



Department of Physics and Engineering

To: Members of the Academic Senate

From: Bob Haring-Kaye, Chair, Department of Physics and Engineering

Re: Proposed changes to Physics Major requirements

Date: February 1, 2023

Dear Academic Senate members,

The faculty of the Department of Physics and Engineering propose a few changes to the requirements of the Physics Major (BS and BA degrees) in order to better realize our departmental learning objectives, fill gaps in our departmental curricular map, prepare our majors for graduate study, and achieve better alignment with our peer institutions. These proposed changes are the result of considerable discussion among the department faculty as well as a thorough comparison of physics major requirements among several peer institutions. The changes are shown explicitly in the relevant *Westmont Academic Catalog* sections included with this proposal but can be summarized by the following major elements:

- **Replace “One four-unit laboratory science class such as CHM-005 or BIO-005” with CS-010.** This better serves our majors by preparing them for productive undergraduate research as well as for the work they are likely to do following their graduation from Westmont. This trade also results in no net gain or loss of lower-division course credit.
- **Require PHY-170 (Advanced Physics Lab).** A careful assessment of the learning objectives in our physics laboratory curriculum indicates that students currently have difficulty achieving a “capstone” level of development unless they complete this course. This was determined after performing a longitudinal assessment of student learning in our laboratory curriculum utilizing a rubric we designed (see attached documentation) that follows the definitions and conventions of VALUE rubrics provided by the American Association of Colleges and Universities (AAC&U). A closer look at our departmental curriculum map also indicates that nowhere else in our curriculum do we address the skills necessary for students to achieve a capstone level of development in the laboratory environment. Also, such a course in advanced laboratory methods is required at several other peer institutions (see Table 1).
- **Require two units of research (PHY-198) for the BS degree.** This new requirement will better prepare our majors for graduate research and is consistent with the expectations of BS programs in physics at several peer institutions (see Table 1). Two minimum required units seems to be a reasonable expectation given the time investment needed to have productive outcomes. It is also the approximate average required by our peer institutions for the BS degree in physics.

- There are a few other proposed changes to the major requirements that mostly provide added convenience to our students without altering unit totals or faculty teaching loads. In particular, one new course (PHY-152: Advanced Electricity and Magnetism) is included as an additional elective that would fulfill an upper-division requirement from among PHY-142/143 (Circuits and Electronics with Lab) and PHY-151 (Electromagnetic Waves and Optics). This course will enhance the foundation in theoretical physics of our physics majors, providing better preparation for graduate school, and will help us to be competitive with our aspirational peer institutions. Ben Carlson plans to submit a proposal for this new course to Senate soon.
- One additional course (PHY-142/143) has been added to the possible list of courses that would satisfy the upper-division course requirement for the Physics Minor.

Table 1. Comparison of required student research units and an Advanced Physics Lab course for BS programs in Physics at several peer institutions. Note that Point Loma offers a specialized Nuclear Physics Lab in place of a more traditional Advanced Lab experience. Similarly, Harvey Mudd offers an upper-level Optics Lab instead of Advanced Lab. At Wheaton, course credit for research is only required for honors projects.

Institution	Required research units	Advanced Lab requirement
Bethel	3	No
Calvin	0	Yes
Harvey Mudd	2–6	Yes
Messiah	1–3	No
Occidental	4	Yes
Point Loma	4	Yes
Pomona	2	Yes
Seattle Pacific	2	Yes
Taylor	2–4	Yes
UCSB	0	Yes
UC Berkeley	0	Yes
Wheaton	2–4	Yes

Although the second and third bullet points together add a total of 2 units to the requirements for a BS degree in physics (the two courses add 3 units but one unit was removed by modifying the existing requirements as shown in the modified catalog excerpt), we strongly believe that the net gain for our students far outweighs the slight increase in course load. Almost all of our current majors are obtaining course credit for research anyway so in practice only the addition of PHY-170 will be new to their overall load.

These proposed changes also have relatively little impact on our departmental teaching loads. All of our current physics faculty are research active and have recently offered (or are currently offering) at least one unit of PHY-198. The addition of PHY-170 can be handed relatively seamlessly by offering it on alternating years as we do currently with several of our other upper-division courses.

Please let me know if you have any questions or concerns about this proposal. I would be happy to discuss them with you further.

Respectfully,

Robert Haring-Kays