Physics & Astrophysics  
Master of Science

The Department of Physics and Astrophysics offers graduate programs leading to the Master of Science and Doctor of Philosophy degrees. Current research in the department emphasizes solid-state physics, materials science, astrophysics, and health physics. Departmental facilities permit both theoretical and experimental research investigations.

The primary functions of the Physics and Astrophysics Department are teaching, research and service. In accordance with the mission of the University, the department provides courses for physics majors and minors, and service courses to students in other programs in the College of Arts & Sciences and other units of the University.

Goal 1: Students will acquire competency in graduate level physics including mechanics, electromagnetism, quantum mechanics, and theoretical methods.
Goal 2: Students will acquire in-depth exposure to research.
Goal 3: Students will acquire skills in oral presentations and acquire experience in writing research papers.
Goal 4: Students will develop analytical skills needed as a professional physicist.

Admission Requirements

The applicant must meet the School of Graduate Studies’ current minimum general admission requirements as published in the graduate catalog.

1. A four-year bachelor’s degree from a recognized college or university.
2. A cumulative Grade Point Average (GPA) of at least 2.75 for all undergraduate work (2.5 for M. Engr.) or a GPA of at least 3.0 for the junior and senior year of undergraduate work (based on a 4.0 scale).
3. Completed a minimum of 21 semester credits of undergraduate physics, plus mathematics through differential equations or the equivalent.
4. Coursework should include intermediate courses in mechanics, electricity and magnetism, optics, thermal physics, and modern quantum physics. Adequate preparation in general chemistry is also necessary.
5. Satisfy the School of Graduate Studies’ English Language Proficiency requirements as published in the graduate catalog.
6. An applicant without satisfactory undergraduate training may be admitted to the program, but will be required to remove deficiencies by completing the necessary undergraduate courses without receiving graduate credit for them.
7. Ph.D. applicants are encouraged to submit the Graduate Record Examination scores for the general test and advanced physics test.

Degree Requirements

Students seeking the Master of Science degree at the University of North Dakota must satisfy all general requirements set forth by the School of Graduate Studies as well as particular requirements set forth by the Physics and Astrophysics Department.

The program is designed to provide the student with basic physics courses at the graduate level and an introduction to research.

1. Minimum of 30 semester credits in a major field, including the credits granted for the thesis and the research

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leading to the thesis.
2. At least one-half of the credits must be at or above the 500-level.
3. A maximum of one-fourth (usually 8-9 semester credits) of the credit hours required for the degree may be transferred from another institution.
4. Complete the following courses:

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<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>PHYS 509</td>
<td>Methods of Theoretical Physics</td>
<td>3</td>
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<tr>
<td>PHYS 539</td>
<td>Quantum Mechanics</td>
<td>3</td>
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<tr>
<td>PHYS 541</td>
<td>Theory Electricity Magnetism</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 545</td>
<td>Analytical Mechanics</td>
<td>3</td>
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5. Complete six additional hours from the following:

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<tr>
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<td>3</td>
</tr>
<tr>
<td>PHYS 540</td>
<td>Quantum Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 542</td>
<td>Theory of Electricity and Magnetism</td>
<td>3</td>
</tr>
</tbody>
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6. Complete research project and PHYS 998 Thesis (4-9 credits).

Faculty and Areas of Expertise
- **Wayne Barkhouse, Ph.D.** Globular clusters, properties of galaxy clusters, galaxy cluster detection methods, multiwavelength surveys, dark energy
- **Graeme A. Dewar, Ph.D.** Negative index of refraction materials, Ferromagnetic resonance and antiresonance. Magneto-acoustics
- **Ju H. Kim, Ph.D.** Condensed matter theory, superconductivity, superconducting nanoelectronic devices, and quantum computing
- **Yen Lee Loh, Ph. D.** Theory of condensed matter and cold atoms
- **Kanishka Marasinghe, Ph.D.** Atomic structure-property relationships of complex novel materials, magnetic interactions at the atomic scale
- **Nuri Oncel, Ph.D.** Fabrication and Characterization of Nanostructured Materials
- **William A. Schwalm, Ph.D.** Condensed matter theory, nonlinearity and disorder, mathematical and computational physics
- **Li-Chun Tung, Ph. D.** Experimental condensed matter physics and infrared optics
- **Timothy R. Young, Ph.D.** Astrophysics, supernovae and supernovae remnants, multidimensional hydrodynamics, numerical simulation, radiation and neutrino transport

Contact Information
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