

**CC Report Addendum**  
**MOTION 3: Physics major revision**

**CC Motion 3: Approve revision of the Physics major to include two optional concentrations.**

A minimum of ten courses and units including:

Major Sequence in Physics:

- 1) Physics 105 and 106
- 2) Physics 207, 304, and 399
- 3) Two courses selected from Physics 405, 406, 407, and 408; one of these must come from Physics 405, 406
- 4) Three additional courses and units in physics selected by the student with the consultation and approval of the major adviser/department chair to form a coherent program.

Physics majors have the option of pursuing a concentration in Optics & Photonics or Astrophysics.

A minimum of eleven courses and units including:

Optics & Photonics Concentration:

- 1) Physics 105 and 106
- 2) Physics 207, 304, and 399
- 3) Physics 406
- 4) One course selected from Physics 405, 407 and 408
- 5) Two courses selected from Physics 307, 308, and 317
- 6) Two additional courses and units in physics selected by the student with the consultation and approval of the major adviser/department chair to form a coherent program.

A minimum of eleven courses and units including:

Astrophysics Concentration:

- 1) Physics 105 and 106
- 2) Physics 207, 304, and 399
- 3) Two courses selected from Physics 405, 406, 407 and 408; one of these must come from Physics 405, 406
- 4) One course selected from Physics 307, 308, and 408
- 5) Physics 310
- 6) Physics 370 (Cosmology)
- 7) Two additional courses and units in physics selected by the student with the consultation and approval of the major adviser/department chair to form a coherent program.

The following physics courses will not count towards the major: Physics 101 (General Physics I), Physics 102 (General Physics II), Physics 110 (Fundamental Astronomy), Physics 120 (Energy and Society), Physics 130 (Sound, Music, Hearing), Physics 131 (How Things Work), Physics 210 (Conceptions of the Cosmos), Physics 231 (How Things Work II), Physics 239 (Problems of Nuclear Disarmament), and Physics 397 (Internship).

Courses outside the department that physics majors are recommended to take:  
Two semesters of chemistry or biology

### **Rationale from Prof. DeHarak**

There are three facets of the proposed requirements we would like to address: the number of concentration related courses required, the specific concentration related courses, and the requirement that students pursuing a concentration are required to complete 11 courses/units for the major (i.e., one more course/unit than physics majors not pursuing a concentration).

There are numerous existing physics programs with concentrations in Astrophysics, and a smaller number with concentrations in Optics, or closely related topics. These programs require as few as two (University of Arkansas) to as many as six (The University of Toledo) concentration related courses. In terms of IWU course units, this equates to a range of 2 to 4.75 units. The majority of programs require 3 or 4 courses. We believe that requiring 3 concentration related courses/units falls well within accepted practice.

The specific courses required by existing programs with a concentration in Optics, or Astrophysics is varied. This seems to be a reflection of the specific interests/expertise of each department. However, the common theme is that they offer a course that covers at least a significant portion of the fundamentals for the topic or a significant subfield, and one or more specialized courses. Our proposed Optics & Photonics concentration will require students to take: Two courses from Physics 307 (Optics), Physics 308 (Scientific Imaging), or Physics 311 (Momentum of the Photon). Physics 307 provides a broad overview of optics, including photonics. Physics 308 gives students a basic understanding of geometric optics, and showcases selected topics in the application of optics and imaging science to topics outside of physics. Physics 311 provides an in-depth study of modern optics and photonics. Requiring two of these courses guarantees that students will either get a broad overview of optics, or concentrated study in modern optics. Physics 406 (Electricity & Magnetism). A course that provides an in-depth understanding of the wave-like nature of light at a fundamental level.

For the proposed Astrophysics concentration we will require students to take Physics 310 (Introduction to Astronomy and Astrophysics), which will provide a broad overview of the field. Physics 370 (Ancient Light), which gives students a more in-depth understanding of the large scale structure, the beginnings, and fate of the universe. One course from Physics 307 (Optics), Physics 308 (Scientific Imaging), and Physics 408 (Statistical Physics). The first two of these courses (Optics, and Scientific Imaging) will help students understand the technology, and

some of the techniques, used in observational astronomy. The last of these courses (Statistical Physics) covers topics necessary for understanding a star's life cycle.

The courses for each concentration are consistent with the offerings at other schools.

Students completing one of these two concentrations will be required to take 11 courses for the major, as opposed to the 10 courses required of students that do not complete a concentration. This is being done to ensure that students study a sufficiently broad number of topics within physics, as well as delving deeply into their concentration.