PHYSICS, B.S. (SCIENCE)

Begin Campus: Any Penn State Campus

End Campus: University Park

Program Description
This major provides a sound program of technical and general education for students planning a career in physics and related fields.

- The General option provides broad coverage with the most physics and mathematics course requirements and is useful for students intending to pursue graduate study in Physics or similar disciplines.
- The Medical and Electronics options incorporate coursework in support of the application of physics and mathematics in various life-science or engineering related fields.
- A Computation option provides background in the application of physical principles and mathematical methods in the solution of scientific problems, simulations, or visualizations using computer and numerical techniques.
- The Nanotechnology/Material Science option provides students with background in the understanding of condensed matter physics at either the nano- or micro/macro- levels.

What is Physics?
Physicists study natural phenomena in the universe, from the smallest length scales to the largest in the cosmos, to discover the basic principles or laws which govern the physical world. Knowledge of physics is crucial to truly understanding the world around us, the world inside us, and the world beyond us. This degree will provide students with the fundamental conceptual, mathematical, computational, and experimental tools that are needed to attack the scientific and technological problems of today and in the future.

You Might Like This Program If...
- You are curious about how things work.
- You are fascinated by how the natural world is organized, how mathematics describes so much of it, how experiments can probe that understanding, and how one can predict new physical phenomena.
- You want to explore these connections via hands-on work in labs, mathematical reasoning and calculations, or using computers and programming.
- You want to solve sophisticated problems beyond standard pencil-and-paper examples using advanced mathematical and experimental technique or computational methods.

Entrance to Major
In order to be eligible for entrance to the Physics major, a student must have:
1. attained at least a 2.00 cumulative grade-point average;
2. completed and earned a grade of C or better in each of the following courses: CHEM 110, MATH 140, MATH 141, PHYS 211, and PHYS 212.

Degree Requirements
For the Bachelor of Science degree in Physics, a minimum of 120 credits is required:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Education</td>
<td>45</td>
</tr>
<tr>
<td>Requirements for the Major</td>
<td>93-96</td>
</tr>
</tbody>
</table>

General Education
Connecting career and curiosity, the General Education curriculum provides the opportunity for students to acquire transferable skills necessary to be successful in the future and to thrive while living in interconnected contexts. General Education aids students in developing intellectual curiosity, a strengthened ability to think, and a deeper sense of aesthetic appreciation. These are requirements for all baccalaureate students and are often partially incorporated into the requirements of a program. For additional information, see the General Education Requirements (http://bulletins.psu.edu/undergraduate/general-education/baccalaureate-degree-general-education-program) section of the Bulletin and consult your academic adviser.

The keystone symbol appears next to the title of any course that is designated as a General Education course. Program requirements may also satisfy General Education requirements and vary for each program.

Foundations (grade of C or better is required.)
- Quantification (GQ): 6 credits
- Writing and Speaking (GWS): 9 credits

Knowledge Domains
- Arts (GA): 6 credits
- Health and Wellness (GHW): 3 credits
- Humanities (GH): 6 credits
- Social and Behavioral Sciences (GS): 6 credits
- Natural Sciences (GN): 9 credits

Integrative Studies (may also complete a Knowledge Domain requirement)
- Inter-Domain or Approved Linked Courses: 6 credits

18 of these 45 credits are included in the Requirements for the Major.

University Degree Requirements
First Year Engagement
All students enrolled in a college or the Division of Undergraduate Studies at University Park, and the World Campus are required to take 1 to 3 credits of the First-Year Seminar, as specified by their college First-Year Engagement Plan.

Other Penn State colleges and campuses may require the First-Year Seminar; colleges and campuses that do not require a First-Year Seminar provide students with a first-year engagement experience.

First-year baccalaureate students entering Penn State should consult their academic adviser for these requirements.

Cultures Requirement
6 credits are required and may satisfy other requirements
- United States Cultures: 3 credits
- International Cultures: 3 credits
Writing Across the Curriculum
3 credits required from the college of graduation and likely prescribed as part of major requirements.

Total Minimum Credits
A minimum of 120 degree credits must be earned for a baccalaureate degree. The requirements for some programs may exceed 120 credits. Students should consult with their college or department adviser for information on specific credit requirements.

Quality of Work
Candidates must complete the degree requirements for their major and earn at least a 2.00 grade-point average for all courses completed within their degree program.

Limitations on Source and Time for Credit Acquisition
The college dean or campus chancellor and program faculty may require up to 24 credits of course work in the major to be taken at the location or in the college or program where the degree is earned. Credit used toward degree programs may need to be earned from a particular source or within time constraints (see Senate Policy 83-80). For more information, check the Suggested Academic Plan for your intended program.

Requirements for the Major
This includes 18 credits of General Education courses: 9 credits of GN courses; 6 credits of GQ courses; 3 credits of GWS courses.

To graduate, a student enrolled in the major must earn a grade of C or better in each course designated by the major as a C-required course, as specified by Senate Policy 82-44. To graduate, a student enrolled in the major must earn a grade of C or better in each course designated by the major as a C-required course, as specified by Senate Policy 82-44. To graduate, a student enrolled in the major must earn a grade of C or better in each course designated by the major as a C-required course, as specified by Senate Policy 82-44.

Common Requirements for the Major (All Options)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 111</td>
<td>Experimental Chemistry I</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 112</td>
<td>Chemical Principles II</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 113</td>
<td>Experimental Chemistry II</td>
<td>1</td>
</tr>
<tr>
<td>ENGL 202C</td>
<td>Effective Writing: Technical Writing</td>
<td>3</td>
</tr>
<tr>
<td>MATH 220</td>
<td>Matrices</td>
<td>2</td>
</tr>
</tbody>
</table>

Prescribed Courses: Require a grade of C or better

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 110</td>
<td>Chemical Principles I</td>
<td>3</td>
</tr>
<tr>
<td>MATH 140</td>
<td>Calculus With Analytic Geometry I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 141</td>
<td>Calculus with Analytic Geometry II</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 211</td>
<td>General Physics: Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 212</td>
<td>General Physics: Electricity and Magnetism</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 213</td>
<td>General Physics: Fluids and Thermal Physics</td>
<td>2</td>
</tr>
<tr>
<td>PHYS 214</td>
<td>General Physics: Wave Motion and Quantum Physics</td>
<td>2</td>
</tr>
<tr>
<td>PHYS 237</td>
<td>Introduction to Modern Physics</td>
<td>3</td>
</tr>
<tr>
<td>MATH 251</td>
<td>Ordinary and Partial Differential Equations</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 400</td>
<td>Intermediate Electricity and Magnetism</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 410</td>
<td>Introduction to Quantum Mechanics I</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 419</td>
<td>Theoretical Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 420</td>
<td>Thermal Physics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 444</td>
<td>Topics in Contemporary Physics</td>
<td>2</td>
</tr>
</tbody>
</table>

Electronics Option (27 credits)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE 210</td>
<td>Circuits and Devices</td>
<td>4</td>
</tr>
</tbody>
</table>

Additional Courses
Select 8 credits from the following:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE 310</td>
<td>Electronic Circuit Design I</td>
<td>3</td>
</tr>
<tr>
<td>EE 350</td>
<td>Continuous-Time Linear Systems</td>
<td>3</td>
</tr>
<tr>
<td>CMPEN 270</td>
<td>Digital Design: Theory and Practice</td>
<td>3</td>
</tr>
</tbody>
</table>

Supporting Courses and Related Areas
Select 6 credits from program list

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMPEN 270</td>
<td>Digital Design: Theory and Practice</td>
<td>3</td>
</tr>
</tbody>
</table>

Additional Courses
Select 3 credits from the following:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMPSC 101</td>
<td>Introduction to Programming</td>
<td>3</td>
</tr>
<tr>
<td>CMPSC 121</td>
<td>Introduction to Programming Techniques</td>
<td>3</td>
</tr>
<tr>
<td>CMPSC 131</td>
<td>Programming and Computation I: Fundamentals</td>
<td>3</td>
</tr>
<tr>
<td>CMPSC 200</td>
<td>Programming for Engineers with MATLAB</td>
<td>3</td>
</tr>
<tr>
<td>CMPSC 201</td>
<td>Programming for Engineers with C++</td>
<td>3</td>
</tr>
</tbody>
</table>

Additional Courses: Require a grade of C or better

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 230</td>
<td>Calculus and Vector Analysis</td>
<td>4</td>
</tr>
<tr>
<td>MATH 231</td>
<td>Calculus of Several Variables</td>
<td>4</td>
</tr>
<tr>
<td>MATH 232</td>
<td>and Integral Vector Calculus</td>
<td>4</td>
</tr>
</tbody>
</table>

Supporting Courses and Related Areas
Select 3 credits of 400-level MATH from departmental list

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMPSC 122</td>
<td>Intermediate Programming</td>
<td>3</td>
</tr>
<tr>
<td>or CMPSC 132</td>
<td>Programming and Computation II: Data Structures</td>
<td>3</td>
</tr>
</tbody>
</table>

Requirements for the Option

Computation Option (24 credits)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 455</td>
<td>Introduction to Numerical Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>MATH 456</td>
<td>Introduction to Numerical Analysis II</td>
<td>3</td>
</tr>
</tbody>
</table>

Additional Courses
Select 6 credits from program list

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 110</td>
<td>Chemical Principles I</td>
<td>3</td>
</tr>
<tr>
<td>MATH 140</td>
<td>Calculus With Analytic Geometry I</td>
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</tr>
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<td>Calculus with Analytic Geometry II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 230</td>
<td>Calculus and Vector Analysis</td>
<td>4</td>
</tr>
<tr>
<td>MATH 231</td>
<td>Calculus of Several Variables</td>
<td>4</td>
</tr>
<tr>
<td>MATH 232</td>
<td>and Integral Vector Calculus</td>
<td>4</td>
</tr>
</tbody>
</table>

1. CMPSC 122 has CMPSC 121 as a prerequisite and CMPSC 132 has CMPSC 131 as a prerequisite so care should be taken when choosing the 'programming requirement' under the Common Requirements for the major.

Supporting Courses and Related Areas
Select 6 credits from the following:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AERSP 424</td>
<td>Advanced Computer Programming</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 430</td>
<td>Introduction to Computational Physics</td>
<td>3</td>
</tr>
<tr>
<td>300-400-level CMPSC</td>
<td>400-level MATH from departmental list</td>
<td>3</td>
</tr>
<tr>
<td>400-level STAT</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Additional Courses
Select 3 credits of natural science (GN) courses that are not listed in the major

<table>
<thead>
<tr>
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<tbody>
<tr>
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<td>MATH 230</td>
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</tr>
</tbody>
</table>

Supporting Courses and Related Areas
Select 6 credits from program list

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>AERSP 424</td>
<td>Advanced Computer Programming</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 430</td>
<td>Introduction to Computational Physics</td>
<td>3</td>
</tr>
<tr>
<td>300-400-level CMPSC</td>
<td>400-level MATH from departmental list</td>
<td>3</td>
</tr>
<tr>
<td>400-level STAT</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>
Select 3 credits of natural science (GN) courses that are not listed in the major

Select 6 credits of EE 300- or 400-level courses

**General Physics Option (25-26 credits)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 402</td>
<td>Electronics for Scientists</td>
<td>4</td>
</tr>
<tr>
<td>or PHYS 458</td>
<td>Intermediate Optics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Select 6-7 credits from items A, B, and/or C:</td>
<td>6-7</td>
</tr>
<tr>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHYS 406</td>
<td>Subatomic Physics</td>
<td></td>
</tr>
<tr>
<td>PHYS 411</td>
<td>Introduction to Quantum Mechanics II</td>
<td></td>
</tr>
<tr>
<td>PHYS 412</td>
<td>Solid State Physics I</td>
<td></td>
</tr>
<tr>
<td>PHYS 413</td>
<td>Solid State Physics II</td>
<td></td>
</tr>
<tr>
<td>PHYS 414</td>
<td>Solid State Physics</td>
<td></td>
</tr>
<tr>
<td>PHYS 430</td>
<td>Introduction to Computational Physics</td>
<td></td>
</tr>
<tr>
<td>PHYS 461</td>
<td>Theoretical Mechanics</td>
<td></td>
</tr>
<tr>
<td>PHYS 472</td>
<td>Elements of Nuclear Physics and its Applications to Medical Imaging and Treatments</td>
<td></td>
</tr>
<tr>
<td>PHYS 479</td>
<td>Special and General Relativity</td>
<td></td>
</tr>
<tr>
<td>PHYS 496</td>
<td>Independent Studies</td>
<td></td>
</tr>
<tr>
<td>PHYS 497</td>
<td>Special Topics</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHYS 402</td>
<td>Electronics for Scientists</td>
<td>2</td>
</tr>
<tr>
<td>or PHYS 458</td>
<td>Intermediate Optics</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASTRO 410</td>
<td>Computational Astrophysics</td>
<td></td>
</tr>
<tr>
<td>ASTRO 440</td>
<td>Introduction to Astrophysics</td>
<td></td>
</tr>
<tr>
<td>ASTRO 485</td>
<td>Introduction to High-Energy Astronomy</td>
<td></td>
</tr>
</tbody>
</table>

**Supporting Courses and Related Areas**

Select 3 credits of natural science (GN) courses that are not listed in the major

Select 9 credits from program list, with a maximum of 6 credits of the following:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 496</td>
<td>Independent Studies</td>
<td>3</td>
</tr>
<tr>
<td>SC 295</td>
<td>Science Co-op Work Experience I</td>
<td></td>
</tr>
<tr>
<td>SC 395</td>
<td>Science Co-op Work Experience II</td>
<td></td>
</tr>
<tr>
<td>SC 495</td>
<td>Science Co-op Work Experience III</td>
<td></td>
</tr>
</tbody>
</table>

Select 3 credits of 400-level MATH from program list

1 Only 3 credits of ASTRO courses may be used.
2 The course not selected above may be used.

**Medical Physics Option (24-25 credits)**

This option prepares students for graduate study in medical physics, medical school, or bioengineering. The courses in option (b) below help satisfy the requirements for a minor in Biomedical Engineering. Application for the BME minor must be made to the Department of Biomedical Engineering.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 110</td>
<td>Biology: Basic Concepts and Biodiversity</td>
<td></td>
</tr>
</tbody>
</table>

**Academic Advising**

The objectives of the university's academic advising program are to help advisees identify and achieve their academic goals, to promote their intellectual discovery, and to encourage students to take advantage of both in-and out-of-class educational opportunities in order that they become self-directed learners and decision makers.
Both advisers and advisees share responsibility for making the advising relationship succeed. By encouraging their advisees to become engaged in their education, to meet their educational goals, and to develop the habit of learning, advisers assume a significant educational role. The advisee’s unit of enrollment will provide each advisee with a primary academic adviser, the information need to plan the chosen program of study, and referrals to other specialized resources.

READ SENATE POLICY 32-00: ADVISING POLICY (http://senate.psu.edu/policies-and-rules-for-undergraduate-students/32-00-advising-policy)

### University Park

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104 Davey Lab - Box#183
University Park, PA 16802
814-863-0965
rq9@psu.edu

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### Suggested Academic Plan

#### General Option at University Park Campus

The course series listed below provides only one of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an Academic Requirements or What If report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.

#### First Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 211*#</td>
<td>4</td>
<td>PHYS 212*#</td>
<td>4</td>
</tr>
<tr>
<td>MATH 140*#†</td>
<td>4</td>
<td>MATH 141*#†</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 110†</td>
<td>3</td>
<td>CHEM 112†</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 111†</td>
<td>1</td>
<td>CHEM 113†</td>
<td>1</td>
</tr>
<tr>
<td>PSU 16</td>
<td>1</td>
<td>ENGL 15, 30, or ESL 15†</td>
<td>3</td>
</tr>
<tr>
<td>General Education Course</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Credits</td>
<td>16</td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

#### Second Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 213 &amp; PHYS 214*</td>
<td>4</td>
<td>PHYS 237†</td>
<td>3</td>
</tr>
<tr>
<td>MATH 230†</td>
<td>4</td>
<td>MATH 251*</td>
<td>4</td>
</tr>
<tr>
<td>MATH 220</td>
<td>2</td>
<td>General Education Course</td>
<td>3</td>
</tr>
<tr>
<td>General Education Course</td>
<td>3</td>
<td>CMPSC 101, 121, 200, 201, or 202</td>
<td>3</td>
</tr>
<tr>
<td>General Education Course (GHW)</td>
<td>1.5</td>
<td>CAS 100, 100A, 100B, or 100C†</td>
<td>3</td>
</tr>
<tr>
<td>Credits</td>
<td>14.5</td>
<td>16</td>
<td></td>
</tr>
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</table>

#### Third Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 400*</td>
<td>4</td>
<td>PHYS 410*</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 419†</td>
<td>3</td>
<td>PHYS 420†</td>
<td>3</td>
</tr>
<tr>
<td>MATH 400 level selection (consult with an academic adviser for options)</td>
<td>3</td>
<td>MATH 400 level selection (consult with an academic adviser for options)</td>
<td>3</td>
</tr>
<tr>
<td>General Education Course</td>
<td>3</td>
<td>PHYS 444†</td>
<td>2</td>
</tr>
</tbody>
</table>

#### Fourth Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
</tr>
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<tbody>
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<td>PHYS 400 level selection (consult with an academic adviser for options)</td>
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<td>PHY 400 level selection (consult with an academic adviser for options)</td>
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<tr>
<td>PHYS 402 or 457W‡</td>
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<td>PHYS 457W or 458‡</td>
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<td>Supporting Course (consult with an academic adviser for options)</td>
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<tr>
<td>ENGL 202C‡</td>
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<td>Supporting Course (consult with an academic adviser for options)</td>
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<tr>
<td>Elective‡</td>
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<td>General Education Course (GHW)</td>
<td>1.5</td>
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<td>Credits</td>
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**University Requirements and General Education Notes:**

US and IL are abbreviations used to designate courses that satisfy University Requirements (United States and International Cultures).

W, M, X, and Y are the suffixes at the end of a course number used to designate courses that satisfy University Writing Across the Curriculum requirement.

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Integrative Studies courses are required for the General Education program. N is the suffix at the end of a course number used to designate an Inter-Domain course and Z is the suffix at the end of a course number used to designate a Linked course.

All incoming Schreyer Honors College first-year students at University Park will take ENGL/CAS 137 in the fall semester and ENGL/CAS 138 in the spring semester. These courses carry the GWS designation and replace both ENGL 30 and CAS 100. Each course is 3 credits.

1. MATH 400 level selection can be taken from the following list: MATH 405, 40, 408, 411, 412, 414, 415, 416, 417, 418, 421, 422, 425, 430, 431, 441, 444, 445, 446, 447, 449, 450, 451, 455, 456, 484 or 486.

2. PHYS 457W requires a grade of C or better.

**Medical Option at University Park Campus**

The course series listed below provides only one of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an Academic Requirements or What If report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.
### First Year

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<thead>
<tr>
<th>Fall</th>
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<tbody>
<tr>
<td>PHYS 211†</td>
<td>4 PHYS 212†</td>
<td>4</td>
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<tr>
<td>MATH 140†‡</td>
<td>4 MATH 141†‡</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 110†‡</td>
<td>3 CHEM 112‡</td>
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<td>CHEM 111†</td>
<td>1 CHEM 113‡</td>
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<td>PSU 16</td>
<td>1 ENGL 15, 30, or ESL 15‡</td>
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</table>

* Course requires a grade of C or better for the major

† Course satisfies General Education and degree requirement

**University Requirements and General Education Notes:**

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Integrative Studies courses are required for the General Education program. N is the suffix at the end of a course number used to designate an Inter-Domain course and Z is the suffix at the end of a course number used to designate a Linked course.

All incoming Schreyer Honors College first-year students at University Park will take ENGL/CAS 137 in the fall semester and ENGL/CAS 138 in the spring semester. These courses carry the GWS designation and replace both ENGL 30 and CAS 100. Each course is 3 credits.

### Second Year

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<th>Credits Spring</th>
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<tbody>
<tr>
<td>PHYS 213</td>
<td>4 PHYS 237†</td>
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<td>MATH 230†</td>
<td>4 MATH 251*</td>
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<td>BIOL 110 or 141†</td>
<td>3-4 BIOL 240W or BME 201†</td>
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<td>CAS 100, 100A, 100B, or 100C‡</td>
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### Third Year

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<tr>
<td>PHYS 400†</td>
<td>4 PHYS 419†</td>
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<td>MATH 400 level selection (consult with an academic adviser for options)</td>
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<td>2 CMPSC 101, 121, 200, 201, or 202</td>
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<td>CHEM 210 (or BME Elective)</td>
<td>3 CHEM 212 (or BME Elective)</td>
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<td>3 General Education Requirement</td>
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### Fourth Year

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<td>CHEM 213 (or BME Elective)</td>
<td>2 PHYS 457W*</td>
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<tr>
<td>ENGL 202C‡</td>
<td>3 Supporting Course (consult with an academic adviser for options)</td>
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<tr>
<td>General Education Course</td>
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**Electronics Option at University Park Campus**

The course series listed below provides only one of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an Academic Requirements or What If report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.

### First Year

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<td>MATH 140†‡</td>
<td>4 MATH 141†‡</td>
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<td>CHEM 110†‡</td>
<td>3 CHEM 112‡</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 111†</td>
<td>1 CHEM 113‡</td>
<td>1</td>
</tr>
<tr>
<td>PSU 16</td>
<td>1 ENGL 15, 30, or ESL 15‡</td>
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<tr>
<td>General Education Course</td>
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### Second Year

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<th>Credits</th>
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<tbody>
<tr>
<td>PHYS 213</td>
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<td>3</td>
</tr>
<tr>
<td>MATH 230†</td>
<td>4 MATH 251*</td>
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</tr>
<tr>
<td>MATH 220</td>
<td>2 CMPEN 270 (or Electrical Engineering 300 level selection)</td>
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<td>EE 210</td>
<td>4 CMPSC 101, 121, 200, 201, or 202</td>
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### General Education Course

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#### Third Year

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<td>PHYS 444</td>
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<td>Electrical Engineering 300 or 400 level selection (consult with an academic adviser for options)</td>
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<tr>
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#### Fourth Year

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<tr>
<td>PHYS 410</td>
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<td>PHYS 420</td>
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<td>PHYS 457W</td>
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<td>ENGL 202C†</td>
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<td>General Education Course</td>
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<td>General Education Course</td>
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<td>Supporting Course (consult with an academic adviser for options)</td>
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<td>General Education Selection (GHW)</td>
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<td>Credits</td>
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Total Credits 124

* Course requires a grade of C or better for the major
† Course requires a grade of C or better for General Education
# Course is an Entrance to Major requirement
‡ Course satisfies General Education and degree requirement

### Computational Option at University Park Campus

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### First Year

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<td>CHEM 110*‡#†</td>
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<td>CHEM 112†</td>
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<td>CHEM 113†</td>
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<td>ENGL 15, 30, or ESL 15†</td>
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### Second Year

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<tr>
<th>Fall</th>
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<th>Spring</th>
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<tbody>
<tr>
<td>PHYS 213 &amp; PHYS 214*</td>
<td>4</td>
<td>PHYS 237*</td>
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<td>MATH 230*</td>
<td>4</td>
<td>MATH 251*</td>
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<td>CMPSC 121</td>
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<td>General Education Course (GHW)</td>
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### Third Year

<table>
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<tr>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
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</thead>
<tbody>
<tr>
<td>PHYS 400</td>
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<td>PHYS 410*</td>
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<tr>
<td>PHYS 419 (or MATH 4xx)*</td>
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<td>PHYS 419 (or MATH 400 level selection)*</td>
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<td>MATH 455</td>
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<td>MATH 456</td>
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<td>PHYS 444*</td>
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<td>General Education Course</td>
<td>3</td>
<td>General Education Course (GHW)</td>
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<tr>
<td>Supporting Course (consult with an academic adviser for options)</td>
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<table>
<thead>
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<th>Credits</th>
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### Fourth Year

<table>
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<tr>
<th>Fall</th>
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<th>Spring</th>
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<tbody>
<tr>
<td>PHYS 420*</td>
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<td>PHYS 457W</td>
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<table>
<thead>
<tr>
<th>Credits</th>
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</table>
MATH 400 level or STAT 400 level or CMPSC 300/400 level selection (consult with an academic adviser for options) | 3 | 3 MATH 400 level or STAT 400 level or CMPSC 300/400 level selection (consult with an academic adviser for options) | 3 | 3

| General Education Course | 3 | 3 General Education Course | 3 | 3

| ENGL 202C† | 3 | 3 Supporting Course (consult with an academic adviser for options) | 3 | 3

Total Credits 121

* Course requires a grade of C or better for the major

‡ Course requires a grade of C or better for General Education

# Course is an Entrance to Major requirement

† Course satisfies General Education and degree requirement

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**Materials-Nanotechnology Option: Nanotechnology Track at University Park Campus**

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**First Year**

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>PHYS 211†</td>
<td>4 PHYS 212§</td>
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<td>PHYS 213 &amp; PHYS 214*</td>
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| CHEM 110†# | 3 | CHEM 112† | 3 |
| CHEM 111† | 1 | CHEM 113† | 1 |
| PSU 16 | 1 | ENGL 15, 30, or ESL 15† | 3 |

| General Education Course | 3 | 3 General Education Course | 3 | 3

| ENGL 202C† | 3 | 3 Supporting Course (consult with an academic adviser for options) | 3 | 3

Total Credits 121

* Course requires a grade of C or better for the major

‡ Course requires a grade of C or better for General Education

# Course is an Entrance to Major requirement

† Course satisfies General Education and degree requirement

** University Requirements and General Education Notes:**

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Materials-Nanotechnology Option: Materials Track at University Park Campus

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<table>
<thead>
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<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
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<tbody>
<tr>
<td>PHYS 211†</td>
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<td>PHYS 212†</td>
<td>4</td>
</tr>
<tr>
<td>MATH 140†‡</td>
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<td>MATH 141†‡</td>
<td>4</td>
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<td>CHEM 110†‡</td>
<td>3</td>
<td>CHEM 112†</td>
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<td>CHEM 111†</td>
<td>1</td>
<td>ENGL 15, 30, or ESL 15†</td>
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<tr>
<td>PSU 16</td>
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### Second Year

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<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
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<tr>
<td>PHYS 213* &amp; PHYS 214*</td>
<td>4</td>
<td>PHYS 237†</td>
<td>3</td>
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<td>MATH 230*</td>
<td>4</td>
<td>MATH 251†</td>
<td>4</td>
</tr>
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<td>MATH 220</td>
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<td>CAS 100†</td>
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<td>CMPSC 101, 121, 200, 201, or 202</td>
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### Third Year

<table>
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<th>Spring</th>
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<td>PHYS 410*</td>
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</tr>
<tr>
<td>PHYS 419 (or MATH 400 level selection (consult with an academic adviser for options))†</td>
<td>3</td>
<td>PHYS 419 (or MATH 400 level selection (consult with an academic adviser for options))*</td>
<td>3</td>
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<tr>
<td>MATSE 430</td>
<td>3</td>
<td>PHYS 444†</td>
<td>2</td>
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<tr>
<td>MATSE 460</td>
<td>1</td>
<td>MATSE 436 or 402</td>
<td>3</td>
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</tbody>
</table>

| General Education Course                  | 3       | General Education Course                    | 3       |
| General Education Course (GHW)            | 1.5     |                                             |         |
|                                           | 15.5    |                                             | 15      |

### Fourth Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 412*</td>
<td>3</td>
<td>PHYS 457†</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 420 (or MATSE 400 level selection (consult with an academic adviser for options))†</td>
<td>3</td>
<td>PHYS 420 (or MATSE 400 level selection (consult with an academic adviser for options))‡</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 202C‡</td>
<td>3</td>
<td>General Education Course</td>
<td>3</td>
</tr>
<tr>
<td>General Education Course</td>
<td>3</td>
<td>Supporting Course (consult with an academic adviser for options)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

Total Credits 122

* Course requires a grade of C or better for the major
† Course requires a grade of C or better for General Education
‡ Course is an Entrance to Major requirement
# Course satisfies General Education and degree requirement

### University Requirements and General Education Notes:

US and IL are abbreviations used to designate courses that satisfy University Requirements (United States and International Cultures).

W, M, X, and Y are the suffixes at the end of a course number used to designate courses that satisfy University Writing Across the Curriculum requirement.

GWS, GQ, GHW, GN, GA, GH, and GS are abbreviations used to identify General Education program courses. General Education includes Foundations (GWS and GQ) and Knowledge Domains (GHW, GN, GA, GH, GS, and Integrative Studies). Foundations courses (GWS and GQ) require a grade of ‘C’ or better.

Integrative Studies courses are required for the General Education program. N is the suffix at the end of a course number used to designate an Inter-Domain course and Z is the suffix at the end of a course number used to designate a Linked course.

All incoming Schreyer Honors College first-year students at University Park will take ENGL/CAS 137 in the fall semester and ENGL/CAS 138 in the spring semester. These courses carry the GWS designation and replace both ENGL 30 and CAS 100. Each course is 3 credits.

### Career Paths

It’s often said that physicists are first and foremost problem solvers. With strong analytical skills in multiple areas, physicists are versatile and adaptable, and find career flexibility in many fields. A BS in Physics provides strong training for direct employment in a wide variety of careers or for further training at the graduate level in many STEM fields. Examples include jobs in private industries, national labs, and small
companies involving basic or applied research, engineering applications, data analysis, or modeling, programming, and simulations.

**Careers**

Physics majors use their analytic and problem-solving skills in a wide variety of 'real world' jobs in both the public and private sector, from national laboratories, the aerospace industry, and advanced technology and communications industries to patent law.

MORE INFORMATION (http://www.aps.org/careers)

**Opportunities for Graduate Studies**

About half of all Physics B.S. students pursue additional graduate education at some point. Many students proceed directly to a Physics Ph.D. program and the vast majority of students who are accepted into such programs receive both a stipend and have full tuition paid for by the institution. Some students find that their employers subsidize additional education in a technical field useful to the company. Physics majors have successfully pursued graduate degrees in all engineering fields, mathematics, statistics, and data science, law school and medical school, and other life science related areas, such as medical physics and neuroscience.

MORE INFORMATION (http://www.gradschoolshopper.com/gradschool)

**Professional Resources**

- The American Physical Society (http://www.aps.org)
- The American Institute of Physics (http://www.aip.org)
- The National Society of Physics Students (SPS) (http://www.spsnational.org)
- The National Sigma Pi Sigma (ΣΠΣ) Physics honor society (http://www.sigmapisigma.org/sigmapisigma)
- The National Society of Black Physicists (NSBP) (https://www.nsbp.org)
- The National Society of Hispanic Physicists (NSHP) (http://www.hispanicphysicists.org)
- American Association of Physicists in Medicine (AAPM) (http://www.aapm.org)

**Contact**

**University Park**

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