

# PHYSICS

*Program Review, July 2025*

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WILLIAM WOODS  
UNIVERSITY

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# 2024 Program Review (2019-2023)

Physics Minor

## Mission and Introduction

### Introduction

1. Provide an overview of the program and the context of where it's housed within the institution (what department, etc.).
2. Discuss any changes in the focus of the program over the cycle of this review.

#### Narrative:

The physics minor is a standalone minor in the School of Science and Health. It requires 20 credit hours in both math and physics courses with optional courses in chemistry.

### Program Mission Statement

1. What changes has the program made to the mission statement over the course of this cycle?
2. Why were these changes made?
3. Are any revisions planned?

#### Narrative:

The primary objective of the physics program is to help students learn to develop and accurately apply mathematical and analytical processes to descriptions and models of systems in the natural world. This is done through hands-on lab work, original research, and traditional coursework. The skills acquired in this program will prepare students to pursue a wide range of technical, educational, and scientific careers.

While all students are invited to pursue a minor in physics, the program is primarily focused on bolstering the academic achievement and scientific education of biology majors at WWU as they pursue future endeavors. Many (if not most) biology majors at WWU have concentrations in either pre-vet or pre-med and are seeking graduate or professional programs after graduating from WWU. This is a highly competitive field, and students strive to set themselves apart from their peers through superior academic achievement and scholarly endeavors. The pursuit of a physics minor not only provides students with a more robust understanding of the natural world, but it also helps to make them more marketable to potential graduate programs by illustrating advanced abilities in problem solving and the mathematical application to science.

## **Alignment to Institution Mission**

1. How does the mission of the program align with the mission of the institution?

### **Narrative:**

The two largest student groups who decide to minor are pre-Vet and pre-Med students, as these fields benefit from the knowledge they will gain by taking physics courses. Since William Woods is a profession-oriented school, students entering these difficult and competitive professions will have an advantage over their peers from other schools as they enter the workforce or post-graduate education.

## **Service to the University (Contribution to Campus Climate)**

1. What programming and organizational support are offered by the program that benefits the greater student population?
2. Does the program support on-ground/OLC General Education Courses?
3. Highlight any cross listed courses with other programs
4. Highlight any interdisciplinary programming or activities
5. Identify student enrichment programming that could include volunteer opportunities, field trips, workshops... (does not have to be specific to the program, but is beneficial to students on campus)

### **Narrative:**

The physics program offers one Natural Science general education course (PHY 201 - Physics I)

The physics and photography department paired up for a school-funded field trip to view the 2024 total solar eclipse. Dr. Sean Baldrige accompanied 12 students on an all-day excursion into southern Missouri to view and photograph the eclipse.

Dr. Sean Baldrige (Cox Distinguished Professorship in Science) hosted a LEAD event and presentation during the campus research symposium entitled "Astronomy Laboratory Exercises in the Classroom". The talk was held on April 11, 2024, and included work by a photography student.

## **Student Learning Outcomes Assessment and Curriculum**

### **Program Student Learning Outcomes and Results**

1. Describe how these Outcomes (Objectives) pertain to the program's mission. Have any changes been made to these outcomes over the course of this cycle? Why or why not?

2. Describe the extent to which students in the program have met these outcomes. Include a

5-year picture of the student outcomes with corresponding data that reflect the success or struggles in assessment.

**Narrative:**

**Program Objective 1: Students will achieve an advanced understanding and appreciation for the physical laws governing the universe, through conceptual problem solving and laboratory experience.**

Objective 1 aligns with providing students with skills to accurately understand our natural world and analytical problem-solving. Objective 1 focuses primarily on the overall conceptual portions of physics -- the physical laws and how they manifest in the world and in their academic studies.

| Year   | Number of Criteria Met |
|--------|------------------------|
| 2021*  | 2/3 Met                |
| 2022   | 2/3 Met                |
| 2023   | 0/3 Met                |
| 2024   | 3/3 Met                |
| 2025** | 3/3 Met                |

\*/\*\* 2021 and 2025 criteria differ from the middle years

**Program Objective 2: Students will learn to model and simulate complex physical interactions computationally, they will design, construct, and program experimental apparatuses to test theories.**

Objective 2 ensures that students are able to bring the conceptual knowledge of physics gained in the course into real-world applications and experimental endeavors. Experimental abilities include mathematical models of real systems, experimental design, and accurate testing of physical theories.

| Year   | Number of Criteria Met<br><i>(*2025 criteria differ from the other years)</i> |
|--------|---|
| 2021*  | 0/1 Met   |
| 2022   | 2/2 Met   |
| 2023   | 1/2 Met   |
| 2024   | 0/2 Met   |
| 2025** | 1/2 Met   |

\*/\*\* 2021 and 2025 criteria differ from the middle years

**Program Objective 3: Students will develop sophisticated mathematical and numerical skills, allowing them to quantitatively understand and predict the behavior of physical systems.**

Objective 3 ensures that student gain the ability to apply mathematical and quantitative methods to their career endeavors. The ability to problem-solve and break a complex situation into its parts is a beneficial skill in all professions. Applied to concrete systems of known variables (such as physics) allows students to practice their problem-solving and

mathematical skills in a situation with real, verifiable answers.

| Year   | Number of Criteria Met<br>(*2025 criteria differ from the other years) |
|--------|--|
| 2021*  | --   |
| 2022   | 1/1 Met  |
| 2023   | 0/1 Met  |
| 2024   | 1/1 Met  |
| 2025** | 0/2 Met  |

\*/\*\* 2021 and 2025 criteria differ from the middle years

In summary, the three program objectives can be succinctly stated as: Understanding the physical world through conceptual (1), experimental (2), and mathematical (3) methods.

#### Evidence:

- [Physics Annual Assessment 2023-2024](#)
- [Physics Minor 2024-2025 Curriculum and Assessment Findings 2024-2025](#)

#### Assessment Measures

1. Discuss the measures (rubric evaluation - tool used to gather information) you've selected or developed to measure for each Outcome (Objective).
2. Why were these measures chosen?
3. Were any measures or assessment instruments changed over the course of this cycle? Why or why not?
4. Note any action items related to assessment measures that will be changed moving forward due to the review of assessment data.

#### Narrative:

There are three outcomes that are assessed for the physics minor:

**PHY.1 Students will achieve an advanced understanding and appreciation for the physical laws governing the universe, through conceptual problem solving and laboratory experience.**

This outcome is measured in three different courses:

PHY 201 - Students are assessed based on their overall homework score.

PHY 212 - Students are assessed based on their overall homework score.

PHY 315 - Students are assessed based on their average exam scores

Each of these measures were chosen to evaluate the student's ability to problem-solve. Since homework assignments and examinations are primarily word problems pertaining to the relevant material of the unit, this seems a reasonable measure of student ability in this criterion.

**PHY.2 Students will learn to model and simulate complex physical interactions computationally, they will design, construct, and program experimental apparatuses to test theories.**

This outcome is measured in two laboratory courses where students are evaluated based on their submitted lab reports for two specific lab experiments:

PHY 202 - Gravity Lab

PHY 212 - Mirrors

While many of the labs for physics follow the typical "cookbook" style of lab activity where students follow a list of steps that progressively lead them to a pre-determined goal, there is at least one lab each semester where students are expected to think on their own and come up with their own experiments with little to no help in order to solve a problem I have presented. These labs serve as a measure of the PHY.2 outcome and students' abilities to test theories in an unguided environment.

**PHY.3 Students will develop sophisticated mathematical and numerical skills, allowing them to quantitatively understand and predict the behavior of physical systems.**

This outcome is only measured in one course: PHY 315 (Modern Physics) as the capstone course of the minor. If the two-semester introductory courses teach students the basics of physics, then Modern Physics allows them to apply those basic concepts to more complicated systems. This is measured through the student's homework scores. The homework assignments in Modern Physics are more complex and require more critical thinking than the previous courses in physics.

It was found that homework assignments are poor measures for assessment, since students have the ability to use external resources (or copy a friend's work). The measures have since been re-worked for future assessments to better reflect a student's individual ability in a controlled manner. As such, examination scores will be used to measure PHY.1 and PHY.3 moving forward.

**Evidence:**

- [Physics Annual Assessment 2019-2020](#)
- [Physics Annual Assessment 2020-2021](#)
- [Physics Annual Assessment 2021-2022](#)
- [Physics Annual Assessment 2022-2023](#)
- [Physics Annual Assessment 2023-2024](#)
- [Physics Minor\\_ 2024-2025 Curriculum and Assessment Findings\\_ 2024-2025](#)

**Curriculum Map**

1. Highlighting any key or core courses, have any changes been made to this pathway or degree requirements over the course of this cycle? (Upload Program Checklist)
2. Why or why not?
3. Explain how the program sequence of courses is designed and why it is laid out in that way? (scaffolding)

**Narrative:**

The core courses of the physics minor are linear, as each course builds upon the material from the previous, while the required math and/or chemistry courses can be taken at any time.

The three core physics courses are intended to provide students with a broad knowledge of both classical and modern physics concepts at an intermediate level. Classical physics is covered in both Physics I (PHY 201/202) and Physics II (PHY 212/213) where students are introduced to concepts in classical mechanics, thermodynamics, light, optics, electricity, and magnetism. Modern Physics (PHY 315) rounds out their introduction to modern concepts such as relativity, atomic and nuclear physics, and quantum mechanics and challenges their interpretation of classical concepts introduced in the previous two courses.

**Concentrations**

1. If the program has concentrations, please upload the concentration data.
2. Speak to the enrollment distribution of students within the concentrations and any impact on course rotation.
3. Include strategies or processes for retention and recruitment within the concentration.
4. Explain the value of each concentration and how they enhance the skills students need to be successful in the field.

**Narrative:**

N/A

**Course Descriptions**

1. Highlight any changes to course descriptions that have occurred over the identified timeframe. (upload a pdf of the course descriptions)

**Narrative:**

No courses have changed their course descriptions in the past 5 years.

**Curriculum Delivery**

1. Does online enrollment impact enrollment in the campus enrollment?
2. If the program has an online component, explain how the program coordinates schedules and curriculum between the two modalities.

**Narrative:**

The physics minor is completely offered on-ground to traditional students. None of the courses required for the minor in physics have online counterparts.

## Participation in Assessment

1. Discuss faculty participation in program assessment
2. How involved are faculty and what is their responsibility for the assessment of the program.

### Narrative:

N/A. There is only one faculty member in the program, and therefore 100% handled by one person.

## Action Items and Use of Results

1. Summarize or highlight action items taken as a result of program's assessment results.
2. How have the results driven improvement over the course of this cycle?

### Narrative:

No action items need to be highlighted at this time in the new system, as they are new. They will be evaluated on future program reviews.

### Evidence:

- [Physics Minor\\_2024-2025 Curriculum and Assessment Findings\\_2024-2025](#)

## General Education

1. • How does program coursework expand on the skills learned in General Education curriculum?

### Narrative:

The introductory physics courses build heavily on the Tier I General Education categories of mathematics and natural science, as students are expected to be able to use those skills to interpret physical laws and perform calculations on real circumstances. The physics laboratory work builds upon the Tier II General Education category of Inquiry and Analysis as students are often presented with a problem that requires students to form an educated hypothesis, gather evidence, and make an informed conclusion based on their results. They often need to revisit their original hypothesis or evaluate their experimental process.

Lastly, Modern Physics is taught from a quasi-historical framework in order to illustrate how the concepts of relativity and quantum mechanics fit into the history of physics at the beginning of the 20th century and how those advancements in knowledge propel our society into a nuclear age and radically advanced our understanding of both the atomic and cosmological universe.

# Faculty Qualifications, Activities and Scholarship

## Faculty Specialization

1. Discuss the scholarship and research content of the faculty in the program, being sure what their specialization brings to the program.
2. Explain the core features of the program based on the current faculty.
3. How could the program be expanded (new courses, areas of specialization, etc.)?
4. How might additional instructional members allow the program to expand and/or change the focus of the program curriculum?

### **Narrative:**

The only faculty member in the physics minor program is Dr. Sean Baldrige, who specializes in observational astrophysics and holds a PhD in Physics from the University of Missouri (2017). His expertise in astrophysics, which encompasses a wide range of physics, astronomy, and chemistry concepts, allows him to teach various courses and topics related to both physics and astronomy.

Despite the faculty's desire to teach more advanced astrophysics courses, the standalone minor is a very small program that serves only a handful of students, there is no drive to expand.

With the employment of a second physics professor to take on some of the teaching load, it would be possible to start an astronomy major at William Woods University. If a new program offering an astronomy major were created, it would be the only one of its kind in the state of Missouri.

## Faculty Awards and Honors

1. Discuss and highlight awards and honors received by faculty over the course of the cycle.

### **Narrative:**

Dr. Baldrige was awarded the Cox Distinguished Professor in Science in 2023.

## Faculty Workload

1. Summarize the workload and responsibilities of faculty.
2. What actions are you taking to avoid faculty overload?
3. % of course load is taught by program faculty vs adjunct

4. % of courses covered by full time faculty

5. % of courses covered through faculty overload

**Narrative:**

The physics faculty member is currently serving as the Dean of the College of Science and Health in addition to his teaching duties and receives a 3-contact hour release due to the appointment.

His teaching load consists of (on average) 15 contact hours in both the spring and fall, spread between physics and general education science courses (Earth Science, Astronomy, and Foundations).

100% of courses in the program are taught by full-time faculty. Modern Physics is typically taught as an overload (and often tutorial).

## **Program Data: Student Experience**

### **Enrollment and Recruitment**

1. What are the trends with enrollment in this program over the course of the review cycle?
2. How does this compare to institutional trends or similar programs on campus?
3. Describe recruitment efforts or goals such as increased enrollment or diversity.
4. Have these initiatives been successful?

**Narrative:**

Between 2020 and 2023, the enrollment in Modern Physics (the capstone course of the minor) was strong, with a peak of 9 students enrolled in 2020. The biology program, whose overall enrollment has remained steady, is the primary pool of students who pursue the physics minor, so it tracks that these numbers did not deviate significantly over the time span.

**Evidence:**

- [Physics Course Enrollment](#)

### **Retention**

1. Has student retention remained in an acceptable range over the course of the review cycle?
2. What strategies are program faculty using to raise retention rates within the program?

## Narrative:

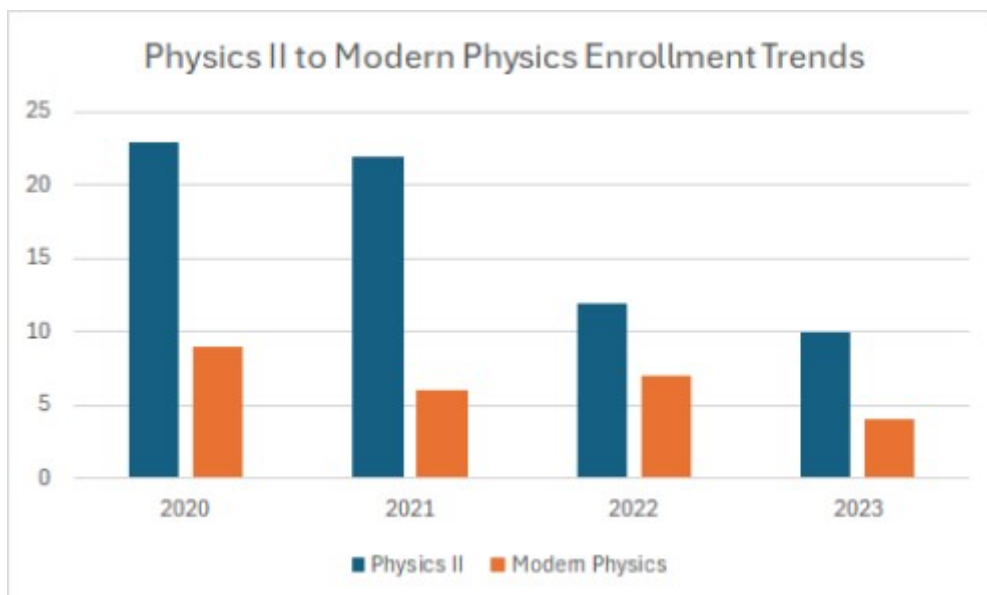
Either students take an extra course beyond the required Physics II (BIO and EXS majors), or they do not. There is no retention data.

## Curriculum/Course Retention and Success

1. Describe enrollment trends in the courses within the program. (upload course enrollment spreadsheet)
2. Reflect on the success of the students within the courses over the designated time frame.
  - Highlight some completion or withdrawal and failure rates in the core courses.
  - Were these in line with expectations? (we will need to provide this data)
3. For programs with dual modalities, reflect on the success of students within the courses over the designated time frame.
  - Highlight some completion or withdrawal and failure rates in the core courses.
  - Were these in line with expectations? (we will need to provide this data)

## Narrative:

The only course in the program that is exclusive to the program is PHY 315, so it serves as the enrollment marker for physics minors. Since students are required to take Physics II (PHY 212) prior to PHY 315, it serves as a baseline for students eligible to earn the minor. As seen in the chart below, over the time period of 2020-2023, the overall enrollment in Modern Physics stayed roughly the same despite the drop in enrollment in Physics II.



## Evidence:

- [Physics Course Enrollment](#)

## Completion

1. How many students are graduating from the program?  
Have the completion rates been in line with expectations?
2. Describe findings resulting from exit surveys or program alumni surveys that were conducted over the course of the cycle. (programs will need to do annual exit surveys to capture this data)

### Narrative:

N/A

## Course Evaluation Data

1. What were some positive and negative feedback received from students who completed the courses?
2. Highlight any trends or insights that came from course evaluations over the course of the cycle. (data will have to be available)

### Narrative:

Overall, student feedback for physics courses is very positive. 7/8 student evaluation questions were rated above the university average. The lowest score was in "The instructor graded assignments in a timely fashion and provided feedback that was helpful to me", at an average of 4.03/5.00. This signifies that graded work was returned slowly and should be addressed in future cycles.

### Evidence:

- [Physics Minor](#)

## Student Advising

1. Describe the advising process for your program?
2. What strategies and structures are in place to facilitate a successful advising period?
3. What is the optimal ratio of advisees to adviser for the program?
4. Explain any other processes to increase the effectiveness of the current advising procedure.

### Narrative:

Students are advised into the physics minor by their program advisors in Biology and Exercise Science (primarily). The physics minor has no dedicated advisors for the program.

## **Student Awards and Achievements**

1. Highlight the accomplishments and external honors received by students in the program over the course of this cycle.

### **Narrative:**

N/A

## **Clubs and Co-Curricular**

1. Does your program support any clubs and co-curricular activities that contribute to positive student experiences?

2. How does this contribute to the program?

3. To the campus experience of students?

### **Narrative:**

N/A

## **Program Analysis**

### **SWOT Analysis**

1. Strengths, Weaknesses, Opportunities, and Threats.

### **Narrative:**

#### **Strengths:**

The physics minor serves to prepare our most motivated students in the biology and exercise science programs to bolster their academic ability and understanding of the natural world. Students who pursue the minor enjoy the program and have even opted to take more courses in physics that are elective.

#### **Weaknesses:**

The physics minor is not a popular program, with only a small percentage of eligible students out of an already small pool of students who decide to pursue it. As such, the capstone course (Modern Physics) is only taken by a handful of students each year.

#### **Opportunities:**

If a push to increase our pre-vet and pre-med enrollment is achieved, this will hopefully increase the number of students who choose to pursue the minor.

#### **Threats:**

The change from a minimum of 5 to 8 students necessary for a class to "make" is a significant danger to a course like Modern Physics, which has rarely come close to having 8 students enrolled. This forces the instructor to teach it on tutorial.

## Campus Facility and Resources

1. Provide an analysis on how adequate the spaces that are most used by the program on campus (laboratories, office space, classrooms/LMS, etc.).
2. Please discuss any updates or modifications to the facility or resources available to the program that have impacted student learning.
3. Recommendations to Improve Facilities and Resources

### Narrative:

All physics instruction takes place in the Cox Science and Language Building. Room 104 is typically reserved for physics lecture courses (unless the class is too large) and includes a large TV in place of a projector. This was installed after the failure of a SMART board at the request of the physics faculty member. When enrollment is over 20, Cox 300 is utilized for physics lectures.

There is also a small physics lab (Room 106) serving the laboratory component of the physics courses. It is a student-oriented laboratory and not a research-oriented laboratory. All instruments and apparatus are designed with education and instruction in mind. In the physics lab (Cox 106), there are 4 physical desktop computers maintained by UIT that possess the software required to perform physics labs. All lab apparatuses are kept in duplicates of 4 to accommodate that number of lab groups simultaneously.

While the lecture space in Cox 104 is adequate, the lab space in Cox 106 could have several revisions to better utilize the space. Currently, two walls are lined with lab counters, which include inoperable sinks/faucets. These are not utilized at all in the physics labs, and if removed, would free up space in the room. Furthermore, there is no space for an instructor's desk. It is also recommended to add a screen (TV or projector) to the room for lab presentations.

## Library Report

\* Upload the Library report provided by the University Library

1. Please describe the usage of library resources.
2. How do faculty and students feel the library meets the program's needs?

### Narrative:

N/A

### Evidence:

- [Collection Analysis--Physics 2025](#)

## Cost Analysis

1. What was the annual budget for the program for the past 5 years?
2. How was the budget spent? (breakdown of budget expenses)

**Narrative:**

The budget of the physics program is \$1500 annually. This is primarily used to keep the physics lab updated and operational.

Some sample items bought with the budget over the last 5 years (all items are related to conducting instructional labs):

- Photogates
- Microphones
- Optical Mirrors
- Lasers
- Spectrometers
- Electronics Components
- Watt-Meters
- Force Platform

**Specialty Accreditation**

Does the program hold specialty accreditation?

If yes, please include the name of the accrediting body and upload the most recent accreditation letter. (description of the data points – describe the accreditation cycle– identify any points of concern noted on the most recent accreditation)

**Narrative:**

N/A

**Industry and Program Trends**

**Analysis of the Discipline**

1. Provide context for the status of the discipline today.
2. What are some emerging trends in this discipline across the country?
3. What is happening in the industries related to this discipline?

**Narrative:**

N/A

**Comparison to Similar Programs at Peer Institutions**

1. Identify and discuss how similar programs compare to your program in terms of size, curriculum and any relevant attributes.

**Narrative:**

Compared to similar colleges, our physics minor is less rigorous regarding advanced physics courses. For instance, Westminster offers a comparable physics minor in terms of credits but requires more physics courses and fewer math courses.

The idea of enhancing the physics minor by adding more physics courses and eliminating the calculus requirement has been considered multiple times. However, from a student's perspective, this change could make obtaining the minor more challenging. Many students already take calculus as part of their primary program. While adding more physics courses would improve the rigor to match industry standards, it is likely to lead to a decrease in the number of students choosing to pursue the minor.

**Evidence:**

- [2024-2025 Physics Minor \(Westminster\)](#)

**Senior Exit Surveys**

1. What were some positive and negative feedback received from students as they complete their degrees?
2. Highlight any trends or insights that came from exit surveys over the course of the cycle.

**Narrative:**

N/A

**Graduate/Alumni Feedback on the Program**

1. What were some positive and negative feedback received from alumni?
2. Highlight any trends or insights that came from alumni feedback over the course of the cycle.

**Narrative:**

N/A

**Recommendations from Previous Program Reviews**

1. Summarize recommendations from previous PRs, describe how those recommendations were applied throughout this cycle.

**Narrative:**

The last program review recommended adding a 3xx or 4xx rotational topic course to add flexibility to the program. This has since been completed and should be available in next year's catalog.

## Industry Relevance and Employment

1. How do your student learning outcomes align with industry needs?

### Narrative:

N/A

## Employment Outlook

1. Describe employment outlook for the degree.

2. What types of employment would constitute working "in the field?"

3. Are there changes to program offerings and activities that would improve the employment outlook for graduates?

### Narrative:

N/A

## Academic Council Review

### Academic Council Response

Academic Council will review the report in its entirety and come together to discuss any remaining questions or concerns. The council will highlight noted areas of improvement for program focus. Issues of resources are discussed if additional resources are needed to implement improvements noted by the Reviewer, the faculty or Academic Council.

### Narrative:

AC Review of Physics:

Strengths:

- The program provided evidence of interdisciplinary/student enrichment type activities i.e. the Eclipse Photography project.
- The program report provided insight as to the rigor of the program which helps to connect to what is happening in industry. This shows the forward thinking of how to keep our students competitive in the field.
- The report clearly lays out the place of the program in the larger University ecosystem; it is clear-eyed, and the program seems to suit that purpose well.
- The curriculum map was well explained, as was the relationship with the general education curriculum.

## Challenges:

- The program has some inconsistencies in assessment – due to faculty transitions but seems to be on the right track moving forward. But some assessment measures are not following best practice. The program should evaluate the approach to using average homework scores for assessment as this includes variables outside the desired objective. The report highlights this concern as well.
- Service to the University seems underdeveloped. It doesn't speak to some of the questions.
- There is no external review for a stand-alone minor, so it is difficult to obtain an outside view on how to improve the program.
- It is worth additional explanation to understand how taking one additional course allows students to earn a minor, and that this additional course can constitute a minor for a pre-med or pre-vet student. Retention and recruitment - more students opt not to take the additional course.
- Recruitment – it seems that the only minors are also majors in Biology, but there could be majors in other departments that would benefit from a minor in Physics. Maybe there is room to connect with additional majors?

## Action Items:

- If a pre-med, pre-vet, or EXS student can take just one additional physics class to earn a minor, does this equal (or is equivalent to) a physics minor from other colleges/universities? Partner with an engineering school - work with strategic partnerships.
- Review of the curriculum to see if there is a way to make physics open to students outside of the biology program. Are there ways to attract other students to the course of study?
- Identify additional activities (like the eclipse) that could engage more students and potentially interest them in the minor. Physics/Astronomy is something that a lot of people find interesting but are intimidated by the difficulty of the work. Some fun/educational events might help to promote the minor and reduce the fear of the work.
- Identify ways that Cox 106 could be a more functional classroom?
- Explore potential of coordinating activities with Westminster?
- The class size of upper-level courses continues to be an issue and the increased numbers with biology pre-vet/pre-med help with that, but this is a concern across campus. It is valuable to note the impact of repeated tutorials on the curriculum and student experience.