NDSU NORTH DAKOTA STATE UNIVERSITY

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PHYSICS

Physics is the most fundamental and exact of the physical sciences. Its laws are basic to deep understanding in all of technology, and in many fields of study, such as astronomy, chemistry, engineering, materials science, photonics, biology, medicine, geology, and environmental science. Physicists often end up in a wide range of leadership positions. Notable examples include Jimmy Carter, Elon Musk, Steven Wolfram, Douglas Hofstadter, and Angela Merkel.

Background Information

The Department of Physics has growing undergraduate and graduate programs. Yet, its size remains comparatively small, allowing personalized interactions between students with all of its 11 faculty members. Not only do students participate in research projects early on, they often become authors in peer-reviewed publications and present their results in the regional and national conferences and workshops. In addition, our students are highly engaged; they regularly participate successfully in the University Physics Competition and contribute actively to various outreach activities.

The Department of Physics has a strong research focus on three fields: materials (especially soft materials), computational physics, and physics education research. While this represents only a small subset of all existing physics fields, our focus makes us competitive and successful on the national level and beyond. Students can choose among a number of curricular options that prepare them for industrial, governmental, and academic careers. The Fargo/Moorhead urban area contains three colleges with a physics program. Courses can be taken in each college through the Tri-College University. This increases the number of available courses to a level typical for large universities only.

High School Preparation

A prospective physics major is generally expected to have taken physics, chemistry, and mathematics courses. Computer courses can also be useful. Incoming students should normally be ready to start learning calculus. Some of our incoming students have already taken AP courses in physics or mathematics. Note, however, that deficiencies in any of these subjects may be remedied in the freshman or later years at the University.

Curriculum Options

The most popular curricular option in the Department of Physics is the standard physics major. Also popular are our two double major programs in Physics and Mathematics as well as in Physics and Computer Science. Since fall 2017 we offer a new double major in Electrical and Computer Engineering and Physics. All these programs allow well-prepared students to complete the requirements for both majors in four years by taking advantage of the close connections between physics, mathematics, computer science, and engineering. In addition, we offer a physics major with a focus on optical science and engineering. The optical science and engineering option, which is the only regional program of this type, includes an interdisciplinary optics/photonics sequence of courses taught by the Department of Physics and the Department of Electrical and Computer Engineering using a state-of-the-art optics teaching laboratory. Finally, highly qualified students can earn both a Bachelor's and Master's degree in physics by enrolling into the Accelerated Masters program in their junior year.

All of our physics majors (including the double majors and physics majors with the optical science and engineering option) take introductory courses in classical mechanics, computational physics, electricity and magnetism, optics, thermodynamics, quantum mechanics, and modern physics, as well as selected specialized courses such as photonics, lasers, or condensed matter physics. In addition, all physics majors get involved in research projects with faculty, typically in fields like materials (including bio- and polymer physics), computational physics, and physics education research. Two dedicated courses allow students to receive credit for their research efforts. Any of our curriculum options prepare students for graduate work in physics or related fields and subsequent employment in industry, government, or academia. Physics graduates have excellent job perspectives because they are widely valued as creative and persistent problem solvers who are often able to step into leadership positions.

Career Opportunities

A great variety of employment opportunities exist for physics majors who wish to pursue careers after obtaining a bachelor's degree. Some find positions in industry or government. Many technical industries seek physics graduates for work in software development, engineering, science and lab technician positions, management and sales. According to the results of the National Association of Colleges and Employers Winter 2016 Salary Survey, physics majors were expected to receive an average starting salary of $65,250.

As technology continues to develop, there will be a need for skilled people to make new discoveries in the basic sciences. Because of this, talented physics majors are encouraged to pursue a doctoral degree. Outstanding doctoral graduates in physics find research and teaching positions in universities or employment in government laboratories and research-oriented industries.

An education in physics is so fundamental that it provides excellent preparation for graduate education in nearly every technical field, including engineering. Additionally, North Dakota State University graduates in physics have entered medical schools and have studied law. One past graduate received a doctorate in biophysics and now works at the University of Minnesota Medical School; another is at the Mayo Clinic in Rochester, Minn. Some of our recent graduates worked on advanced degrees in biomedical engineering, chemical physics, electrical engineering, solid-state physics, meteorology and radiological science. A number of recent graduates have pursued graduate studies at schools such as Cornell University, Michigan State University, the University of Minnesota, Carnegie Mellon University, Ohio State University, the University of Illinois at Chicago, State University of New York Stony Brook, Rutgers University and Northwestern University.

Financial Aid

Financial aid at NDSU is available in the form of loans, grants, scholarships, and work-study. Students who qualify for federal college work-study may be paid for work on department research projects. Highly qualified students may be hired through the Department of Physics or the College of Science and Mathematics as undergraduate Research Assistants (RA) or Learning Assistants (LA).

Internships

The Cooperative Education Program provides students the opportunity to earn money and gain valuable experience by spending one or more semesters working in industrial or government laboratories. Internship opportunities include Sanford Medical Center in Fargo and NASA. Students may also apply to participate in research projects through the Department of Physics or Research Experience for Undergraduates program at NDSU or other institutions.

Physics Plan of Study

Please note this is a sample plan of study and not an official curriculum. Actual student schedules for each semester will vary depending on start year, education goals, applicable transfer credit, and course availability. Students are encouraged to work with their academic advisor on a regular basis to review degree progress and customize an individual plan of study.

Freshman

Fall	Credits	Spring	Credits
PHYS 171 Introductory Projects in Physics	1	PHYS 251 University Physics I	5
MATH 165 Calculus I	4	and 251L University Physics I Laboratory	
CHEM 150 Principles of Chemistry I	4	PHYS 251R University Physics I Recitation	1
and 160 Principles of Chemistry Laboratory I		MATH 129 Basic Linear Algebra	3
ENGL 110 College Composition I	4	or 329 Intermediate Linear Algebra	
or 120 College Composition II (based on placement)		MATH 166 Calculus II	4
Gen Ed Wellness	2	CHEM 151 Principles of Chemistry II	4
		and 161 Principles of Chemistry Laboratory II	
	15		**17**

Sophomore

Fall	Credits	Spring	Credits
PHYS 252 University Physics II	5	CSCI 161 Computer Science II	4
and 252L University Physics II Laboratory		PHYS 350 Modern Physics	3
PHYS 252R University Physics II Recitation	1	MATH 266 Introduction to Differential Equations	3
MATH 265 Calculus III	4	COMM 110 Fundamentals of Public Speaking	3
CSCI 160 Computer Science I	4	Gen Ed Humanities & Fine Arts/Gen Ed Global Perspectives	3
	14		**16**

Junior

Fall	Credits	Spring	Credits
PHYS 355 Classical Mechanics	3	PHYS 370 Introduction to Computational Physics	3
PHYS 360 Modern Physics II	3	ENGL 324 Writing in the Sciences	3
MATH 4XX Math Elective	3	PHYS 361 Electromagnetic Theory	3
Free Elective	3	MATH 4XX Math Elective	3
Free Elective	3	Gen Ed Humanities & Fine Arts	3
	15		**15**

Senior

Fall	Credits	Spring	Credits
PHYS 462 Thermal and Statistical Physics	3	PHYS 489 Senior Project II	2
PHYS 485 Quantum Mechanics I	3	PHYS 481 Condensed Matter Physics	3
PHYS 411 Optics for Scientists & Engineers	4	PHYS 486 Quantum Mechanics II	3
and 411L Optics for Scientists and Engineers Lab		Physics Elective	3
PHYS 488 Senior Project I	1	Gen Ed Social & Behavioral Sciences/Gen Ed Cultural Diversity	3
Gen Ed Social & Behavioral Sciences	3		
	14		**14**

Total Credits: 120

View NDSU equivalencies of transfer courses at: www.ndsu.edu/transfer/equivalencies

For Further Information

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