PHYSICS, B.A.

WELCOME TO THE UW-MADISON DEPARTMENT OF PHYSICS

We have a long history of providing our students with a great educational experience. Our physics department awarded its first Ph.D. in 1899. Since then, our students have earned degrees in virtually every area of physics, and our faculty have played key roles in a myriad of important research efforts.

Physics is the science of the properties of matter, radiation, and energy in all forms. As such, it is the most fundamental of the sciences. It provides the underlying framework for the other physical sciences and engineering and for understanding physical processes in biological and environmental sciences.

CHOOSE TO BE A PHYSICS MAJOR

WHY STUDY PHYSICS?

• Intellectual Satisfaction. First, and foremost, physics satisfies our deep desire to understand how the universe works. Physics is interesting.

• Intellectual Challenge. By striving for fundamental understanding, the physicist accepts the challenge to move past a merely descriptive approach of our world and probes deeply into how and why it works.

• Physics Produces New Technology. Today’s esoteric physics research will become tomorrow’s technological advances.

• Technical Expertise. Physicists exploit forefront technologies in their pursuits.

• Flexibility. In a fast-paced and changing world, it is much more important to have a broad substantive education than to be trained in a specific skill. We teach people how to think, and how to apply and extend what they know to new types of problems.

• Physics is Analytical and Quantitative. People who can reason analytically and quantitatively are essential for the success of almost any pursuit.

A degree in physics helps prepare you for employment in industry, research, government, and academia. A bachelor’s degree from the undergraduate physics program will provide an overall view of both classical and modern physics along with problem-solving ability and the flexibility to continue learning.

Your education can:

• Prepare you for employment in industrial or governmental laboratories.

• Prepare you for graduate studies for master’s or doctoral degrees in experimental or theoretical physics.

• Provide a broad background for further work in other sciences, such as materials sciences, aerospace, astronomy, computer science, geophysics, meteorology, radiology, medicine, biophysics, engineering, and environmental studies.

• Provide a science-oriented liberal education. This training can be useful in some areas of business administration, law, or other fields where a basic knowledge of science is useful.

• Provide part of the preparation you need to teach physics. To teach physics in high school, you will also take education courses to become certified. You will need a doctoral degree to become a college or university professor.


OTHER PROGRAMS

AMEP
A program in applied mathematics, engineering and physics (AMEP) (http://guide.wisc.edu/undergraduate/letters-science/mathematics/applied-mathematics-engineering-physics-bs-amep) is described in its own section of the Guide.

Astronomy–Physics
Students interested in an astronomy–physics major should contact the astronomy department (http://guide.wisc.edu/undergraduate/letters-science/astronomy).

Education–Physics
A student working toward the Bachelor of Science–Education degree may major or minor in physics. Interested students should contact the School of Education (http://guide.wisc.edu/undergraduate/education). Upon request, the physics department will assign an advisor.

Medical Physics
A suggested curriculum for students interested in graduate study in medical physics is available in the medical physics (https://www.medphysics.wisc.edu) department office.

HOW TO GET IN

TO DECLARE A PHYSICS MAJOR

Students should discuss declaration with one of the undergraduate advisors (p. 5) as early as possible and bring a What-If DARS for the Physics major to their meeting.

To be eligible to declare the major, students must have a combined MATH and PHYSICS GPA of at least a 2.500. Eligible students can declare the physics major anytime by completing the department’s major declaration form (https://www.physics.wisc.edu/sites/default/files/Physics%20Declaration%20Form.pdf) and having it signed by a physics undergraduate advisor.

There are additional steps to declaring Physics as an Additional Major. Section C of the major declaration form (https://www.physics.wisc.edu/sites/default/files/Physics%20Declaration%20Form.pdf) has important information about this process. Students should consult the Guide page of their home school or college for more information about declaring an Additional Major in L&S.

REQUIREMENTS

UNIVERSITY GENERAL EDUCATION REQUIREMENTS

All undergraduate students at the University of Wisconsin–Madison are required to fulfill a minimum set of common university general education requirements to ensure that every graduate acquires the essential core of an undergraduate education. This core establishes a foundation for
living a productive life, being a citizen of the world, appreciating aesthetic values, and engaging in lifelong learning in a continually changing world. Various schools and colleges will have requirements in addition to the requirements listed below. Consult your advisor for assistance, as needed. For additional information, see the university Undergraduate General Education Requirements (http://guide.wisc.edu/undergraduate/#requirementsforundergraduatestudytext) section of the Guide.

**General Education**
- Breadth—Humanities/Literature/Arts: 6 credits
- Breadth—Natural Science: 4 to 6 credits, consisting of one 4- or 5-credit course with a laboratory component; or two courses providing a total of 6 credits
- Breadth—Social Studies: 3 credits
- Communication Part A & Part B *
- Ethnic Studies *
- Quantitative Reasoning Part A & Part B *

* The mortarboard symbol appears before the title of any course that fulfills one of the Communication Part A or Part B, Ethnic Studies, or Quantitative Reasoning Part A or Part B requirements.

**COLLEGE OF LETTERS & SCIENCE BREADTH AND DEGREE REQUIREMENTS: BACHELOR OF ARTS (B.A.)**

Students pursuing a bachelor of arts degree in the College of Letters & Science must complete all of the requirements below. The College of Letters & Science allows this major to be paired with either a bachelor of arts or a bachelor of science curriculum. View a comparison of the degree requirements here. ([https://pubs.wisc.edu/home/archives/ug15/images/babs2009.pdf](https://pubs.wisc.edu/home/archives/ug15/images/babs2009.pdf))

**BACHELOR OF ARTS DEGREE REQUIREMENTS**

**Mathematics**
- Fulfilled with completion of University General Education requirements Quantitative Reasoning a (QR A) and Quantitative Reasoning b (QR B) coursework. Please note that some majors may require students to complete additional math coursework beyond the B.A. mathematics requirement.

**Foreign Language**
- Complete the fourth unit of a foreign language; OR
- Complete the third unit of a foreign language and the second unit of an additional foreign language

*Note: A unit is one year of high school work or one semester/term of college work.*

**L&S Breadth**
- Humanities, 12 credits: 6 of the 12 credits must be in literature
- Social Sciences, 12 credits
- Natural Sciences, 12 credits: must include one 3+ credit course in the biological sciences; must include one 3+ credit course in the physical sciences

**Liberal Arts and Science Coursework**
- 108 credits

**Depth of Intermediate/Advanced work**
- 60 intermediate or advanced credits

**NON–L&S STUDENTS PURSUING AN L&S MAJOR**

Non–L&S students who have permission from their school/college to pursue an additional major within L&S only need to fulfill the major requirements and do not need to complete the L&S breadth and degree requirements above. Please note that the following special degree programs are not considered majors so are not available to non–L&S degree-seeking candidates:

- Applied Mathematics, Engineering and Physics (Bachelor of Science—Applied Mathematics, Engineering and Physics)
- Journalism (Bachelor of Arts—Journalism; Bachelor of Science—Journalism)
- Music (Bachelor of Music)
- Social Work (Bachelor of Social Work)

**REQUIREMENTS FOR THE MAJOR**

The physics major requires 35 credits from the following:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYSICS 247</td>
<td>A Modern Introduction to Physics (recommended)</td>
<td>5</td>
</tr>
<tr>
<td>PHYSICS 207</td>
<td>General Physics</td>
<td></td>
</tr>
<tr>
<td>PHYSICS 201</td>
<td>General Physics</td>
<td></td>
</tr>
<tr>
<td>E M A 201 &amp; E M A 202</td>
<td>Statics and Dynamics</td>
<td>5</td>
</tr>
<tr>
<td>E M A 201 &amp; M E 240</td>
<td>Statics and Dynamics</td>
<td></td>
</tr>
<tr>
<td>PHYSICS 248</td>
<td>A Modern Introduction to Physics (recommended)</td>
<td></td>
</tr>
<tr>
<td>PHYSICS 208</td>
<td>General Physics</td>
<td></td>
</tr>
<tr>
<td>PHYSICS 202</td>
<td>General Physics</td>
<td></td>
</tr>
<tr>
<td>PHYSICS 249</td>
<td>A Modern Introduction to Physics (recommended)</td>
<td></td>
</tr>
<tr>
<td>PHYSICS 205</td>
<td>Modern Physics for Engineers (not recommended for majors)</td>
<td></td>
</tr>
<tr>
<td>PHYSICS/ E C E 235</td>
<td>Introduction to Solid State Electronics (not recommended for majors)</td>
<td></td>
</tr>
<tr>
<td>PHYSICS 241</td>
<td>Introduction to Modern Physics</td>
<td></td>
</tr>
<tr>
<td>PHYSICS 311</td>
<td>Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>PHYSICS 322</td>
<td>Electromagnetic Fields</td>
<td>3-9</td>
</tr>
</tbody>
</table>
ECE 220  Electrodynamics I
& ECE 320  and Electrodynamics II
& ECE 420  and Electromagnetic Wave Transmission

Thermal Physics (complete one): 3-6
PHYSICS 415  Thermal Physics
CHEM 561  Physical Chemistry
& CHEM 562  and Physical Chemistry
M E 361  Thermodynamics

Quantum Mechanics (complete one): 3-6
PHYSICS 448  Atomic and Quantum Physics
& PHYSICS 449  and Atomic and Quantum Physics
PHYSICS 531  Introduction to Quantum Mechanics

Laboratory 6
Full registered credit per course:
PHYSICS 307  Intermediate Laboratory-Mechanics and Modern Physics
PHYSICS 407  Advanced Laboratory

Two credits apply from each of the following:
PHYSICS 321  Electric Circuits and Electronics
PHYSICS 325  Optics
PHYSICS 623  Electronic Aids to Measurement
PHYSICS 625  Applied Optics

N E 427  Nuclear Instrumentation Laboratory
N E 428  Nuclear Reactor Laboratory
E C E 305  Semiconductor Properties Laboratory
E C E 313  Optoelectronics Lab

Advanced Physics Electives 0-4

Total Credits 35

1 The introductory course sequence consists of three courses: PHYSICS 247/PHYSICS 248/PHYSICS 249 in the honors sequence recommended for prospective physics majors, PHYSICS 201/PHYSICS 202/PHYSICS 205 is recommend for engineers, and PHYSICS 207/PHYSICS 208/PHYSICS 241 is intended for life sciences and chemistry majors, and is a suitable alternative for physics majors. Although the department recommends following one of these sequences, students are allowed to mix them, with the exception that transfers into the PHYSICS 247/PHYSICS 248/PHYSICS 249 honors sequence are not permitted.

2 Both courses must be taken and together count 5 credits toward the 35 required for the major. These credits can be counted toward the 35 required for the major only if these courses are used to satisfy this requirement.

3 All three of ECE 220 and ECE 320 and ECE 420 must be taken, and together count 3 credits toward the 35 required for the major. These credits can be counted toward the 35 required for the major only if these courses are used to satisfy this requirement.

4 PHYSICS 415 is strongly recommend as the course to satisfy the Thermal Physics Requirement, except for students pursuing additional majors in physics.

5 Both courses CHEM 561 and CHEM 562 must be taken and together count 3 credits toward the 35 required for the major. These credits can be counted toward the 35 required for the major only if these courses are used to satisfy this requirement.

6 All four credits for each course count toward 35-credit total.

7 For non-PHYSICS courses, students will receive only the credit applied as lab toward the 35-credit requirement.

ADVANCED PHYSICS ELECTIVE COURSES

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYSICS 301</td>
<td>Physics Today (recommended)</td>
<td>1</td>
</tr>
<tr>
<td>PHYSICS 307</td>
<td>Intermediate Laboratory-Mechanics and Modern Physics</td>
<td>2</td>
</tr>
<tr>
<td>PHYSICS 311</td>
<td>Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>PHYSICS 321</td>
<td>Electric Circuits and Electronics</td>
<td>4</td>
</tr>
<tr>
<td>PHYSICS 322</td>
<td>Electromagnetic Fields</td>
<td>3</td>
</tr>
<tr>
<td>PHYSICS 323</td>
<td>Electromagnetic Fields</td>
<td>3</td>
</tr>
<tr>
<td>PHYSICS 325</td>
<td>Optics</td>
<td>4</td>
</tr>
<tr>
<td>PHYSICS 406</td>
<td>Special Topics in Physics</td>
<td>1-4</td>
</tr>
<tr>
<td>PHYSICS 407</td>
<td>Advanced Laboratory</td>
<td>2-4</td>
</tr>
<tr>
<td>PHYSICS 415</td>
<td>Thermal Physics</td>
<td>3</td>
</tr>
<tr>
<td>PHYSICS 448</td>
<td>Atomic and Quantum Physics</td>
<td>3</td>
</tr>
<tr>
<td>PHYSICS 449</td>
<td>Atomic and Quantum Physics</td>
<td>3</td>
</tr>
<tr>
<td>PHYSICS/</td>
<td>Scientific Background to Global Problems</td>
<td>3</td>
</tr>
<tr>
<td>ENVIR ST 472</td>
<td>Environmental Problems</td>
<td></td>
</tr>
<tr>
<td>PHYSICS 498</td>
<td>Directed Study</td>
<td>1-3</td>
</tr>
<tr>
<td>PHYSICS 499</td>
<td>Directed Study</td>
<td>1-3</td>
</tr>
<tr>
<td>PHYSICS/B M E/H ONCOL/MED PHYS 501</td>
<td>Radiological Physics and Dosimetry</td>
<td>3</td>
</tr>
<tr>
<td>PHYSICS/E C E/N E 525</td>
<td>Introduction to Plasmas</td>
<td>3</td>
</tr>
<tr>
<td>PHYSICS/E C E/N E 527</td>
<td>Plasma Confinement and Heating</td>
<td>3</td>
</tr>
<tr>
<td>PHYSICS 531</td>
<td>Introduction to Quantum Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>PHYSICS 535</td>
<td>Introduction to Particle Physics</td>
<td>3</td>
</tr>
<tr>
<td>PHYSICS 545</td>
<td>Introduction to Atomic Structure</td>
<td>3</td>
</tr>
<tr>
<td>PHYSICS/E C E 546</td>
<td>Lasers</td>
<td>2-3</td>
</tr>
<tr>
<td>PHYSICS 551</td>
<td>Solid State Physics</td>
<td>3</td>
</tr>
<tr>
<td>PHYSICS 623</td>
<td>Electronic Aids to Measurement</td>
<td>4</td>
</tr>
<tr>
<td>PHYSICS 625</td>
<td>Applied Optics</td>
<td>4</td>
</tr>
<tr>
<td>PHYSICS 681</td>
<td>Senior Honors Thesis</td>
<td>3</td>
</tr>
<tr>
<td>PHYSICS 682</td>
<td>Senior Honors Thesis</td>
<td>3</td>
</tr>
<tr>
<td>PHYSICS 691</td>
<td>Senior Thesis</td>
<td>2-3</td>
</tr>
<tr>
<td>PHYSICS 692</td>
<td>Senior Thesis</td>
<td>2-3</td>
</tr>
</tbody>
</table>

8 It is recommended that the student’s program include the seminar PHYSICS 301 Physics Today.

RESIDENCE AND QUALITY OF WORK IN THE MAJOR

- 2.000 GPA in all PHYSICS and all major courses
- 2.000 on at least 15 credits in Upper Level work, taken in residence
- 15 credits in PHYSICS, taken on campus
Courses that meet the Core and Laboratory requirements, and Advanced level PHYSICS courses, count as upper-level in the major.

HONORS IN THE MAJOR

Students may declare Honors in the Major in consultation with their major advisor and the Honors Program.

HONORS IN THE MAJOR REQUIREMENTS

To earn Honors in the Major, students must satisfy both the requirements for the major (above) and the following additional requirements:

- Earn a 3.300 University GPA
- Earn a 3.300 GPA in all PHYSICS and all major courses
- 12 credits of Honors PHYSICS courses with grades of B or better, to include:
  - PHYSICS 681 - PHYSICS 682, for a total of 6 credits
  - 3 additional credits of Advanced level PHYSICS for Honors, with a grade of B or better
  - 3 credits at any level in PHYSICS for Honors, with a grade of B or better

DISTINCTION IN THE MAJOR

Distinction in the Major requires no declaration, and is awarded at the time of graduation. Students may not receive Distinction and Honors in the same major. To receive Distinction in the Major, students must have met the following requirements and notify a departmental advisor:

- 3.300 University GPA
- 3.300 GPA in all PHYSICS and all major courses
- 6 additional credits in Advanced level PHYSICS beyond the minimum required for the major.

THESIS OF DISTINCTION

An exceptional original thesis will be designated as a Thesis of Distinction upon recommendation by the department.

LEARNING OUTCOMES

1. Understand basic physical principles.
2. Solve problems proficiently using both quantitative and qualitative applications of these physical principles.
3. Appreciate the excitement of physics and be acquainted with a wide range of research areas in physics.
4. Know how to perform quantitative measurements of physical phenomena and understand the statistical significance of observations made in the presence of statistical and systematic uncertainties.
5. Be prepared for graduate study and/or careers in STEM fields.
6. Communicate effectively with scientific peers and the public, both orally and in writing.
7. Understand their own learning processes and be able to continue to educate themselves after graduation.

FOUR-YEAR PLAN

SAMPLE FOUR-YEAR PLAN

Students should arrange a meeting with a departmental advisor as soon as they are even thinking about a physics major. It is important to get major advising as early as possible.

This is one of many paths through the physics major. For other possibilities and details on math preparation and sequence of courses, see the Advising and Careers page (https://guide.wisc.edu/undergraduate/letters-science/physics/physics-bs/#advisingandcareerstext).

<table>
<thead>
<tr>
<th>First Year</th>
<th>Credits</th>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYSICS 247 (Physics First Introductory Course)</td>
<td>4</td>
<td>MATH 234</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MATH 340</td>
<td>3</td>
<td>COMM 101</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Foreign Language (if needed)</td>
<td>4</td>
<td>MATH 321</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>14</td>
<td>16</td>
<td>14</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Second Year</th>
<th>Credits</th>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYSICS 249 (Physics Third Introductory Course)</td>
<td>1</td>
<td>MATH 321</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>PHYSICS 311 (Mechanics)</td>
<td>2</td>
<td>MATH 322</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>INTER-LS 210</td>
<td>3</td>
<td>1 Biological Science</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>15</td>
<td>14</td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

UNIVERSITY DEGREE REQUIREMENTS

Total Degree
To receive a bachelor's degree from UW–Madison, students must earn a minimum of 120 degree credits. The requirements for some programs may exceed 120 degree credits. Students should consult with their college or department advisor for information on specific credit requirements.

Residency
Degree candidates are required to earn a minimum of 30 credits in residence at UW–Madison. "In residence" means on the UW–Madison campus with an undergraduate degree classification. "In residence" credit also includes UW–Madison courses offered in distance or online formats and credits earned in UW–Madison Study Abroad/Study Away programs.

Quality of Work
Undergraduate students must maintain the minimum grade point average specified by the school, college, or academic program to remain in good academic standing. Students whose academic performance drops below these minimum thresholds will be placed on academic probation.
Third Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYSICS 321</td>
<td></td>
<td>4 PHYSICS 407</td>
<td>2-4</td>
</tr>
<tr>
<td>PHYSICS 448 (Quantum</td>
<td></td>
<td>3 PHYSICS 415 (Thermal</td>
<td>3</td>
</tr>
<tr>
<td>Physics)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication B</td>
<td></td>
<td>3-4 PHYSICS 449</td>
<td>3</td>
</tr>
<tr>
<td>Humanities Breadth</td>
<td></td>
<td>3 Humanities Breadth</td>
<td>3</td>
</tr>
<tr>
<td>Social Science Breadth</td>
<td></td>
<td>3 Social Science Breadth</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>14</td>
<td></td>
</tr>
</tbody>
</table>

Fourth Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Literature Breadth</td>
<td></td>
<td>3 Literature Breadth</td>
<td>3</td>
</tr>
<tr>
<td>Electives</td>
<td></td>
<td>12 Electives</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>16</td>
<td></td>
</tr>
</tbody>
</table>

Total Credits 120

**ADVISORY AND CAREERS**

**PHYSICS UNDERGRADUATE ADVISORS**

Professor Jan Egedal  
3275 Chamberlin Hall  
608-262-3628

Professor Dan McCammon  
6207 Chamberlin Hall  
608-262-5916

Professor Deniz Yavuz  
5320 Chamberlin Hall  
608-263-9399

Physics AMEP Advisors

Professor Cary Forest  
3277 Chamberlin Hall  
608-263-0486

Professor Robert McDermott  
5112 Chamberlin Hall  
608-263-4476

The Department of Physics encourages our majors to begin working on their career exploration and preparation soon after arriving on campus. We partner with SuccessWorks at the College of Letters & Science. L&S graduates are in high demand by employers and graduate programs. It is important to us that our students are career ready at the time of graduation, and we are committed to your success.

Additional Resources:

- Link to physics department student jobs and research opportunities (https://www.physics.wisc.edu/academics/undergrads/news)

**ADVISORY INFORMATION**

**Mathematics**

There are specific math courses listed as prerequisites for our Physics courses. Depending on your interest in math (some Physics majors also major in Math as well), the courses you select may be different. A typical math sequence is: MATH 221, MATH 222, MATH 234, MATH 319, (or MATH 320 instead of MATH 319, MATH 340), MATH 321, MATH 322, MATH 340. Please consult with an advisor when choosing your Mathematics courses, particularly before deciding on one of the honors sequences in Math. We do not recommend the honors sequences for physics majors unless you are considering a second major in Math.

**MATH 221 Calculus and Analytic Geometry 1/ Calculus and Analytic Geometry 2 (MATH 222):** MATH 221 is a prerequisite to PHYSICS 247, PHYSICS 207, and PHYSICS 201.

**MATH 234 Calculus—Functions of Several Variables:** typically taken to complete the sequence MATH 221/MATH 222/MATH 234. This course can be taken simultaneously with MATH 319.

**MATH 319 Techniques in Ordinary Differential Equations:** You are strongly advised to take MATH 319 and MATH 340, or MATH 320 before PHYSICS 311 Mechanics.

**MATH 340 Elementary Matrix and Linear Algebra:** This course is a bridge between concrete and abstract math. The next step for students interested in more abstract math is MATH 521/MATH 522. MATH 340 is particularly useful for PHYSICS 311 and later for quantum mechanics and we strongly suggest taking it or MATH 320. MATH 320 is a "light" version combining MATH 319 and MATH 340. It is adequate for the rest of our undergraduate physics curriculum, but is not recommended for those planning on continuing to graduate school. There is a special honors section, Math 320!, that thoroughly covers all of the material in MATH 319 and MATH 340. We recommend it as a good way to fit in both topics before you take PHYSICS 311, but it is a more challenging course.

**Applied Mathematical Analysis (MATH 321):** Techniques for solving problems in the physical sciences, engineering, and applied mathematics, using advanced calculus and analytic function theory. Can be taken before or after MATH 322. It is recommended that MATH 321 be taken before taking PHYSICS 322. MATH 321 is highly recommended for physics majors but requires a significant time commitment.

**MATH 322 Applied Mathematical Analysis:** Techniques for solving partial differential equations, with an emphasis on practical problems in the physical sciences. Also covers special functions, Fourier Transformations, etc. MATH 321 and MATH 322 are recommended for those planning to continue on to graduate school in Physics.

**Chemistry**

A college course in chemistry is useful for all physics students, but not required.

**Computing**

Students should become familiar with scientific programming. The most useful languages are Python followed by C or C++. The computer sciences department offers introductory courses. The Division of Information Technology (DoIT) also offers short courses to introduce programming.

**L&S CAREER RESOURCES**

SuccessWorks at the College of Letters & Science helps students leverage the academic skills learned in their major; certificates, and liberal arts degree; explore and try out different career paths; participate in internships; prepare for the job search and/or graduate school applications; and network with professionals in the field (alumni and employers). In short, SuccessWorks helps students in the College of
Letters & Science discover themselves, find opportunities, and develop the skills they need for success after graduation.

SuccessWorks can also assist students in career advising, résumé and cover letter writing, networking opportunities, and interview skills, as well as course offerings for undergraduates to begin their career exploration early in their undergraduate career.

Students should set up their profiles in Handshake (https://careers.ls.wisc.edu/handshake) to take care of everything they need to explore career events, manage their campus interviews, and **apply to jobs and internships from 200,000+ employers around the country.**

- SuccessWorks (https://careers.ls.wisc.edu)
- Set up a career advising appointment (https://careers.ls.wisc.edu/make-an-appointment)
- INTER-LS 210 L&S Career Development: Taking Initiative (1 credit, targeted to first- and second-year students)—for more information, see Inter-LS 210: Career Development, Taking Initiative (https://careers.ls.wisc.edu/inter-ls-210-career-development-taking-initiative)
- INTER-LS 215 Communicating About Careers (3 credits, fulfills Com B General Education Requirement)
- Handshake (https://careers.ls.wisc.edu/handshake)
- Learn how we’re transforming career preparation: L&S Career Initiative (http://ls.wisc.edu/lsci)

### FACULTY

**Yang Bai** (https://www.physics.wisc.edu/people/yangbai), Associate Professor

**Baha Balantekin** (https://www.physics.wisc.edu/people/bahabalantekin), Professor

**Vernon Barger** (https://www.physics.wisc.edu/people/vernon-dbarger), Professor

**Keith Bechtol** (https://www.physics.wisc.edu/people/keithbechtol), Assistant Professor

**Kevin Black** (https://www.physics.wisc.edu/people/kevinblack), Professor

**Tulika Bose** (https://www.physics.wisc.edu/people/tulikabose), Professor

**Stanislaw Boldyrev** (https://www.physics.wisc.edu/people/StanislawBoldyrev), Professor

**Victor Brar** (https://www.physics.wisc.edu/people/victorbrar), Assistant Professor

**Duncan Carlsmith** (https://www.physics.wisc.edu/people/duncancarlsmith), Professor

**Daniel Chung** (https://www.physics.wisc.edu/people/daniel-jchung), Professor

**Susan Coppersmith** (https://www.physics.wisc.edu/people/susan-coppersmith), Robert E. Fassnacht Professor

**Sridhara Dasu** (https://www.physics.wisc.edu/people/sridharadasu), Department Chairperson and Professor

**Jan Egedal** (https://www.physics.wisc.edu/people/janegedal), Professor

**Mark Eriksson** (https://www.physics.wisc.edu/people/markeriksson), Vilas Distinguished Achievement Professor

**Lisa Everett** (https://www.physics.wisc.edu/people/lisa-leverett), Professor

**Cary Forest** (https://www.physics.wisc.edu/people/cary-bforest), Prager Professor of Experimental Physics

**Pupa Gilbert** (https://www.physics.wisc.edu/people/pupagilbert), Vilas Distinguished Achievement Professor

**Francis Halzen** (https://www.physics.wisc.edu/people/francis-ihalzen), Gregory Breit Professor and Hilldale Professor

**Kael Hanson** (https://www.physics.wisc.edu/people/kael-dhanson), Professor, WIPAC Director

**Aki Hashimoto** (https://www.physics.wisc.edu/people/akihashimoto), Professor

**Matthew Herndon** (https://www.physics.wisc.edu/people/matthew-herndon), Professor

**Lev Ioffe** (https://www.physics.wisc.edu/people/levioffe), Professor

**Robert Joynt** (https://www.physics.wisc.edu/people/robert-joynt), Professor

**Albrecht Karle** (https://www.physics.wisc.edu/people/albrechtkarle), Professor, IceCube Associate Director, Science and Instrumentation

**Shimon Kolkowitz** (https://www.physics.wisc.edu/people/shimonkolkowitz), Assistant Professor

**James Lawler** (https://www.physics.wisc.edu/people/james-elawler), Arthur and Aurelia Schawlow Professor

**Alex Levchenko** (https://www.physics.wisc.edu/people/alexlevchenko), Associate Professor

**Dan McCammon** (https://www.physics.wisc.edu/people/danmccammon), Professor

**Robert McDermott** (https://www.physics.wisc.edu/people/Robert-McDermott), Professor

**Marshall Onellion** (https://www.physics.wisc.edu/people/marshall-onellion), Professor

**Kimberly Palladino** (https://www.physics.wisc.edu/people/kimberly-palladino), Assistant Professor

**Yibin Pan** (https://www.physics.wisc.edu/people/yibinpan), Associate Professor

**Brian Rebel** (https://www.physics.wisc.edu/people/brianrebel), Visiting Associate Professor

**Mark Rzchowski** (https://www.physics.wisc.edu/people/markrzchowski), Associate Chairperson and Professor

**Mark Saffman** (https://www.physics.wisc.edu/people/marksaffman), Professor
John Sarff (https://www.physics.wisc.edu/people/john-ssarff), Professor
Gary Shiu (https://www.physics.wisc.edu/people/garyshiu), Professor
Paul Terry (https://www.physics.wisc.edu/people/paul-wterry), Professor
Peter Timbie (https://www.physics.wisc.edu/people/peter-ttimbie), Professor
Justin Vandenbroucke (https://www.physics.wisc.edu/people/justinvandenbroucke), Assistant Professor
Maxim Vavilov (https://www.physics.wisc.edu/people/maxim-gvavilov), Professor
Thad Walker (https://www.physics.wisc.edu/people/thad-gwalker), Professor
Sau Lan Wu (https://www.physics.wisc.edu/people/sau-lanwu), Enrico Fermi Professor and Vilas Professor
Deniz Yavuz (https://www.physics.wisc.edu/people/denizyavuz), Professor
Ellen Zweibel (https://www.physics.wisc.edu/people/ellen-gzweibel), William L Kraushaar Professor of Astronomy & Physics

WISCONSIN EXPERIENCE

PHYSICS UNDERGRADUATE COLLOQUIUM

There is a weekly series of talks in the spring semester called "Physics Today," at which a topic of local research is described by one of the physics faculty. These are open and may be attended by anyone. They can also be taken as a course, PHYSICS 301 Physics Today. See the Course Guide for location and time.

THE PHYSICS CLUB

The University Physical Society (UPS)—also known as the Physics Club—is a student organization for people interested in physics and related fields.

WHAT DOES THE PHYSICS CLUB DO?

The Physics Club organizes events such as seminars, tours, trips, and socials for its members. Physics Club volunteers also offer free drop-in tutoring to students in introductory physics and astronomy classes. In addition, we maintain subscriptions to science related magazines such as Scientific American, Astronomy, and Physics Today, which are kept in the club’s room located at 2328 Chamberlin Hall. Every Friday afternoon, we meet with the physics colloquium speaker to learn about the process of becoming a scientist. In addition, UPS sponsors a variety of other events. For example, in the past, we have taken a field trip to Fermilab, sponsored a racquetball tournament, and have frequently gathered for social events such as ice skating, movie night, and bowling.

WHY SHOULD YOU JOIN THE PHYSICS CLUB?

By joining the Physics Club you’ll be meeting many physics majors, who are, in general, really cool people to hang out with. If you are thinking about declaring a physics major, this is the place to come for helpful advice about taking classes and finding an undergraduate job in the physics department. If you join, you can get access to the Physics Club room, 2328 Chamberlin Hall. Joining also adds you to the club email list, so you can be notified about club sponsored events.

PERKS OF BEING A PHYSICS CLUB MEMBER

When you join the Physics Club, you get access to an excellent room, 2328 Chamberlin Hall. This room contains a refrigerator, reference shelves of textbooks, couch, tables, and chairs, a phone, blackboards, and a microwave. We have a several computers in the room. You can get your own key to the room and visit at your leisure, and stay as long as you like. Plus, you get the added bonus of knowing people who are in your classes.

University Physical Society
2328 Chamberlin Hall
ups.physics.wisc.edu
ups-officers@googlegroups.com

To Join:
Drop by Room 2328 Chamberlin Hall and pick up a membership form. Turn in a completed form with your annual dues to a UPS club officer.

PHYSICS LEARNING CENTER

The Physics Learning Center: Striving to help all students succeed in Physics

• Do you enjoy Physics?
• Are you patient?
• Do you like to teach?
• Would you like to help other undergraduate students?

The Physics Learning Center (PLC) matches upper-level undergraduate students as tutor/mentors in small study groups with students studying introductory physics (algebra-based PHYSICS 103—PHYSICS 104 and calculus-based PHYSICS 207—PHYSICS 208). Physics Peer Mentor Tutors meet twice a week with the same small group of students to overview key concepts, choose and supervise practice problems, answer questions, and serve as a mentor. We strive to create a supportive learning environment to help students gain skills, increase confidence, and meet potential study partners.

Peer mentor tutors receive extensive training in teaching physics and in general pedagogy. Tutors meet with a PLC staff member each week to discuss strategies for teaching course content, including how to use teaching materials that stress conceptual understanding. In addition, tutors from all courses meet as a group for a weekly teaching seminar to discuss issues such as group dynamics, techniques for actively involving students in learning, helping students to prepare for exams, raising awareness of diversity in student experiences, resources on campus, and so on.

Our peer mentor tutors report that they greatly enjoy working with their students and in the process strengthen their own foundation in physics and presentation skills. They also tell us that teaching physics helps to review for the Graduate Record Exam and to prepare for postgraduate teaching in middle/high school or as a university teaching assistant. Most tutors are upper-class students majoring in physics, astrophysics, secondary science education, and engineering. We also welcome students from other fields if they have a strong physics background. Students receive either independent study credit or a stipend for participation in the Physics Peer Mentor Tutor program. To apply, please submit a resume, your transcript (unofficial copy is fine), and a short statement about why you would like to be a physics peer mentor tutor (½—1 page).
RESOURCES AND SCHOLARSHIPS

The Physics Department is very happy to offer a number of awards for undergraduate and graduate students in physics each year. Many of these awards have been made possible through very generous donations by alumni and friends of the Department.

For a list of all the Undergraduate and Graduate Awards please visit www.physics.wisc.edu/awards (https://www.physics.wisc.edu/awards)

APPLICATION PROCESS

Eligibility

• Must be enrolled as a full-time student at UW-Madison in both semesters of the Academic Year

• Must be a physics major (some awards also include astronomy majors)

Applicants will be judged by the Student Awards Committee. You may apply for a specific award below however the Committee will consider all eligible applications for relevant awards. The Committee will review your transcript.

The call for applications will be sent out in the middle of the spring semester, and the awards decisions will be made by the Awards Committee soon thereafter. Awardees will be notified and asked to attend the Physics Awards Banquet to be held at the end of the spring semester.

TO APPLY

Once the call for applications has been sent out, each applicant is to submit the following (in PDF) by the deadline via "Scholarships @ UW" in your student center or here: https://scholarships.wisc.edu/Scholarships/

• Resume/CV

• Statement of current research/teaching activity and future plans as a physics major (one page)

• Letter of recommendation from a faculty or staff member (one page)

• On-line application system will automatically prompt letter writer to submit letter

• If indicated below, a statement of need (one page)

For More information

Please visit the Department of Physics Awards webpage (https://www.physics.wisc.edu/awards) or contact the Department of Physics info@physics.wisc.edu