

# Physics

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## Department Information

- **Department Chair:**  
Sylvio May, Ph.D.
- **Graduate Coordinator:**  
Mila Kryjevskaja, Ph.D.
- **Department Location:**  
218 South Engineering
- **Department Phone:**  
(701) 231-8974
- **Department Web Site:**  
[www.ndsu.edu/physics/](http://www.ndsu.edu/physics/) (<http://www.ndsu.edu/physics/>)
- **Application Deadline:**  
For U.S. students, one month before registration; for international students, March 1 for fall semester and September 1 for spring/summer semester.
- **Credential Offered:**  
Ph.D., M.S., Accelerated M.S.
- **Test Requirement:**  
GRE (general and subject recommended)
- **English Proficiency Requirements:**  
RA-TOEFL iBT 79, IELTS 6; TA- TOEFL iBT 81 (Speaking 23, Writing 21), IELTS 7 (Speaking 6, Writing 6); Duolingo 105

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## Program Description

The Department of Physics offers graduate study leading to the M.S. and Ph.D. degrees. Advanced work may involve specialized training in the following areas: biophysics, computational physics, condensed matter, nanomaterials, physics education research, polymer physics, soft matter physics, and statistical mechanics.

Research and academic programs are tailored to meet individual needs and interests. New students are strongly urged to visit faculty members to discuss research opportunities soon after their arrival.

## Admissions Requirements

The Department of Physics graduate program is open to all qualified graduates of universities and colleges of recognized standing.

## Financial Assistance

Prospective students must apply to the Graduate School and be accepted in full or conditional status before being eligible for an assistantship in the Department of Physics.

Generally, graduate students are supported during the academic year by either teaching assistantships or research assistantships. The 2019-2020 academic year stipend is \$19,500 for 9 months. Additional support during the summer is also possible. Graduate tuition (but not student fees) is fully waived for all teaching assistants and research assistants.

## Research Equipment

NDSU's Materials and Nanotechnology Center is located in the Research and Technology Park. The Center is equipped with two state-of-the-art wet labs, a synthesis lab, optical characterization facilities (optical/NIR fluorescence microscopy, laser-scanning confocal microscopy, and light scattering/reflectometry), and surface characterization facilities (nano-indentation and atomic-force microscopy). There are seven fume hoods in the lab space, as well as a number of synthesis tools, including a Beckman Coulter Optima L-80 XP Ultracentrifuge. We also have access to state-of-the-art chemical synthesis facilities in the Departments of Chemistry and Biochemistry and Coatings and Polymeric Materials, including a Photo Emissions Tech Model SS50AAA Solar Simulator equipped with a Keithley 2400 Series Source meter. NDSU's Center for Computationally Assisted Science and Technology (CCAST) provides large-scale computing resources to NDSU users.

The Graduate Coordinator or Chair shall assign to each incoming graduate student a temporary adviser, who shall assist in the selection of courses. During the first semester, the student is expected to discuss potential projects for thesis research with faculty members. By the beginning of the second semester, the student must have a permanent research supervisor. By the end of the second semester, the student must have filed a plan of study, selected a thesis topic, and secured two additional faculty members for the Advisory Committee.

## Master of Science

Code	Title	Credits
Physics courses number 601-689 or 700-789		10
Didactic courses numbered 601-689 or 700-789		16
PHYS 790	Graduate Seminar	1
PHYS 798	Master's Thesis	6-10
<b>Total Credits</b>		<b>30</b>

Students are required to attend all seminars and colloquia.

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## Accelerated Master of Science

Code	Title	Credits
PHYS 790	Graduate Seminar	1
<b>Choose from the following:</b>		<b>21</b>
PHYS 611	Optics for Scientists & Engineers	
PHYS 611L	Optics for Scientists and Engineers Lab	
PHYS 613	Lasers for Scientists and Engineers	
PHYS 615	Elements of Photonics	
PHYS 662	Thermal and Statistical Physics	
PHYS 681	Condensed Matter Physics	
PHYS 685	Quantum Mechanics I	
PHYS 686	Quantum Mechanics II	
PHYS 752	Mathematical Methods in Physics I	
PHYS 758	Statistical Physics	
PHYS 761	Electromagnetism	
PHYS 771	Quantum Physics I	
PHYS 781	Solid State Physics	
PHYS 798	Master's Thesis	6-8
<b>Total Credits</b>		<b>30</b>

Students must meet all requirements of the Physics bachelor and master programs. For the master's degree, students must earn at least 30 graduate credits, numbered 601-798, with these conditions:

- Up to 15 credits from this list may count toward the bachelor program requirements. It is recommended that students take the 600-level of PHYS 462/662, 481/681, 485/685, and 486/686 while fulfilling the requirements for the bachelor's degree.
- Between 6 and 8 credits are PHYS 798 (Master's Thesis), with the goal to publish a paper based on the thesis research, although this is not a requirement to graduate.
- At least one credit is PHYS 790 Graduate Seminar.

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## Doctoral Degree

Code	Title	Credits
<b>Required Courses</b>		<b>16</b>
PHYS 752	Mathematical Methods in Physics I	
PHYS 758	Statistical Physics	
PHYS 761	Electromagnetism	
PHYS 771	Quantum Physics I	
PHYS 781	Solid State Physics	
PHYS 790	Graduate Seminar	
Letter-graded courses number 601-689 or 700-789		27
PHYS 899	Doctoral Dissertation	
<b>Total credits</b>		<b>90</b>

Credits used to satisfy the requirements for the M.S. degree may be included in the total. Students are required to attend all seminars and colloquia.

### **Comprehensive Examination**

By the end of their fourth semester, students:

- submit a report that summarizes their research results so far and details a research plan for the rest of their research work;
- give a talk about their research accomplishments and plans; and
- must pass an oral examination by the Advisory Committee to confirm doctoral candidacy.

Students who pass the comprehensive examination and, at the time of the exam, have completed 30 credits (16 of which are didactic) will earn a master's degree and be eligible to participate in commencement that semester. Students should choose the Ph.D. + master's option from the drop-down menu on the Doctoral Degree Plan of Study and on the Request to Schedule Examination. After students have passed the comprehensive examination, they should complete the Exit Survey and the Degree Application. A link to these items will be emailed to them by the Graduate School.

If the student fails the comprehensive examination, she/he will be given the opportunity to repeat the examination in the next semester (this examination can be repeated only once). Alternatively, the student may elect to work for a master's degree instead.

Students should submit their doctoral thesis for examination at the end of their fourth year

### **Dissertation Video**

Doctoral students are required to submit a three-minute video summarizing their dissertation research for a lay audience. The video should be produced, with guidance from the thesis supervisor, during the final semester of study and presented to the supervisory committee at the final defense.

For the comprehensive and final examinations, students must submit the appropriate forms to the Graduate School.

#### **Warren Christensen, Ph.D.**

Iowa State University, 2007

Postdoctoral: University of Maine, 2007-2009

Research Interests: Physics Education Research, Student Content Understanding, Curriculum Development

#### **Yongki Choi, Ph.D.**

The City University of New York, 2010

Postdoctoral: University of California Irvine, 2010-2014

Research Interests: Nano-Bio-physics, Nano-electronics, Single-Molecule science

#### **Andrew Croll, Ph.D.**

McMaster University, 2009

Postdoctoral: University of Massachusetts, 2008-2010

Research Interests: Polymers, Diblock Copolymers, Thin Films, Pattern Formation, Mechanics

#### **Alan R. Denton, Ph.D.**

Cornell University, 1991

Postdoctoral: University of Guelph, 1991-94; Technical University of Vienna, 1994-95, Research Center Julich, 1996-98

Research Interests: Soft Condensed Matter Theory, Computational Physics

#### **Eric Hobbie, Ph.D.**

University of Minnesota, 1990

Research Interests: Nanotechnology, Nanoparticles, Polymers, Optics and Rheology

#### **Andrei Kryjevski, Ph.D.**

University of Washington, 2004

Research Interests: First-Principles Numerical Techniques for Fermi Systems, Electronic Structure of Nanoparticles

#### **Mila Kryjevskaja, Ph.D., Graduate Coordinator**

University of Washington, 2008

Research Interest: Physics Education Research

#### **Sylvio May, Ph.D., Department Chair**

Friedrich-Schiller University, 1996

Postdoctoral: Hebrew University Jerusalem, 1997-98

Research Interests: Physics of Lipid Membranes, Biophysics, Ionic Liquids, Drug delivery

#### **Orven Swenson, Ph.D.**

Air Force Institute of Technology, 1982

Research Interests: Laser Materials Processing, Optics Education

**Alexander J. Wagner, Ph.D.**

University of Oxford, 1997

Postdoctoral: MIT, 1998-2000, Edinburgh, 2000-2002

Research Interests: Computational Soft Matter, Phase Separation, Diffusion, Interfaces Physics

## Emeritus

**Ghazi Q. Hassoun, Ph.D.**

University of Minnesota, 1963

Postdoctoral: University of Michigan, 1963-65

Research Interests: Foundations of Quantum Mechanics

**Daniel M Kroll, Ph.D.**

University of Chicago, 1973

Research Interests: Theoretical and Computational Modeling of Complex Fluids and Biomembranes

**Charles A. Sawicki, Ph.D.**

Cornell University, 1975

Postdoctoral; Cornell University, 1975-79

Research Interests: Acoustics, Biophysics, Geophysics

**Mahendra K. Sinha, Ph.D.**

Pennsylvania State University, 1961

Postdoctoral: National Research Council (Ottawa), 1964-66

Research Interests: Field Emission and Field-Ion Microscopy Adjunct

## Adjunct Faculty

**Stuart Croll, Ph.D.**

University of Leeds, 1974

Research Interests: Weathering Durability, Film Formation, Internal Stresses In Films, Modern Art Conservation, and History of Paint Technology

**Khang Hoang, Ph.D.**

Michigan State University, 2007

Research Interests: Materials theory, Defect physics, Solid state ionics

**Dane Skow, Ph.D.**

University of Rochester, 1990

Research Interests: High Energy Physics