A. Executive Summary of Program Review Team for the CUNY Lehman College Physics Department

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Review team:

Enrique del Barco, Pegasus Professor of Physics, University of Central Florida
Michael Kavic, Associate Provost, SUNY Old Westbury

a. General Observations

The Department of Physics is a very valuable resource of the Lehman College at CUNY and has demonstrated very high quality in both research and education. It is positioned to continue leading the physics research activities at CUNY and its upward trajectory if given the necessary resources and support. Most of the goals from the last program review have been accomplished. The faculty size was increased from 4 to 7, with one additional tenure-earning line in the works. The faculty, graduate students, and undergraduate students are involved in exciting research and morale is high. Department faculty are a small but highly-engaged and well-coordinated group that covers an amazing amount of ground in terms of what they are able to accomplish. The students are a diverse and well-supported group both at the undergraduate and graduate level.

b. Program Strengths

The strengths of the program are clear. The extraordinary research and undergraduate academic support facilities, including the active partnership with the Museum of Natural History via the AstroCom NYC program, facilitate the development of very successful collaborative research enterprises and outreach activities that increase the visibility of the Lehman College Physics department at CUNY within the local, national, and international communities. The Astrophysics group is particularly well engrained and drives a very active research portfolio that involves a number of graduate and undergraduate students in the department. The department in terms of both faculty and students is a tight-knit community where support is available, and much progress is being made in terms of research and pedagogy.

c. Areas of Concern

The seniority of a number of faculty members stands as a potential weakness if a solid plan to replace upcoming retirements is not envisioned and put in place. This may particularly affect the solid-state physics group, currently composed of two members, particularly when considering this area being usually central in most physics departments nationwide. The number of majors is modest. There is also a concern that a small group of faculty is tasked with keeping a complex and substantial academic ~~enterprise~~ operational enterprise with limited physical and financial resources.

d. Opportunities and threats

Over the next several years, it is probable that several of the faculty will retire. If no new faculty are hired at the same rate, the department will worsen, jeopardizing several of the ongoing educational and research initiatives that have been ~~developed~~ established in the department. A clearly identified threat is the future of the solid-state group, which may cease to exist if not more faculty is added. The current sustained funding efforts at the Federal and State levels on quantum and semiconducting technologies (e.g. the CHIPS Act) present an opportunity for the physics department. There is an excellent opportunity for the development of a new astronomy minor and a medical physics program that would do much to increase the number of physics majors.

e. Recommendations

The highest priority actions that the review panel recommends are the following:

1. Add one additional tenure-earning faculty member within the next few years to strengthen the solid-state group. This effort will position the physics department in a more competitive position regarding excellent funding opportunities related to technological advances.

2. Develop a plan of action with the higher administration to guarantee one-to-one replacements of retiring faculty in order to maintain the faculty body within current numbers.

3. Complete the development of the astronomy minor and begin development of a medical physics program.

4. Provide greater physical plant support, particularly more student and faculty offices.

B. Program Review Report

a. Curriculum

The Department of Physics and Astronomy offers two degrees for majors in physics: a 38-credit B.A. degree and a 60-credit B.S. degree. These degrees feature a comprehensive undergraduate education that covers all majors areas of physics. The department fulfills a substantial service mission teaching a large number of general physics sections including an algebra-based sequence taken by a large number of health science students. In addition to this the department offers a number of general education courses particularly in astronomy and energy and environment. Of particular note are courses that support the Speech Pathology program related to the physics of sound. To have a relatively small group of faculty carry out such a large and complex series of curricular structures is most impressive.

Areas of concern:

In a general sense it is concerning that such a large number of courses need to be supported by a small group of faculty. This will limit the flexibility and frequency with which courses can be offered.

With a limited number of majors and faculty, upper division courses need to be offered in a sequence that could be less than ideal depending on a given student's cohort. This was mentioned by a number of students but seems to have been addressed to a certain extent by recent reforms.

The department, in terms of its research composition, is almost entirely theoretical. This is reflected in the curriculum with a lack of advanced lab courses.

Recommendations:

One obvious recommendation that would address some of the concerns noted above would be to hire more faculty in experimental physics. This would allow for greater faculty support for course offerings and for the development of advanced lab courses.

A second recommendation is to develop curricula that can attract a greater number of physics majors. The department is currently developing an astronomy minor and is considering a health science concentration. These are both ideas worthy of support.

b. Students

The average number of active majors (B.S. and B.A.) over the past 5 years was 36 students. During that time 19 majors graduated with a B.S. and 7 with a B.A. In the preceding 5-year period the mean number of majors was 48 students. In a given semester the department enrolls more than 600 non-major students in service courses. While the number of majors has held steady, the number of non-majors has steadily increased. Diversity is the strength of Lehman College generally speaking with large percentages of Hispanic and African American students.

This diversity is represented in the students served by the Physics Department. Graduates from the Physics Department are broadly successful with well over 90% being either employed or in graduate study following graduation. Many undergraduate physics majors have participated at a high-level in research mentored by faculty. While these numbers have fallen in recent times due to COVID, they are currently recovering. The department has 8 graduate students shared across a relatively small number of advisors. Three graduate students have graduated in the review period. These graduate students interface with and the larger CUNY system for much of their graduate education.

During a meeting with undergraduate students, they expressed broad satisfaction with the faculty and their efforts to assist and support the physics majors. There were ongoing efforts to establish more of a sense of community among the majors including a physics club. In speaking to the graduate students, broad satisfaction was expressed for the interaction with their advisors and their progression towards their degrees.

Areas of concern & Recommendations:

A major concern is that the number of majors, while stable, is modest. This is not uncommon for Physics programs across NYS. If a larger number of majors could be attracted there would be a more diverse series of courses that could be offered with greater frequency.

In speaking with undergraduate students, the lack of community environment of campus, availability of courses, and tutoring resources were broadly expressed as frustrations. Students should be engaged, and resources should be deployed to address these concerns.

In speaking to the graduate students, they seemed to have little infrastructure and support on campus. There seemed to be very little office space for them to utilize when they were on campus for example. They ~~only seemed~~expressed to be on campus to teach and more should be developed to attract them to be part of the campus community.

Given that the number of student researchers has decreased in recent years, more support for student research should be provided.

c. Faculty

The Physics department at the CUNY Lehman College has 7 tenured (T) and tenure track (TT) faculty teaching at the undergraduate and graduate levels, and 3 full-time adjuncts of instruction responsible for multiple sections of introductory physics courses that are not research active. Given the number of undergraduate physics majors (~36) and graduate students (6) currently enrolled in the Physics programs (undergraduate case) and supervised by Lehman physics faculty (Graduate case), the student-to-faculty ratios are ~5-1 and ~1-1 for undergraduate and graduate students, respectively, which is appropriate.

All faculty are extremely valued by both undergraduate and graduate students, who openly praise their faculty as highly accessible and caring, offering a high level of instruction and

research opportunities, with some faculty being recognized as particularly helpful in their mentoring capacity.

All T/TT faculty are research active and most have active external research grants supporting a number of very successful research initiatives which involve undergraduate, graduate, and postdoctoral associates.

There are three research topics composed by more than one faculty member.

The Astrophysics group, currently with 2 tenured faculty and an incoming additional tenure-earning faculty, is particularly active in research and has gained ample recognition within the research community for their work on cosmic rays and their use as probes for high energy physics and the study of supermassive black holes, among others. This group is particularly active in outreach activities, including a number of initiatives in partnership with the Museum of Natural History via the AstroCom NYC program.

The High Energy Physics (HEP) group is composed of 3 tenured faculty members that are also highly successful and recognized, working on several hot topic areas in HEP, some of which find excellent synergy with those developed by the Astrophysics group.

The commendable synergy between the Astrophysics and HEP groups when it comes to research can be extended as the representative nature of the physics department, as excellent synergy and collegiality constitute a palpable characteristic of the physics faculty at the Lehman College.

The Solid-State group, composed of 2 tenured faculty members, although small, it is extremely well recognized and active. With a focus on magnetism at the nanoscale, this group has been instrumental for the advance of some areas of magnetism, such as quantum magnetism in single-molecular magnets, to name an example.

Areas of concern:

The small size of the faculty body is a concern to this review committee. This is amplified by the high seniority of the faculty body, with 6 full professors out of 7 faculty. Over the next several years, it is probable that several of the faculty will retire. If no new faculty are hired at the same rate, the department will worsen, jeopardizing several of the ongoing educational and research initiatives developed in the department. A clearly identified threat is the future of the solid-state group, which may cease to exist if not more faculty is added. The current sustained funding efforts at the Federal and State levels on quantum and semiconducting technologies (e.g. the CHIPS Act) present an opportunity for the physics department.

Recommendations:

The committee recommends to:

1. Add one additional tenure-earning faculty member within the next few years to strengthen the solid-state group. This effort will position the physics department in a more competitive position regarding excellent funding opportunities related to technological advances.

2. Develop a plan of action with the higher administration to guarantee one-to-one replacements of retiring faculty in order to maintain the faculty body within current numbers.

d. Administrative Structure and Facilities

The Physics department office has 1 full-time support staff that expand several administrative services, including human resources, acting as a liaison between faculty and the different administration offices on campus. Given the low number of faculty and graduate students, this seems appropriate. The department is governed by a faculty chair that maintains teaching responsibilities while serving in the post.

The department maintains a number of facilities, including instructional laboratories for introductory and modern physics courses in the Gillet Hall building that seem to be properly maintained and with the adequate experimentation equipment necessary to fulfill the needs of the respective courses. These facilities are supervised and operated by a full-time staff member.

Areas of concern:

There seems to be no dedicated budget for instructional laboratory supplies that is usually funded from student lab fees. This presents a burden for the maintenance of instructional laboratory equipment when it comes to rapid replacement of expendable supplies (e.g., batteries).

Office space is of the greatest concern, as faculty and staff must share offices in many cases. This jeopardizes intimacy and can constitute an infringement of FERPA rules when meeting with students. The Provost discussed the capital plans of the university, mentioning that the relocation of some units in the college should habilitate additional space to satisfy the needs of the physics department.

Recommendations:

This review committee recommends to:

1. Establish a student lab fee or a dedicated funding line for the daily operations of the instructional labs.

2. Work with the Dean and Provost offices to identify additional space for faculty offices that guarantees individual rooms for each faculty member.