

NORTHEASTERN UNIVERSITY

DEPARTMENT OF PHYSICS

Boston, Massachusetts 02115
<http://cos.northeastern.edu/physics>

General University Information

President: Joseph E. Aoun
Dean of Graduate School: Kenneth W. Henderson
University website: <http://www.northeastern.edu/>
School Type: Private
Setting: Urban
Total Faculty: 2,829
Total number of Students: 35,635
Total number of Graduate Students: 15,713

Department Information

Department Chairman: Prof. Mark Williams, Chair
Department Contact: Meni Wanunu, Professor and Graduate Program Director
Total full-time faculty: 36
Total number of full-time equivalent positions: 53
Full-Time Graduate Students: 81
Female Full-Time Graduate Students: 0
First-Year Graduate Students: 15
Female First-Year Students: 5
Total Post Doctorates: 28

Department Address

111 Dana Research Center
360 Huntington Avenue
Boston, MA 02115
Phone: (617) 373-4240
Fax: (617) 373-2943
E-mail: gradphysics@northeastern.edu
Website: <http://cos.northeastern.edu/physics>

ADMISSIONS

Admission Contact Information

Address admission inquiries to: Graduate Coordinator, Physics Department, Northeastern University, 360 Huntington Ave, 111 DA, Boston, MA 02115
Phone: (617) 373-4240
E-mail: gradphysics@northeastern.edu
Admissions website: <https://cos.northeastern.edu/physics/academics/graduate/admissions-and-financial-aid/>

Application deadlines

Fall admission:
U.S. students: January 1 *Int'l. students:* January 1

Application fee

U.S. students: \$75 *Int'l. students:* \$75
The priority deadline for Ph.D. programs is January 1.

Admissions information

For Fall of 2018:
Number of applicants: 170
Number admitted: 58
Number enrolled: 27

Admission requirements

Bachelor's degree requirements: A Bachelor's degree in Physics or a related field is required.

GRE requirements

The GRE is required.
We do not have minimum GRE score requirements.

Subjective GRE requirements

The Subjective GRE is recommended.
GRE Physics is strongly recommended but not required.

TOEFL requirements

The TOEFL exam is required for students from non-English-speaking countries.
iBT score: 86

Other admissions information

Additional requirements: The GRE General is required and Physics Subject Test is strongly recommended for admission to the Ph.D. program. The minimum acceptable score suggested for admission is not specified.

Undergraduate preparation assumed: Although preparation will vary, a strong background in differential and integral calculus and differential equations is expected. Courses using Classical Mechanics (Marion), Electromagnetic Theory (Hayt and Buck), and Modern Physics (Serway) are assumed. It is also desirable, but not required, to have studied complex variables and linear algebra and to have an undergraduate background in most of the following areas: statistical physics and thermodynamics (Sears), optics (Hecht), solid-state physics (Kittel), and quantum mechanics (Griffiths).

TUITION

Tuition year 2018–2019:
Full-time students: \$1,503 per credit
Credit hours per semester to be considered full-time: 8
Deferred tuition plan: Yes
Health insurance: Available at the cost of \$2,159 per year.
Other academic fees: Full health insurance coverage provided for all graduate assistants. Additional fees include International Student, University Health Center, Student Activity, Campus Recreation and Student Center Fee
Academic term: Semester
Number of first-year students who received full tuition waivers: 18

Teaching Assistants, Research Assistants, and Fellowships

Number of first-year
Teaching Assistants: 18
Average stipend per academic year
Teaching Assistant: \$23,886
Research Assistant: \$23,886
Average stipend is per "eight month" academic year, and the stipend includes full tuition coverage. Most students receive an additional equivalent four month summer stipend. Stipend rates are for 2018–2019.

FINANCIAL AID

Application deadlines

Fall admission:
U.S. students: March 1 *Int'l. students:* March 1

Loans

Loans are available for U.S. students.
Loans are not available for international students.
GAPSFAS application required: No
FAFSA application required: Yes

For further information

Address financial aid inquiries to: Student Financial Services, 360 Huntington Ave, 354 Richards Hall, Boston, MA 02115.
 Phone: (617) 373-5899
 E-mail: sfs@northeastern.edu
 Financial aid website: <http://studentfinance.northeastern.edu>

HOUSING

Availability of on-campus housing

Single students: Yes
 Married students: No

For further information

Address housing inquiries to: Housing and Residential Life, 360 Huntington Ave, 4 Speare Commons, Boston, MA 02115.
 Phone: (617) 373-2814
 E-mail: housing@northeastern.edu
 Housing aid website: <https://www.northeastern.edu/housing/>

Table A—Faculty, Enrollments, and Degrees Granted

Research Specialty	2017–18 Faculty	Enrollment Fall 2017		Number of Degrees Granted 2017–18 (2013–18)		
		Mas-ter's	Doc-torate	Mas-ter's	Terminal Master's	Doc-torate
Biophysics	6	–	17	–	–	3(11)
Condensed Matter Physics	5	–	16	–	–	3(6)
Medical, Health Physics	1	–	1	–	–	–
Nano Science and Technology	6	–	7	–	–	1(6)
Network Science	3	–	7	–	–	1(3)
Particles and Fields	8	–	16	–	–	–(12)
Plasma and Fusion	1	–	2	–	–	–(1)
Non-specialized	6	2	14	6(18)	2(13)	–
Total	36	–	80	6(18)	2(13)	8(39)
Full-time Grad. Stud.	–	2	80	–	–	–
First-year Grad. Stud.	–	2	14	–	–	–

GRADUATE DEGREE REQUIREMENTS

Master's: Thirty-two semester hours, of which 24 are in specific courses, and a minimum grade average of B are required. Time in residence is not stipulated. Foreign languages and comprehensive and/or qualifying examination are not required. Some options include a standard M.S. with/without an M.S. thesis or an M.S. with a concentration in applied physics, engineering physics, chemical physics, biophysics, materials physics, mathematical physics, or computational physics.

Doctorate: Forty-two semester hours and a minimum grade average of B are required. Time in residence is one year after the qualifying examination. Foreign languages are not required. A qualifying examination is required after completion of one year of graduate courses. A thesis is required. M.S. degree may be earned while qualifying for Ph.D. degree.

SPECIAL EQUIPMENT, FACILITIES, OR PROGRAMS

Northeastern University is located in the Back Bay section of Boston, close to the Museum of Fine Arts, the Conservatory of Music, Symphony Hall, and historic Copley Square. It is an exciting, vibrant place to pursue graduate studies, because Greater Boston is home to more universities and research facilities than any other area in the world.

This research can be undertaken in any one of the department's research specialties or in interdisciplinary areas, such as materials physics, mathematical physics, chemical physics, molecular biophysics, or applied engineering physics. An additional option allows cooperative research to be done at high-technology industrial, government, national or international laboratories, and at medical research institutions in the Boston area.

The department is housed in the Dana Research Center, with some optics, biological physics, and condensed matter physics laboratories also located in the Egan Research Center and the new ISEC building. There are ample modern research laboratories, department and student machine shops, an electronics shop, a high-resolution electron microscope, conference and seminar rooms, and faculty and graduate student offices. The Egan Center provides a direct interface with materials researchers in chemistry and engineering. Numerous computational facilities are available on campus, including the Physics Department Computer Center in the Dana Research Center, and the newly developed Massachusetts Green High Performance Computational Center near Holyoke, Massachusetts (www.mghpcc.org).

In addition to the research they do at campus facilities, faculty members and graduate students also work at research centers located in the United States and Europe. High-energy physics experiments are under way at Fermilab (Batavia, Illinois) and CERN (Geneva, Switzerland). Astroparticle physics research is performed at the Pierre Auger Observatory in Argentina. Some groups use the synchrotron facilities at Brookhaven National Laboratory (Long Island, New York) and Argonne National Laboratory (Argonne, Illinois), and many faculty members have flourishing collaborations with scientists in Europe, Asia, and South America.

Table B—Separately Budgeted Research Expenditures by Source of Support

Source of Support	Departmental Research	Physics-related Research Outside Department
Federal government	\$11,259,402	
State/local government		
Non-profit organizations	\$3,226,986	
Business and industry	\$592,179	
Other	\$84,000	
Total	\$15,162,567	

Table C—Separately Budgeted Research Expenditures by Research Specialty

Research Specialty	No. of Grants	Expenditures (\$)
Experimental biological and medical physics	18	\$3,598,674
Condensed Matter Theory	9	\$1,464,968
Experimental Nanophysics	18	\$1,696,133
Network Science	26	\$7,104,015
Particles and Fields	9	\$1,298,777
Total	80	\$15,162,567

FACULTY

Professor

- Bansil**, Arun, Ph.D., Harvard University, 1974. *Condensed Matter Physics*. Theoretical condensed matter physics.
- Barabási**, Albert-László, Ph.D., Boston University, 1994. Network Science.
- Champion**, Paul M., Ph.D., University of Illinois at Urbana-Champaign, 1975. *Biophysics*. Experimental biological physics.

- Heiman**, Donald, Ph.D., University of California, Irvine, 1975. Experimental nanophysics.
- Karma**, Alain S., Ph.D., University of California, Santa Barbara, 1985. Theoretical condensed matter and biological physics.
- Kravchenko**, Sergey, Ph.D., Institute of Solid State Physics, Chernogolovka, 1988. Experimental nanophysics.
- Markiewicz**, Robert S., Ph.D., University of California, Berkeley, 1975. Theoretical condensed matter physics.
- Nath**, Pran, Ph.D., Stanford University, 1964. Theoretical particle physics.
- Sridhar**, Srinivas, Ph.D., California Institute of Technology, 1983. Experimental nanophysics.
- Taylor**, Tomasz, Ph.D., Warsaw University, 1981. Theoretical particle physics.
- Vespignani**, Alessandro, Ph.D., University of Rome, 1994. Network Science.
- Williams**, Mark C., Ph.D., University of Minnesota, 1998. Experimental biological physics.
- Wood**, Darien, Ph.D., University of California, Berkeley, 1987. Experimental particle physics.

Associate Professor

- Alverson**, George O., Ph.D., University of Illinois at Urbana-Champaign, 1979. *Particles and Fields*. Experimental particle physics.
- Barberis**, Emanuela, Ph.D., University of California, Santa Cruz, 1996. Experimental particle physics.
- Feiguin**, Adrian E., Ph.D., Facultad de Ciencias Exactas e Ingeniería. Universidad Nacional de Rosario, 2000. Theoretical condensed matter physics.
- Israeloff**, Nathan, Ph.D., University of Illinois at Urbana-Champaign, 1991. Experimental nanophysics.
- Kar**, Swastik, Ph.D., Indian Institute of Science, 2004. Experimental nanophysics.
- Krioukov**, Dmitri, Ph.D., Old Dominion University, 1998. Network Science.
- Menon**, Latika, Ph.D., Tata Institute of Fundamental Research, 1997. Experimental nanophysics.
- Nelson**, Brent, Ph.D., University of California, Berkeley, 2001. College of Science Associate Dean for Undergraduate Affairs. Theoretical particle physics.
- Sage**, J. Timothy, Ph.D., University of Illinois at Urbana-Champaign, 1986. Experimental biological physics.
- Stepanyants**, Armen, Ph.D., University of Rhode Island, 1999. Theoretical condensed matter and biological physics.
- Swain**, John D., Ph.D., University of Toronto, 1990. Experimental particle physics.
- Wanunu**, Meni, Ph.D., Weizmann Institute of Science, 2005. *Biophysics, Nano Science and Technology*. Experimental biological physics.
- Whitford**, Paul C., Ph.D., University of California, San Diego, 2009. Theoretical condensed matter and biological physics.

Assistant Professor

- Bi**, Dapeng Max, Ph.D., Brandeis University, 2012. *Biophysics, Condensed Matter Physics*. Theoretical condensed matter and biological physics.
- Halverson**, James, Ph.D., University of Pennsylvania, 2012. *Particles and Fields*. Theoretical particle physics.
- Orimoto**, Toyoko J., Ph.D., University of California, Berkeley, 2006. Experimental particle physics.
- Spring**, Bryan, Ph.D., University of Illinois at Urbana-Champaign, 2008. *Biophysics*. Experimental biomedical physics.
- Venkatachalam**, Vivek, Ph.D., Harvard University, 2012. Experimental Biological Physics.

Emeritus

- Aaron**, Ronald, Ph.D., University of Pennsylvania, 1961. Medical physics.
- Argyres**, Petros N., Ph.D., University of California, Berkeley, 1954. Condensed matter theory.
- José**, Jorge V., National University of Mexico, 1976. Theoretical Condensed Matter Physics.
- Lowndes**, Robert P., Ph.D., University of London, 1966. Condensed matter physics.
- Perry**, Clive H., Ph.D., University of London, 1960. Condensed matter experimental physics.
- Shiffman**, Carl A., Ph.D., University of Oxford, 1956. Medical physics.
- Sokoloff**, Jeffrey B., Ph.D., Massachusetts Institute of Technology, 1967. Theoretical condensed matter physics.
- Srivastava**, Yogendra, Ph.D., Indiana University, 1964. Condensed matter theory.
- Vaughn**, Michael T., Ph.D., Purdue University, 1960. Elementary particle theory.
- von Goeler**, Eberhard, Ph.D., University of Illinois, 1961. High-energy experimental physics.
- Wu**, Fa-Yueh, Ph.D., Washington University, 1963. Condensed matter theory.

Distinguished Adjunct Professor

- Kotliar**, Gabriel, Ph.D., Princeton University, 1983. Condensed Matter Physics.

Adjunct Professor

- Das**, Tanmoy, Ph.D., Northeastern, 2009. Theoretical condensed matter physics.
- Farmelo**, Graham, Ph.D., University of Liverpool, 1977. High-energy experimental physics.
- Gongora-Trevino**, Maria Araceli, Ph.D., University of Oxford, 1984. Condensed matter physics.
- Lindroos**, Matti, Ph.D., Tampere University of Technology, Finland, 1979. Condensed matter theory.
- Lu**, Wentao, Ph.D., Northeastern University, 2001. Electron microscopy facility manager.
- Mijnarends**, Peter, Ph.D., Delft University of Technology, 1969. Condensed matter theory.

Adjunct Assistant Professor

- Lin**, Hsin, Ph.D., Northeastern University, 2008. Condensed matter physics.

Affiliate Professor

- Nieminen**, Juoko, Ph.D., Tampere University of Technology, 1989. Condensed matter physics.

Affiliate Associate Professor

- Wang**, Dashun, Ph.D., Northeastern University, 2013. Network Science.

Affiliate Assistant Professor

- Sharma**, Amitabh, Ph.D., Institute of Genomics and Integrative Biology, CSIR, 2008. Network science.
- Sinatra**, Roberta, Ph.D., University of Catania, 2012. Network science.
- Szell**, Michael, Ph.D., University of Vienna, 2012. Network science.

Other

- Wray**, Andrew, Ph.D., Princeton University, 2010. Adjunct Research Scientist. Experimental condensed matter physics.

DEPARTMENTAL RESEARCH SPECIALTIES AND STAFF

Theoretical

Condensed Matter Theory. The group performs research on diverse topics that span forefront areas of hard/soft condensed matter physics and emerging areas at the intersection of physics and other disciplines. Specific research areas include the electronic structure and spectroscopy of high-temperature superconductors and other complex materials, nanotribology atomic-scale friction in crystalline and polymeric materials, theoretical/computational materials science, cardiac nonlinear dynamics, and theoretical/computational neuroscience. Bansil, Barabási, Bi, Feiguin, José, Karma, Sokoloff, Stepanyants, Vespignani, Whitford, Wu.

High Energy Theory. The faculty and students in the theoretical particle physics group are actively exploring questions concerning supersymmetry SUSY, and more specifically its local extension to supergravity SUGRA, with a view to understanding the connection between the universe at very large and very small scales. This leads to the study of supersymmetry and supergravity, possible extra dimensions beyond the usual four, and related exotic phenomena, such as mini-black holes, which may be produced at accelerators or by ultra-high-energy cosmic rays. Our formal investigations in superstring theory and M-theory are also conducted with the purpose of making connections between fundamental theory and experiment. The elementary particle theory group at NU initiated the PASCOS and SUSY series of conferences, which have become major conferences in high-energy physics. Halverson, Nath, Nelson, Srivastava, Taylor.

Network Science. Complex network research is not a single discipline; it is highly interdisciplinary, seeking the answers to some fundamental questions about living, adaptable, and changeable systems. Several of the main disciplines are “network theory” involving the research areas of computer science, network science, and graph theory. Another is “network science (NS)” attempting to research engineered networks, information networks, biological networks, semantic networks, and social networks, whereas “dynamic network analysis (DNA)” will use traditional social network analysis, link analysis and multi-agent systems involving large amounts of electronic data. We should also add “complex adaptive systems,” which is grounded in modern chemistry, biological views on adaptation, expatriation, and evolution. In all of these and more network-related areas, the study of emergence and self-

organization are fundamental. Although academic disciplines are hugely diverse in complex network research, here in the Department of Physics, disciplines in statistical analysis involving physics, mathematics, and computational analysis (data mining) are its primary focus. Barabási, Krioukov, Vespignani.

Experimental

Experimental Biological and Medical Physics. The group performs research on multiple levels from molecules to cells to tissue. Research programs include single molecule DNA-protein interactions, nanoscale biophysical interaction measurements, vibrational dynamics of biomolecules, femtosecond protein dynamics, and biomedical optics. Aaron, Champion, Israeloff, Sage, Shiffman, Spring, Venkatachalam, Wanunu, Williams.

Experimental Nanophysics. The faculty is actively pursuing research at the frontiers of nanoscience. The thrust areas in nanophysics include the following: left-handed metamaterials for photonic crystals, nanomedicine, spintronics, mesoscopic physics, low-dimensional electronic systems, nanomagnetism, and quantum chaos. Research is aimed at the synthesis of nanoscale materials and devices, as well as fundamental materials issues. Heiman, Israeloff, Kar, Kravchenko, Menon, Sridhar.

Experimental Particle Physics. The Experimental Particle Physics group concentrates its efforts on the following activities: CMS and the Pierre Auger Observatory. Compact Muon Solenoid at LHC (Alverson, Barberis, Orimoto, Wood): The CMS detector recently resumed operations at the Large Hadron Collider (LHC), located near Geneva, Switzerland. The LHC is currently colliding protons at 13 TeV, the highest energy available in the world. At Northeastern, we are supporting the end cap muon detector and the electromagnetic calorimeter, are studying the newly-found Higgs boson, and are searching for leptoquarks (exotic particles with properties of both leptons and quarks), Dark Matter, massive new gauge bosons (Stueckelberg Z-primes), and other new physics. Post-doctoral fellows include Dr. Andreas Massironi, Dr. David Morse, and Dr. Daniele Trocino. Pierre Auger Observatory (Swain): The Pierre Auger Observatory makes use of the one accelerator bigger than the LHC—the one that gives us cosmic rays from intergalactic space. Currently taking data with a fully instrumented detector covering 3000 square kilometers. Alverson, Barberis, Orimoto, Swain, Wood.

View additional information about this department at www.gradschoolshopper.com. Check out the “Why Choose Us?” section, find out more about the department’s culture and get links to social media networks.