety/>.

It should also be noted that three of the department's faculty members (Drs. Steve Pate, Vassilios Papavassiliou, Jacob Urquidi) are responsible for the use of radioactive sources in the building, and one of them (Dr. Steve Pate) is a member of the University's Radiation Safety Committee.

Within the Department of Physics students are offered computing classes, such as PHYS 150 (optional) and PHYS 476 (elective), to train students in the use of computers in addressing physics problems. Moreover, all EP students take computing courses in Engineering as part of the engineering portion of their degree requirements. Additional courses, for example C++, Java, or object-oriented programming and numerical methods are offered by the NMSU Computer Science and Mathematical Sciences departments.

D. Maintenance and Upgrading of Facilities

Describe the policies and procedures for maintaining and upgrading the tools, equipment, computing resources, and laboratories used by students and faculty in the program.

Gardiner Hall, which hosts the Department of Physics, underwent a major renovation from Fall of 2009 until Summer of 2010, at a total cost of about 13 M\$. During that period, the building was completely vacated, and all offices and laboratories (both research and instructional) were temporarily relocated to other buildings on the NMSU campus. As part of the renovation, all classrooms and offices received new furniture and audiovisual equipment. Moreover, new desktop computers and color printers (or scanner/fax/printer units) were purchased for all faculty members. The renovated building now houses both the Department of Physics and the Department of Geological Sciences.

The Department of Physics has two exempt staff members (Francisco Carreto-Parra, MS in Physics, and Forhad Hossain, MS in Physics) who are charged with maintaining and upgrading the instructional laboratories and the computational facilities. They perform minor repairs, upgrades, and maintenance (often in collaboration with undergraduate students in physics or EP), order parts and supplies, and install new equipment. Costs are paid by the Physics Department's operational funds or from the College of Engineering E-Fee (described in Criterion 8). Since it has been some time since new computers were purchased after the building renovation in 2010, we replace faculty and staff computers from time to time upon request, typically on a 3-4 year cycle. Also, the audiovisual classroom equipment was upgraded by NMSU Information and Communication Technologies (ICT) Department about 2-3 years ago, to transition from VGA to HDMI resolution and modern laptop connectors. NMSU computers are protected with a campus-wide anti-virus software (Sophos) maintained by ICT. All NMSU faculty and staff also have a campus-wide license for Microsoft Windows, Office, Adobe Acrobat, and other software.

In previous years, the institution used to solicit requests for Equipment Renewal and Replacement (ER&R) from the departments twice a year. Also, in the Fall semester, there used to be a call for requests to distribute Student Equipment Maintenance Fees. These funds could be used for equipment, software, maintenance, and supplies. Requests used to be routed from the Department of Physics through the College of Arts and Sciences to the central administration. Typical allocations to the Department of Physics used to be around 10 k\$ per year. In recent years, this process was discontinued due to the difficult financial situation of the university, given several years of successive declining tuition revenue and state appropriations. These ER&R and student fee allocation funds were replaced with funds from the College of Engineering E-Fee, which are adequate, in the short term, to fill our needs for small equipment and supplies. Each spring, the Physics Department Head makes a request to the College of Engineering for distribution of E-Fee funds. Once allocated, the funds become available during

the following academic year. Physics faculty and staff then request use of these funds from the department head and/or the laboratory committee (see below), who prioritize requests based on need and available funds.

Mr. Carreto-Parra and the Physics Department Head manage the NMSU inventory in the Department of Physics. The department has 498 inventory items for research and instructional purposes. These items are physically located and their barcodes are scanned once a year. Exceptions (items not found and scanned) are reported to the NMSU's Board of Regents. By state law, inventory items are defined as items with an acquisition cost of USD 1000 or higher, regardless of age or depreciation. NMSU's risk management includes property insurance with a 5000-dollar deductible for any theft and a 1000-dollar deductible for any loss due another covered occurrence.

While funds for new equipment are no longer available through ER&R requests from the central administration through the College of Arts and Sciences twice, such requests can now be made through the College of Engineering using the Engineering E-Fee. For example, we purchased a Germanium gamma ray detector in 2016 (25 k\$) and several smaller pieces of electronic equipment from the E-Fee, to provide additional experimental stations for our growing EP program. We also purchased a classroom set of oscilloscopes for the PHYS 214L freshmen lab. Such equipment items can also be purchased from the department's operational or foundation funds, on a limited basis. The Dr. Horace Coburn Physics Fund (annual earnings about 8 k\$ per year) is used to purchase or build lecture demonstration or display equipment, for example the torsional oscillator purchased in 2013. The Coburn funds can also be used for EP capstone projects, if the purpose of these projects is to build demonstration of display equipment. Funds for instructional equipment can also be requested from government funding agencies, such as the National Science Foundation (NSF) and the Army Research Office (ARO). A previous NSF grant paid for equipment items in our instructional mechanics lab. Two ARO grants were received recently to purchase a powder and high-resolution x-ray diffractometer (used in PHYS 315L and PHYS 468 cross-listed with CHME 488) and a Fourier-transform infrared ellipsometer (used in PHYS 489 and 471). Finally, many of the faculty members engaged in the EP program have research grants which pay for computers, software, equipment, and facilities. Usually, these research laboratories can be used for undergraduate instruction or capstone projects on a limited case-by-case basis. Computers and software purchased from research funds for faculty and graduate students are typically also used to manage physics courses.

Repairs and maintenance of multimedia equipment in the classrooms are maintained by NMSU Information and Communication Technologies (ICT). The NMSU Office of Facilities and Services (F&S) provides janitorial services daily, which is adequate considering the use of the building. F&S also responds to work order requests for routine repairs. Emergency repairs (for example, a leaky faucet) are usually carried out rather quickly. The cost of routine building maintenance and repairs is covered by F&S. Recent maintenance included a replacement of the keycard access system to the building and selected rooms, because parts for the old system were no longer available. Once a year, each department used to request Building Repair and Renewal (BRR) funds from the central administration through the College of Arts & Sciences. This competition has been discontinued due to difficult fiscal situation.

The Department of Physics has a Laboratory Committee meets to discuss and prioritize the needs of the instructional labs. If competing requests exceed the available budget, then a decision is made concerning which requests need to be met first.

E. Library Services

Describe and evaluate the capability of the library (or libraries) to serve the program including the adequacy of the library's technical collection relative to the needs of the program and the faculty, the adequacy of the process by which faculty may request the library to order books or subscriptions, the library's systems for locating and obtaining electronic information, and any other library services relevant to the needs of the program.

Refer to Library Write-Up in Appendix? Or do we add it here?

F. Overall Comments on Facilities

Describe how the program ensures the facilities, tools, and equipment used in the program are safe for their intended purposes. (See the 2017-2018 APPM section I.E.5.b.(1).)

After the renovation of Gardiner Hall, the quality of the departmental facilities is greatly improved, although the Department of Physics lost ~30% of its pre-renovation space since the Department of Geological Sciences was moved into Gardiner Hall as well. Any future infrastructure work in the building will be done by the University Plant Services, to make sure all work done is up to code. Even with the loss of space, we believe that the current departmental facilities are superior compared to pre-renovation conditions. As a consequence, we are able to better serve the needs of our students and the different programs.

All rooms in Gardiner Hall classified as laboratories are inspected annually by the NMSU ESH&R department. Each chemical laboratory maintains a chemical inventory, which is checked annually for agreement with the actual chemicals stored in the room (usually in designated chemical storage spaces). Safety data sheets are kept on file in each chemical laboratory. Proper signage to inform students and staff about hazards is checked during the inspections. Findings are documented to the responsible faculty member with copy to the department head. They must be corrected within 30 days. The x-ray laboratory has area radiation monitors, which are replaced quarterly and only show background exposure. A state inspection of chemical laboratories in Gardiner Hall occurred in the fall of 2017 but did not have any findings. Chemical waste is removed from laboratories by designated ESH&R personnel upon request. ESH&R also performs annual radiation surveys in rooms containing radioactive sources.

On many occasions (especially in exit interviews), our EP students did indicate that needed facilities in the Department of Physics and in the participating engineering departments rank from 'adequate' to 'excellent', especially for the instructional laboratories.