

# BACHELOR OF ARTS

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The laws of physics are the starting point for most scientific research and engineering applications. Students majoring in physics obtain broad-based knowledge and expertise applying these laws, as well as hands-on experience building electronic equipment and performing experiments, allowing them to pursue a wide range of educational and employment opportunities after graduation.

## About this Program

- **College:** Liberal Arts and Sciences (<http://catalog.ufl.edu/UGRD/colleges-schools/UGLAS/>)
- **Degrees:** Bachelor of Arts (p. 1) | Bachelor of Science ([http://catalog.ufl.edu/UGRD/colleges-schools/UGLAS/PS\\_BA\\_BS/PS\\_BS/](http://catalog.ufl.edu/UGRD/colleges-schools/UGLAS/PS_BA_BS/PS_BS/))
- **Specializations:** Medical Physics (BS) ([http://catalog.ufl.edu/UGRD/colleges-schools/UGLAS/PS\\_BA\\_BS/PS\\_BS03/](http://catalog.ufl.edu/UGRD/colleges-schools/UGLAS/PS_BA_BS/PS_BS03/)) | Nanoscience (BS) ([http://catalog.ufl.edu/UGRD/colleges-schools/UGLAS/PS\\_BA\\_BS/PS\\_BS02/](http://catalog.ufl.edu/UGRD/colleges-schools/UGLAS/PS_BA_BS/PS_BS02/)) | Optics (BS) ([http://catalog.ufl.edu/UGRD/colleges-schools/UGLAS/PS\\_BA\\_BS/PS\\_BS01/](http://catalog.ufl.edu/UGRD/colleges-schools/UGLAS/PS_BA_BS/PS_BS01/))
- **Credits for Degree:** 120
- **Contact:** Email ([advising@phys.ufl.edu?Subject=Physics%20Major](mailto:advising@phys.ufl.edu?Subject=Physics%20Major))
- **More Info**

*To graduate with this major, students must complete all university, college, and major requirements.*

## Department Information

The Department of Physics is making strides toward becoming one of the premier physics departments in the United States. With active groups in astrophysics, biological physics, condensed matter/materials physics, and elementary particle physics, undergraduate and graduate students participate in cutting-edge research that prepares them for successful careers in a wide variety of fields.

**Website** (<https://www.phys.ufl.edu/wp/>)

## CONTACT

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## Curriculum

- Combination Degrees
- Physics
- Physics Minor

A physics major provides a wide range of career options. Many students pursue further studies in physics, other scientific disciplines, and various branches of engineering and medicine. Professional physicists work in universities and government laboratories seeking answers to fundamental questions about nature, in industry leading the development of new technologies, and in the medical sector performing clinical service and research. The analytical, problem-solving, and communications skills acquired by physics majors also lead to career opportunities in business and finance.

The Department of Physics offers two undergraduate degree programs: The Bachelor of Science (B.S.) is intended for students who wish to pursue graduate study in physics as well as for other students with a deep interest in the subject. The Bachelor of Arts (B.A.) is intended for students who seek the benefits of a physics degree but desire greater flexibility to follow interests in other fields.

## Bachelor of Arts

The B.A. degree program is for students who want to major in physics but are not presently contemplating graduate studies in physics. It provides a good foundation in the fundamentals while offering increased flexibility in the major, through fewer required courses and more electives, and opportunity for parallel studies in another discipline and/or preprofessional studies.

## Bachelor of Science

The B.S. degree program is intended for students planning to do graduate work in physics or related science and engineering disciplines. The B.S. requires a minimum of 41 credits in Physics plus 28 credits of related coursework. Minimum grades of C are required for coursework counted toward the major.

In addition to the Physics BA and BS degrees, there are three optional specializations for the Physics BS degree. Each specialization consists of a specific choice of the 4000 level Physics elective plus three courses in other departments.

## Medical Physics

Medical physics applies the principles and experimental techniques of physics to medical problems. A common example is the use of different forms of radiation in medical diagnosis and treatment. This specialization will help prepare students for a graduate program in medical physics.

## Nanoscience

Nanoscience is the study of extremely small things – only 10 to 100 atoms wide. It is an interdisciplinary field involving physics, chemistry, and many engineering disciplines. This specialization helps prepare students for careers in industry and graduate school in engineering as well as physics.

## Optics

There are applications of optics and photonics in consumer equipment, telecommunications, medicine, construction, aviation, and many more fields. This broad field involves both physics and engineering. The optics specialization will prepare students for graduate programs in optics as well as employment in industry.

## Coursework for the Major

Coursework for the major will depend upon the degree program chosen.

Courses for the B.S. or B.A. degree include four pairs of alternative courses:

| Code                    | Title   | Credits |
|-------------------------|---|---------|
| PHY 2048<br>or PHY 2060 | Physics with Calculus 1<br>Enriched Physics with Calculus 1 | 3       |
| PHY 2049<br>or PHY 2061 | Physics with Calculus 2<br>Enriched Physics with Calculus 2 | 3       |
| PHY 3101<br>or PHY 3063 | Introduction to Modern Physics<br>Enriched Modern Physics   | 3       |
| PHY 3221<br>or PHZ 3113 | Mechanics 1<br>Introduction to Theoretical Physics          | 3       |

In each case, the second course includes selected advanced topics not covered in the first. While both courses prepare students for upper-level physics classes, students should see a department advisor to determine which course meets their needs.

Required coursework for each degree can be found below in the Critical Tracking section. Transfer students must take a minimum of 15 credits of required physics courses at UF.

## Course Details

Several courses meet the criteria for the general education physical sciences (P) requirement. Some mathematical training (indicated in parentheses) is desirable or required for many of these courses. Of the courses below, only PHY 2048/PHY 2049 count toward the major.

| Code  | Title  | Credits |
|---|--|---------|
| MET 1010  | Introduction to Weather and Climate                    | 3       |
| PHY 1033C   | Discovering Physics                                    | 3       |
| PHY 2020  | Introduction to Principles of Physics <sup>1</sup>     | 3       |
| Select one general physics sequence: <sup>2</sup> |  | 6-8     |
| PHY 2004<br>& PHY 2005                            | Applied Physics 1<br>and Applied Physics 2             |         |
| PHY 2048<br>& PHY 2049                            | Physics with Calculus 1<br>and Physics with Calculus 2 |         |
| PHY 2053<br>& PHY 2054                            | Physics 1<br>and Physics 2                             |         |

<sup>1</sup> MAC 1147 provides mathematical training desirable or required for this course.

<sup>2</sup> Students should check the prerequisites carefully before enrolling in a general physics course.

## Placement

Students with Advanced Placement credit should consult the catalog's Academic Advising section for course equivalencies. Sequences for advanced students are available from any physics advisor or the department website.

## Research

All undergraduate majors are encouraged to participate in research activities. Many physics majors participate in research during the academic year and/or through summer research programs. Advanced students may also be eligible to enroll in certain graduate courses, thereby accelerating their education. Physics majors are urged to confer with a department advisor as early as possible and especially as their educational goals evolve.

## Bachelor of Arts

The B.A. degree program is for students who want to major in physics but are not presently contemplating graduate studies in physics. It provides a good foundation in the fundamentals while offering increased flexibility in the major, through fewer required courses and more electives, and opportunity for parallel studies in another discipline and/or preprofessional studies.

The B.A. requires a minimum of 32 credit hours in physics plus 25 credits of related coursework. Minimum grades of C are required for coursework counted toward the major.

### Required Coursework

| Code  | Title   | Credits   |
|---|---|-----------|
| PHY 2048<br>or PHY 2060   | Physics with Calculus 1<br>Enriched Physics with Calculus 1 | 3         |
| PHY 2048L   | Laboratory for Physics with Calculus 1                      | 1         |
| PHY 2049<br>or PHY 2061   | Physics with Calculus 2<br>Enriched Physics with Calculus 2 | 3         |
| PHY 2049L   | Laboratory for Physics with Calculus 2                      | 1         |
| PHY 3101<br>or PHY 3063   | Introduction to Modern Physics<br>Enriched Modern Physics   | 3         |
| PHY 3221<br>or PHZ 3113   | Mechanics 1<br>Introduction to Theoretical Physics          | 3         |
| PHY 3323  | Electromagnetism 1  | 3         |
| PHY 3513  | Thermal Physics 1   | 3         |
| PHY 4604  | Introductory Quantum Mechanics 1                            | 3         |
| PHY 4802L<br>or PHY 4803L   | Laboratory Physics 1<br>Laboratory Physics 2                | 3         |
| 4000-level or higher physics courses that are included in the physics major curriculum (minimum) <sup>1</sup> |   | 6         |
| <b>Total Credits</b>  |   | <b>32</b> |

<sup>1</sup> PHY 4905 and PHY 4911 are not acceptable for this requirement.

### Related Coursework

| Code   | Title                             | Credits |
|--|-----------------------------------|---------|
| MAC 2311                                     | Analytic Geometry and Calculus 1  | 4       |
| MAC 2312                                     | Analytic Geometry and Calculus 2  | 4       |
| MAC 2313                                     | Analytic Geometry and Calculus 3  | 4       |
| CHM 2045                                     | General Chemistry 1               | 3       |
| CHM 2046                                     | General Chemistry 2               | 3       |
| CHM 2045L                                    | General Chemistry 1 Laboratory    | 1       |
| MAP 2302                                     | Elementary Differential Equations | 3       |
| Approved math courses (minimum) <sup>1</sup> |                                   | 3       |

<sup>1</sup> Select a course beyond MAP 2302. Certain computer science courses may substitute for the math elective.

### Critical Tracking

Critical Tracking records each student's progress in courses that are required for progress toward each major. Please note the critical-tracking requirements below on a per-semester basis.

For degree requirements outside of the major, refer to CLAS Degree Requirements: Structure of a CLAS Degree (<http://catalog.ufl.edu/UGRD/colleges-schools/UGLAS/#degreerequirementstext>).

Equivalent critical-tracking courses as determined by the State of Florida Common Course Prerequisites (<http://www.flvc.org/cpp/displayRecord.jsp?cip=400801&track=01>) may be used for transfer students.

## Semester 1

- Complete CHM 1025 or CHM 2045; or PHY 2048 or PHY 2060; and a MAC course with minimum grades of C
- 2.0 UF GPA required

## Semester 2

- Complete CHM 2045/CHM 2045L and MAC 2311 with minimum grades of C
- 2.0 UF GPA required

## Semester 3

- Complete CHM 2046, MAC 2312, and PHY 2048 or PHY 2060 with minimum grades of C
- 2.0 UF GPA required

## Semester 4

- Complete MAC 2313; and PHY 2049 or PHY 2061 with minimum grades of C
- 2.5 critical-tracking GPA required
- 2.0 UF GPA required

## Semester 5

- Complete MAP 2302 with a minimum grade of C
- Complete 2 required 3000-level physics courses with minimum grades of C
- 2.5 critical-tracking GPA
- 2.0 UF GPA required

## Semester 6

- Complete the remaining required 3000-level physics courses with minimum grades of C
- 2.0 UF GPA required

## Semester 7

- Complete 2 required 4000-level physics courses with minimum grades of C
- 2.0 UF GPA required

## Semester 8

- Complete the remaining required 4000-level physics courses with minimum grades of C
- 2.0 UF GPA required

### Model Semester Plan

This plan is structured for students taking Calculus 1 the first semester. Students can have different schedules when they enter UF because of their backgrounds. In particular, students are encouraged to take Physics with Calculus 1 (PHY 2048 or PHY 2060) as soon as they have completed Calculus 1, even if this means delaying chemistry. For all physics courses, adequate mathematical preparation is essential and is built into the suggested plans. Physics majors should meet with a department advisor before planning their schedules.

Additional sample schedules are available on the department's website.

More Info (<http://www.phys.ufl.edu/academics/undergraduate/degrees.shtml/>)

Students are expected to complete the writing requirement while in the process of taking the courses below. Students are also expected to complete the general education international (GE-N) and diversity (GE-D) requirements concurrently with another general education requirement (typically, GE-C, H, or S). MAC 2312, MAC 2313, MAP 2302, and math electives count towards 3000 level or above electives outside of the major.

To remain on track, students must complete the appropriate critical-tracking courses, which appear in bold. These courses must be completed by the terms as listed above in the Critical Tracking criteria.

*This semester plan represents an example progression through the major. Actual courses and course order may be different depending on the student's academic record and scheduling availability of courses. Prerequisites still apply.*

| Course   | Title  | Credits      |
|--|--|--------------|
| <b>Semester One</b>  |  |              |
| CHM 2045<br>& 2045L  | General Chemistry 1<br>and General Chemistry 1 Laboratory ( <b>Critical Tracking</b> ; State Core Gen Ed Physical Sciences)<br>1 | 4            |
| MAC 2311   | Analytic Geometry and Calculus 1 ( <b>Critical Tracking</b> ; State Core Gen Ed Mathematics) <sup>1</sup>                        | 4            |
| State Core Gen Ed Composition ( <a href="http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext">http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext</a> ); Writing Requirement |  | 3            |
| State Core Gen Ed Social and Behavioral Sciences ( <a href="http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext">http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext</a> )   |  | 3            |
| <b>Credits</b>   |  | <b>14</b>    |
| <b>Semester Two</b>  |  |              |
| Quest 1 (Gen Ed Humanities)  |  | 3            |
| CHM 2046   | General Chemistry 2 ( <b>Critical Tracking</b> ; Gen Ed Physical Sciences) <sup>1</sup>  | 3            |
| MAC 2312   | Analytic Geometry and Calculus 2 ( <b>Critical Tracking</b> ; Gen Ed Mathematics) <sup>1</sup>                                   | 4            |
| Select one:  |  | 3            |
| PHY 2048   | Physics with Calculus 1 ( <b>Critical Tracking</b> ) <sup>1</sup>  |              |
| PHY 2060   | Enriched Physics with Calculus 1 ( <b>Critical Tracking</b> ; Gen Ed Physical Sciences) <sup>1</sup>                             |              |
| PHY 2048L  | Laboratory for Physics with Calculus 1 (Gen Ed Physical Sciences)  | 1            |
| Elective   |  | 2            |
| <b>Credits</b>   |  | <b>16</b>    |
| <b>Semester Three</b>  |  |              |
| Quest 2 (Gen Ed Biological Sciences or Social and Behavioral Sciences)   |  | 3            |
| MAC 2313   | Analytic Geometry and Calculus 3 ( <b>Critical Tracking</b> ; Gen Ed Mathematics) <sup>1</sup>                                   | 4            |
| Select one:  |  | 3            |
| PHY 2049   | Physics with Calculus 2 ( <b>Critical Tracking</b> ) <sup>1</sup>  |              |
| PHY 2061   | Enriched Physics with Calculus 2 ( <b>Critical Tracking</b> ; Gen Ed Physical Sciences) <sup>1</sup>                             |              |
| PHY 2049L  | Laboratory for Physics with Calculus 2 (Gen Ed Physical Sciences)  | 1            |
| Foreign language   |  | 4-5          |
| <b>Credits</b>   |  | <b>15-16</b> |
| <b>Semester Four</b>   |  |              |
| MAP 2302   | Elementary Differential Equations ( <b>Critical Tracking</b> ; Gen Ed Mathematics) <sup>1</sup>                                  | 3            |
| PHY 3101   | Introduction to Modern Physics (Gen Ed Physical Sciences)  | 3            |
| Gen Ed Biological Sciences   |  | 3            |
| Foreign language   |  | 3-5          |
| State Core Gen Ed Humanities ( <a href="http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext">http://catalog.ufl.edu/UGRD/academic-programs/general-education/#genedcoursestext</a> )                       |  | 3            |
| <b>Credits</b>   |  | <b>15-17</b> |
| <b>Semester Five</b>   |  |              |
| PHY 3221   | Mechanics 1 ( <b>Critical Tracking</b> ; Gen Ed Physical Sciences) <sup>1</sup>  | 3            |
| PHY 3513   | Thermal Physics 1 ( <b>Critical Tracking</b> ; Gen Ed Physical Sciences) <sup>1</sup>  | 3            |
| Gen Ed Biological Sciences or Social and Behavioral Sciences (area NOT taken in semester 3)  |  | 3            |
| Mathematics elective   |  | 3            |
| Elective, or foreign language if 4-3-3 option  |  | 3            |
| <b>Credits</b>   |  | <b>15</b>    |
| <b>Semester Six</b>  |  |              |
| PHY 3323   | Electromagnetism 1 ( <b>Critical Tracking</b> ; Gen Ed Physical Sciences) <sup>1</sup>   | 3            |
| ENC 3254   | Professional Writing in the Discipline (Recommended; Gen Ed Composition; Writing Requirement)                                    | 3            |
| Physics elective ( <b>Critical Tracking</b> ; 4000 level or higher) <sup>1</sup>   |  | 3            |
| Gen Ed Humanities  |  | 3            |
| Elective   |  | 3            |
| <b>Credits</b>   |  | <b>15</b>    |
| <b>Semester Seven</b>  |  |              |
| PHY 4604   | Introductory Quantum Mechanics 1 ( <b>Critical Tracking</b> ; Gen Ed Physical Sciences) <sup>1</sup>                             | 3            |
| PHY 4802L  | Laboratory Physics 1 ( <b>Critical Tracking</b> ) <sup>1</sup>   | 3            |
| Gen Ed Social and Behavioral Sciences  |  | 3            |
| Electives (3000 level or higher, outside major)  |  | 7            |
| <b>Credits</b>   |  | <b>16</b>    |
| <b>Semester Eight</b>  |  |              |
| Physics elective ( <b>Critical Tracking</b> ; 4000 level or higher) <sup>1</sup>   |  | 3            |

|           |                      |            |
|-----------|----------------------|------------|
| Electives |                      | 11         |
|           | <b>Credits</b>       | <b>14</b>  |
|           | <b>Total Credits</b> | <b>120</b> |

<sup>1</sup> Minimum grade of C required.

### Academic Learning Compact

The laws of physics are the starting point for most scientific research and engineering applications. Students majoring in physics obtain broad-based knowledge and experience applying these laws as well as hands-on experience building electronic equipment and performing experiments. Many students go on to graduate study in physics, and a considerable number pursue advanced degrees in other science disciplines, all branches of engineering and medical school. Physics majors are employed in industry doing applied work and in academia seeking the answers to fundamental questions.

## Before Graduating Students Must

- Pass the UF physics field test, which consists of five parts. One part is given in each of these required courses:

| Code                    | Title   | Credits |
|-------------------------|---|---------|
| PHY 2060<br>or PHY 3221 | Enriched Physics with Calculus 1<br>Mechanics 1 | 3       |
| PHY 3323                | Electromagnetism 1                              | 3       |
| PHY 3513                | Thermal Physics 1                               | 3       |
| PHY 4604                | Introductory Quantum Mechanics 1                | 3       |
| PHY 4802L               | Laboratory Physics 1                            | 3       |

- Complete requirements for the baccalaureate degree, as determined by faculty.

## Students in the Major Will Learn to

### Student Learning Outcomes (SLOs)

#### Content

- Identify, define and describe the core fields of physics: classical mechanics, electricity and magnetism, thermal physics and quantum mechanics.
- Identify, define and explain experimental physics and data analysis.

#### Critical Thinking

- Formulate, solve problems and draw conclusions from data.

#### Communication

- Effectively and clearly communicate ideas in speech and in writing in an accepted style.

## Curriculum Map

*I = Introduced; R = Reinforced; A = Assessed*

| Courses              | SLO 1 | SLO 2 | SLO 3 | SLO 4 |
|----------------------|-------|-------|-------|-------|
| PHY 2048 or PHY 2060 | I     |       | I     |       |
| PHY 2048L            | I     | I     | I     | I     |
| PHY 2049 or PHY 2061 | I     |       | I     |       |
| PHY 2049L            | I     | I     | I     | I     |
| PHY 3101 or PHY 3063 | I, R  |       | I, R  | R     |
| PHY 3221 or PHZ 3113 | R, A  |       | R, A  | R     |
| PHY 3323             | R, A  |       | R, A  | R     |
| PHY 3513             | R, A  |       | R, A  | R     |
| PHY 4604             | R, A  |       | R, A  | R     |
| PHY 4802L            | R, A  | R, A  | R, A  | R, A  |

## Assessment Types

- Field test
- Report
- Presentation