

# Physics



## Career Profile

Physics deals with the behavior and composition of matter and its interactions at the most fundamental level. It is concerned with the nature of physical reality that is, only with things that can be measured with instruments. Sub-fields within physics include solid-state or condensed matter physics, nuclear physics, high energy and particle (HEP) physics, biophysics, and astrophysics/cosmology.

The curriculum provides a background in applications of physics for students seeking employment in industry and also provides a solid foundation for graduate study in physics or in other fields such as geophysics, meteorology, metallurgy, computer science, mathematics, materials science, and many branches of engineering.

## Accreditation

The South Dakota School of Mines and Technology is accredited by the Higher Learning Commission of the North Central Association of Colleges and Secondary Schools, the recognized accrediting agency for the north central states. In 2006, the HLC voted to continue accreditation of the School of Mines. The School of Mines has been accredited since 1925.

## Labs and Facilities

The facilities in the Electrical Engineering-Physics Building are equipped for all aspects of the department's experimental work from the introductory laboratories through graduate research. They enable students to observe physical phenomena, demonstrate physical principles, and learn techniques for making quantitative measurements in the fields of mechanics, heat, optics, electricity and magnetism, atomic physics, and solid state physics.

## Faculty

Chair: Dr. Andre Petukhov, Professor  
Professors: Dr. Michael Foygel and Dr. Vladimir Sobolov  
Associate Professor: Dr. Robert Corey

## Features and Strengths

The recent down-select by the National Science Foundation of the Sanford Underground Science and Engineering Lab (SUSEL) at Homestake as the future home of the world's deepest underground laboratory opens new avenues for physics majors. Located in Lead, S.D., a short distance from the School of Mines, the laboratory will provide research and employment opportunities for our students like nowhere else in the world.

## Program Overview

The goal of the program of study in physics is to provide the student with an understanding of the basic laws of physics and to develop skills that will enable the student to further explore physical phenomena and to solve related problems. The student will be expected to develop a high level of mathematical skills and become proficient in oral and written communications. Laboratory skills are also emphasized.

## Outcomes

- School of Mines graduates received salary offers that average approximately \$54,000.
- 100 percent of 2006-07 School of Mines physics graduates were placed in their field or have entered a graduate program within three months of graduation.
- 80 percent of graduates gain real-life experience through internships and co-ops.

## Student Organizations

Students at the School of Mines also have a variety of opportunities for extra-curricular activities that range from music, intramurals, and drama to ski and snowboarding clubs, and more than 75 other clubs and professional student organizations. These are important activities for our students and we encourage them to take full advantage of out-of-classroom events.

The Center for Advanced Manufacturing and Production (CAMP) is designed to teach students engineering, science and design skills, as well as the ability to work in teams. Team members design, build, market and raise the money for their projects. All students are welcome to work on CAMP projects.

## Research

Students have the opportunity to be involved in research with professors conducting work on projects such as solid state nuclear magnetic resonance, properties of ferroelectric and magnetically ordered materials, electronic properties of nanoscale materials and devices, semiconductor spintronics, and more.

**PHYSICS CURRICULUM/CHECKLIST**

**FRESHMAN YEAR**

**First Semester**

MATH 123	Calculus I	4
CHEM 112	General Chemistry I	3
CHEM 112L	General Chemistry I Lab	1
ENGL 101	Composition I	3
PE	Physical Education	1
IS 110	Explorations	2
Humanities or Social Sciences Elective(s)		3
<b>TOTAL</b>		<b>17</b>

**Second Semester**

MATH 125	Calculus II	4
PHYS 211	University Physics I	3
PE	Physical Education	1
CHEM 114	General Chemistry II	3
CHEM 114L	Gen Chemistry II Lab	1
CSC 150	Computer Science I	3
<b>TOTAL</b>		<b>15</b>

**SOPHOMORE YEAR**

**First Semester**

MATH 225	Calculus III	4
PHYS 213	University Physics II	3
PHYS 213L	University Physics II Lab	1
PHYS 275	Relativity	3
ENGL 279	Technical Communications I	3
Humanities or Social Sciences Elective(s)		3
<b>TOTAL</b>		<b>17</b>

**Second Semester**

MATH 321	Differential Equations	4
EE 220	Circuits I	4
ENGL 289	Technical Communications II	3
Humanities or Social Sciences Elective(s)		6
<b>TOTAL</b>		<b>17</b>

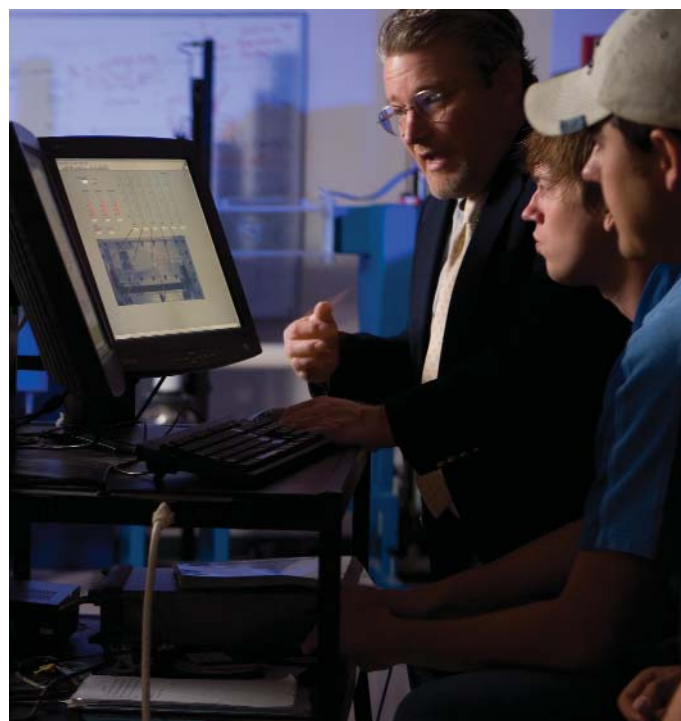
**JUNIOR YEAR**

**First Semester**

MATH 432	Partial Differential Equations	3
PHYS 341	Thermodynamics	3
PHYS 312	Exper Physics Design I	2
CENG 244	Intro to Digital Systems	4
PHYS 451	Classical Mechanics	4
<b>TOTAL</b>		<b>16</b>

**Second Semester**

MATH 315	Linear Algebra	4
PHYS 471	Quantum Mechanics	4
PHYS 445	Statistical Mechanics <sup>1</sup>	4
PHYS 314	Exper Physics Design II	2
Humanities or Social Sciences Elective(s)		3
<b>TOTAL</b>		<b>18</b>



**SENIOR YEAR**

**First Semester**

PHYS 421	Electromagnetism	4
PHYS 361	Optics <sup>1</sup>	3
PHYS 412	Advanced Design Projects I	2
PHYS 481	Mathematical Physics <sup>1</sup>	4
Humanities or Social Sciences Elective(s)		3
<b>TOTAL</b>		<b>16</b>

**Second Semester**

PHYS 433	Nuclear and Particle Physics <sup>1</sup>	3
PHYS 439	Solid State Physics <sup>1</sup>	4
PHYS 414	Advanced Design Projects II	2
Humanities or Social Sciences Elective(s)		6
<b>TOTAL</b>		<b>15</b>

**128 credits required for graduation**

**Curriculum Notes**

At the end of the sophomore year twelve (12) hours of electives must include six (6) hours in humanities (in two (2) disciplines or in a sequence of foreign language courses) and six (6) hours in social sciences (in two (2) disciplines).

The electives must contain a minimum of sixteen (16) hours in social sciences and humanities and three (3) hours of mathematics or computer science at the 200 level or above. Ten (10) credit hours of military science may also be used as electives.

<sup>1</sup> Courses offered alternate years.