DUKE UNIVERSITY
DEPARTMENT OF PHYSICS
Durham, North Carolina 27708-0305
http://www.phy.duke.edu

General University Information

President: Vincent Price, Ph.D.
Dean of Graduate School: Paula D. McClain, Ph.D.
University website: http://www.duke.edu
School Type: Private
Setting: Suburban
Total Faculty: 3,637
Total number of Students: 15,192
Total number of Graduate Students: 8,660

Department Information

Department Chairman: Prof. Warren S. Warren, Chair
Department Contact: Patricia Hight Davis, Administrative Manager
Total full-time faculty: 45
Full-Time Graduate Students: 144
Female Full-Time Graduate Students: 13
First-Year Graduate Students: 11
Female First-Year Students: 1
Total Post Doctorates: 12

Department Address
120 Physics Building, Box 90305
Science Drive, Duke University
Durham, NC 27708-0305
Phone: (919) 660-2690
Fax: (919) 660-2525
E-mail: patty.hight.davis@duke.edu
Website: http://www.phy.duke.edu

ADMISSIONS

Admission Contact Information
Address admission inquiries to: Stephen Teitsworth, Director of Graduate Studies, Department of Physics, Box 90305, Duke University, Durham, NC 27708-0305
Phone: (919) 660-2560
E-mail: dgs@phy.duke.edu
Admissions website: http://www.gradschool.duke.edu

Application deadlines
Fall admission:
U.S. students: December 10
Int'l. students: December 10

Application fee
U.S. students: $85
Int'l. students: $85

All application materials must be received by the deadline. Applications are normally reviewed by the Graduate Admissions Committee. Applications received earlier may be reviewed by other faculty and be recommended to the committee.

Admissions information
For Fall of 2018:
Number of applicants: 258
Number admitted: 45
Number enrolled: 11

Admission requirements
Bachelor's degree requirements: A Bachelor's degree in Physics or related subject is required.

GRE requirements
The GRE is required.

While there are no official minimums for the GRE scores, students who obtain a score below 160 in Quantitative, 140 in Verbal, and 3.0 in Writing are admitted rarely and only under exceptional circumstances.

Subjective GRE requirements
The Subjective GRE is required.
While there is no official minimum for the Physics GRE score, students who receive a score of less than 600 are admitted rarely and only under exceptional circumstances.

TOEFL requirements
The TOEFL exam is required for students from non-English-speaking countries.
IBT score: 90

Other admissions information
Undergraduate preparation assumed: Marion and Thornton, Classical Dynamics of Particles and Systems; Griffiths, Introduction to Electrodynamics; Schroeder, Introduction to Thermal Physics; Harris, Modern Physics; Griffiths, Introduction to Quantum Mechanics.

TUITION

Tuition year 2018-19:
Full-time students: $57,240 annual
All admitted graduate students receive an assistantship (TA, RA, or fellowship) that includes tuition and most fees.
Credit hours per semester to be considered full-time: 9
Deferred tuition plan: Yes
Health insurance: Yes, No Charge.
Other academic fees: $40 One time transcript charge. $179.25 Health fee per semester, $287.94 Health fee summer.
Academic term: Semester
Number of first-year students who received full tuition waivers: 13

Teaching Assistants, Research Assistants, and Fellowships

Number of first-year
Teaching Assistants: 16
Fellowship students: 2
Average stipend per academic year
Teaching Assistant: $31,160.04
Research Assistant: $31,160.04
Fellowship student: $31,160.04

FINANCIAL AID

Application deadlines
Fall admission:
U.S. students: February 1
Int'l. students: February 1

Loans
Loans are available for U.S. students.
Loans are available for international students.
GAPSFAS application required: No
FAFSA application required: Yes

For further information
Address financial aid inquiries to: Ms. Lisa Wioskowski, Financial Aid Coordinator, Graduate School Office, 2127 Campus Drive, Durham, NC 27708.
Phone: (919) 681-3247
HOUSING

Availability of on-campus housing
Single students: No
Married students: No
Childcare Assistance: Yes

For further information
Address housing inquiries to: The Chronicle, Advertising Office, 1517 Hull Avenue, Durham, NC 27708.
Phone: 919-684-3811
E-mail: ads@dukechronicle.com
Housing aid website: https://gradschool.duke.edu/admissions/admitted-students/housing

Table A—Faculty, Enrollments, and Degrees Granted

<table>
<thead>
<tr>
<th>Research Specialty</th>
<th>2017–18 Faculty</th>
<th>Enrollment Fall 2017</th>
<th>Number of Degrees Granted 2017–18 (2014–18)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Master’s</td>
<td>Doctorate</td>
<td>Master’s</td>
</tr>
<tr>
<td>Atomic, Molecular, &amp; Optical Physics</td>
<td>4</td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td>Biophysics</td>
<td>5</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Cosmology &amp; String Theory</td>
<td>4</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>High Energy Physics</td>
<td>7</td>
<td>9</td>
<td>-</td>
</tr>
<tr>
<td>Medical, Health Physics</td>
<td>4</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Nano Science and Technology</td>
<td>7</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>Nanophysics</td>
<td>7</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Nonlinear Dynamics and Complex Systems</td>
<td>10</td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td>Nuclear Physics</td>
<td>5</td>
<td>13</td>
<td>-</td>
</tr>
<tr>
<td>Particles and Fields</td>
<td>6</td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td>Photonics and Quantum Information</td>
<td>5</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>Physics of Beams</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Non-specialized</td>
<td>1</td>
<td>16</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>67</td>
<td>76</td>
<td>16</td>
</tr>
<tr>
<td>Full-time Grad. Stud.</td>
<td>-</td>
<td>76</td>
<td>-</td>
</tr>
<tr>
<td>First-year Grad. Stud.</td>
<td>-</td>
<td>13</td>
<td>-</td>
</tr>
</tbody>
</table>

GRADUATE DEGREE REQUIREMENTS

Master’s: Master of Arts (M.A.): The department admits students only for the Ph.D. degree. However, if the student successfully completes nine graduate physics courses, he/she may be eligible for an M.A if he/she passes a masters level oral exam. There are further graduate school requirements. Master of Science (M.S.): Same as M.A. plus written thesis. Final examination on thesis.


SPECIAL EQUIPMENT, FACILITIES, OR PROGRAMS

Duke University is an institutional member of the Triangle Universities Nuclear Laboratory (TUNL), a Department of Energy (DOE) Center of Excellence in nuclear physics research. The Center operates three DOE-funded particle accelerator facilities on the campus of Duke university: (1) the High-Intensity Gamma-ray Source at the Duke Free Electron Laser Laboratory, (2) the Laboratory for Experimental Nuclear Physics, and (3) the tandem accelerator laboratory. These facilities have substantial inventories of particle detectors and signal-processing electronics that are used in carrying out experimental nuclear-physics research.

Table B—Separately Budgeted Research Expenditures by Source of Support

<table>
<thead>
<tr>
<th>Source of Support</th>
<th>Departmental Research</th>
<th>Physics-related Research Outside Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal government</td>
<td>$11,054,986</td>
<td>-</td>
</tr>
<tr>
<td>State/local government</td>
<td>-</td>
<td>$11,928</td>
</tr>
<tr>
<td>Non-profit organizations</td>
<td>-</td>
<td>$80,844</td>
</tr>
<tr>
<td>Business and industry</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Other</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>$11,157,758</td>
<td>-</td>
</tr>
</tbody>
</table>

Table C—Separately Budgeted Research Expenditures by Research Specialty

<table>
<thead>
<tr>
<th>Research Specialty</th>
<th>No. of Grants</th>
<th>Expenditures ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atomic, Molecular, &amp; Optical Physics</td>
<td>8</td>
<td>$464,252</td>
</tr>
<tr>
<td>Biophysics</td>
<td>3</td>
<td>$202,073</td>
</tr>
<tr>
<td>Condensed Matter Physics</td>
<td>3</td>
<td>$464,325</td>
</tr>
<tr>
<td>Cosmology &amp; String Theory</td>
<td>2</td>
<td>$107,477</td>
</tr>
<tr>
<td>High Energy Physics</td>
<td>20</td>
<td>$1,662,515</td>
</tr>
<tr>
<td>Nano Science and Technology</td>
<td>3</td>
<td>$148,308</td>
</tr>
<tr>
<td>Nonlinear Dynamics and Complex Systems</td>
<td>12</td>
<td>$657,915</td>
</tr>
<tr>
<td>Nuclear Physics</td>
<td>24</td>
<td>$4,412,127</td>
</tr>
<tr>
<td>Photonics and Quantum Information</td>
<td>11</td>
<td>$1,090,257</td>
</tr>
<tr>
<td>Particles and Fields</td>
<td>8</td>
<td>$1,198,859</td>
</tr>
<tr>
<td>Physics of Beams</td>
<td>8</td>
<td>$709,650</td>
</tr>
<tr>
<td>Total</td>
<td>102</td>
<td>$11,157,758</td>
</tr>
</tbody>
</table>

FACULTY

Professor


Baranger, Harold U., Ph.D., Cornell University, 1986. Theoretical condensed matter physics; nanophysics.


United States: Geographic Listing of Graduate Programs  

North Carolina


Driehuys, Bastiaan, Ph.D., Princeton University, 1995. Professor of Radiology. *Medical, Health Physics*. Medical physics; radiology (primary appointment: Department of Radiology and Biomedical Engineering).


Howell, Calvin, Ph.D., Duke University, 1984. *Nuclear Physics*. few-nucleon systems; applications of nuclear physics in biology, medicine and national security.


Kim, Jungsang, Ph.D., Stanford University, 1999. Professor of Electrical and Computer Engineering. Photonics, quantum information (primary appointment: electrical and computer engineering).


Mehlen, Thomas, Ph.D., Johns Hopkins University, 1998. *Nuclear Physics, Particles and Fields*. Theoretical nuclear and particle physics; effective field theory.


Schmidt, Christoph, Ph.D., Technical University Munich, 1988. Experimental Biophysics.


**Associate Professor**


Chandrasekharan, Shailesh, Ph.D., Columbia University, 1995. *Computational Physics, Nuclear Physics, Particles and Fields*. Theoretical nuclear and particle physics; lattice field theory.


Delaire, Olivier, Ph.D., California Institute of Technology, 2006. *Condensed Matter Physics*. elementary excitations in condensed-matter systems (phonons, electrons, spins), their couplings (phonon-phonon interaction, electron-phonon coupling, spin-phonon coupling), and their effects on macroscopic material properties.

Lu, Jianfeng, Ph.D., Princeton University, 2009. *Computational Physics*. Electronic structure and many body problems; quan...
tum molecular dynamics; multi-scale modeling and analysis; rare events and sampling techniques.

Mercer, John M., Ph.D., Yale University, 1981. Associate Director of Undergraduate Studies of Physics. Biophysics.


Assistant Professor


Marvian, Iman, Ph.D., University of Waterloo and Perimeter Institute, 2012. Condensed Matter Physics, Quantum Foundations. Quantum information and computation theory.


Troxel, Michael, Ph.D., University of Texas at Dallas, 2014. Astronomy, Astrophysics. Astrophysics and Cosmology.


Emeritus

Evans, Lawrence E., Ph.D., Johns Hopkins University, 1960. Particles and Fields. Theoretical elementary particle physics.


Thomas, John E., Ph.D., Massachusetts Institute of Technology, 1979. Atomic, Molecular, & Optical Physics, Condensed Matter Physics. Experimental quantum optics; atomic and molecular collision physics.


Research Associate Professor

Fischer, Martin, Ph.D., University of Texas at Austin, 2001. Atomic, Molecular, & Optical Physics. exploring novel non-linear optical contrast mechanisms for molecular imaging.

Adjunct Faculty

Chapman, Art, Ph.D., Yale University, 1982. Director, Triangle Universities Nuclear Laboratory/Professor UNC-Chapel Hill. Nuclear Physics. Experimental Nuclear Astrophysics.


West, Bruce, Ph.D., University of Rochester, 1970. Biophysics.

Lecturer


DEPARTMENTAL RESEARCH SPECIALTIES AND STAFF

Theoretical

Biophysics. Theoretical neuroscience; Dynamics of networks of spiking neurons: irregular activity, oscillations; Models of synaptic plasticity, learning and memory; fixed point attractors, temporal sequences. Brunel, Buchler, Greenside, Rubinstein, Socolar.

Computational Physics. Computational physics; numerical techniques for solving non-linear partial differential equations; Monte Carlo algorithms in field theory and statistical mechanics; molecular dynamics; networks; large-scale computations on vector and parallel computers. Computational methods in fluid dynamics, material sciences, plasma physics, and geophysical flow; emergent behavior in flocking and swarming; numerical analysis and scientific computing. Baranger, Barthel, Bass, Robert Brown, Chandrasekhar, Charboneau, Curtarolo, Greenside, Liu, Yang.

Cosmology & String Theory. String theory; geometry of spacetime, supersymmetry and duality; mirror symmetry, general relativity. Aspinwall, Bray, Petters, Plesser.

Nanophysics. Coherence and correlations in nanoscale systems like quantum dots and carbon nanotubes; coulomb blockade; quantum impurity effects; quantum phase transitions; quantum computing quantum entanglement; quantum information; thermodynamics of materials; density functional theory. Baranger, Barthel, Beratan, Chandrasekhar, Curtarolo, Marvian, Yang.


Particles and Fields. Quantum chromodynamics and weak interactions; heavy quark physics; quark-gluon plasma; heavy-ion collisions; effective field theories of particle and nuclear interactions; lattice field theories and Monte Carlo simulations; strongly coupled field theories; thermalization. Bass, Chandrasekharan, Mehen, Mueller, Springer.

Polymer Physics/Science. Rubinstein.

Statistical and nonlinear physics. Non-linear and complex systems; computational studies of non-linear and biological systems including genetic networks, heart and brain dynamics; collective behavior in matter and dynamical systems; spin glasses and glasses; adaptive algorithms; static and dynamic critical behavior in optics and magnetism; granular materials network dynamics; fractal growth; granular matter; in- and out-of-equilibrium dynamical properties of materials self-assembly; microphase formation; protein aggregation; glass and gel formation; stochastic dynamics of far-from-equilibrium systems. Brunel, Charbonneau, Greenside, Liu, Socolar, Teitsworth.

Experimental
Astrophysics and Cosmology. Walter.

Atomic, Molecular, & Optical Physics. quantum optics; single photon switching; quantum information; new technologies for optical communication; single photon sources; electromagnetic properties of materials; photonic crystals and metamaterials; molecular and biomolecular imaging. Kenneth Brown, Kim, Mikkelsen, Smith, Warren.

Biophysics. Emergent properties and tissue dynamics; fast thermodynamics in laser-tissue interactions; applications of free-electron lasers to biology and medicine; characterization and control of heart dynamics; stochastic processes in biological systems; optical analysis of molecular dynamics in single synapses; optical stimulation of single synapses; development of high-resolution imaging techniques; evolution of bistable and oscillatory dynamics in gene networks. Buchler, Edwards, Schmidt, West.

High Energy Physics. Precision tests of the Standard Model using the top quark, W, Z, and Higgs bosons; searches for new fundamental symmetries and extra dimensions; tests of the QCD hadron production models; studies of neutrino properties; neutrino oscillations; neutrino scattering; neutrino astrophysics; research program based at Fermilab, CERN, ORNL, and in Japan; state-of-the-art wire chamber and silicon detector development and construction; electronics design for high-energy physics experiments. Arce, Barbeau, Goshaw, Kotwal, Kruse, Oh, Scholberg, Walter.

Medical, Health Physics. Biomedical imaging; magnetic resonance imaging; magnetic resonance microscopy; X-ray microscopy, tomography, and microPET; X-ray imaging, breast tomosynthesis, dual-energy imaging, Monte Carlo simulation; radiation dose and image quality; imaging optimization. Dobkins, Driehuys, Johnson, Kapadia, Samei.

Nano Science and Technology. Electronic properties of carbon nanotubes, nanocrystals, semiconductor quantum dots, and self-assembled DNA structures; physics of Luttinger liquids; scanning tunneling; capacitance and atomic force microscopy; optoelectronic processes in semiconductor microstructures; subpicosecond optical characterization of nanostructures; nanometer-scale photonic, plasmonic, and phononic band engineering; solid-state spintronics, quantum information science, nanophotonics; non-linear electronic transport in semiconductor nanostructures. Barthel, Chang, Everitt, Finkelstein, Gauthier, Mikkelsen, Smith, Teitsworth.

Nonlinear Dynamics and Complex Systems. Non-linear and complex systems; granular materials; dynamics of granular flow; chaotic networks; pattern formation and spatio-temporal chaos in far-from-equilibrium fluids and electronic systems; noise-induced dynamics in far-from-equilibrium systems. Gauthier, Teitsworth.

Nuclear Physics. QCD and weak interactions in nuclear physics; nucleon structure, few-nucleon systems, and nucleon-nucleon interactions; electromagnetic nuclear physics; testing QCD using real photon beams; fundamental symmetry studies with ultra-cold neutrons, e.g., search for neutron electric dipole moment; Coherent neutrino scattering, double beta-decay searches; nuclear astrophysics. Barbeau, Gao, Howell, Tonchev, Vossen, Wu.

Photonics and Quantum Information. High-data-rate quantum key distribution; high-brightness hyper-entangled sources; multi-mode quantum communication; multi-element photon counting detector development; solid-state spin qubits. Everitt, Gauthier, Kim, Mikkelsen, Skatrud, Smith.

Physics of Beams. Beam physics; FEL and novel light source development; high-intensity gamma-ray source; FEL applications; plasma accelerators. Wu.

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.