

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

DEPARTMENT OF PHYSICS

Urbana, Illinois 61801-3080

<http://physics.illinois.edu>

General University Information

President: Timothy Killeen
Dean of Graduate School: Wojtek Chodzko-Zajko
University website: <http://illinois.edu>
School Type: Public
Setting: Urban
Total Faculty: 2,765
Total Graduate Faculty: 1,899
Total number of Students: 49,399
Total number of Graduate Students: 15,666

Department Information

Department Chair: Prof. Matthias Grosse Perdekamp, Head
Department Contact: Professor S. Lance Cooper, Associate Head for Graduate Programs
Total full-time faculty: 66
Total number of full-time equivalent positions: 66
Full-Time Graduate Students: 275
Female Full-Time Graduate Students: 77
First-Year Graduate Students: 44
Female First-Year Students: 7
Total Post Doctorates: 59

Department Address

Loomis Laboratory of Physics
1110 West Green Street
Urbana, IL 61801-3080
Phone: (217) 333-3645
Fax: (217) 333-4898
E-mail: grad@physics.illinois.edu
Website: <http://physics.illinois.edu>

ADMISSIONS

Admission Contact Information

Address admission inquiries to: Graduate Office, Department of Physics, 1110 W. Green St., Urbana, IL 61801-3080
Phone: (217) 333-3645
E-mail: grad@physics.illinois.edu
Admissions website: <http://physics.illinois.edu/admissions/graduates/apply.html>

Application deadlines

Fall admission:
U.S. students: January 15 *Int'l. students:* January 15

Application fee

U.S. students: \$70 *Int'l. students:* \$90
The application fee must be paid by a credit card at the time an application is submitted online. Payment is valid for only one semester and must be submitted before any action is taken on an application.

Admissions information

For Fall of 2019:
Number of applicants: 745
Number admitted: 139
Number enrolled: 44

Admission requirements

Bachelor's degree requirements: A bachelor's degree in physics or a related field is required. On the last 60 hours of work, 20 semester hours (30 quarter hours) of intermediate and advanced undergraduate physics are also required.

GRE requirements

The GRE is required.
Mean GRE score range (25th–75th percentile): 870
The General Graduate Record Examination (GRE), administered by the Educational Testing Service (ETS), is required. The GRE Physics Subject Test is OPTIONAL. While the application form asks that you provide GRE scores, your official score must be sent from ETS directly to the Department of Physics by the application deadline (January 15). Please list your GRE registration number on your application. The department does not set a minimum GRE score.

GRE Physics requirements

The GRE Physics is not required.
No definite minimum score is set for the GRE. The average GRE Physics subject score for 2018 admissions was 870.

TOEFL requirements

The TOEFL exam is required for students from non-English-speaking countries.
Minimum accepted TOEFL scores:
PBT score: 610
iBT score: 102

Most students to whom we offer admission are also offered a teaching assistantship for financial support. To receive an appointment as a teaching assistant, an international graduate student is required to demonstrate proficiency in spoken English. This proficiency can be demonstrated in one of four ways: by having a score of 24 or above on the speaking sub-section of the Internet Based TOEFL; by having a score of 8 or above on the speaking sub-section of the IELTS academic exam; by having a score of 50 or above on the TSE; or by having a score of 5 or above on the locally administered University of Illinois English proficiency interview.

Other admissions information

Additional requirements: Admission to our program is competitive. We have a holistic review process that considers grade-point average, research experiences, GRE scores, and potential fit into our research programs. Admissions decisions are made by a committee of our senior faculty; please do not contact individual professors requesting admission to our program. No informal assessment of your chances for admission can be made.

Undergraduate preparation assumed: Although preparation will vary, we generally expect one year of upper-division mechanics, one year of electricity and magnetism, one semester of optics, one semester of statistical and thermal physics, and one year of quantum mechanics. One or two semesters of advanced laboratory courses are also expected.

TUITION AND ASSISTANTSHIPS

Teaching Assistants, Research Assistants, and Fellowships

Number of first-year
Teaching Assistants: 41
Fellowship students: 3

Average stipend per academic year

Teaching Assistant: \$24,266

Research Assistant: \$24,266

Fellowship student: \$25,000

The amounts quoted above are for the 11-month calendar year (9-month academic year plus 2-month summer term) for first-year students. Students who have passed their preliminary examination receive an automatic salary increase. The Department of Physics makes every effort to ensure that eligible prospective students are not deterred from attending because of financial constraints, and we are proud of our tradition of providing continuing and adequate support for our students. In case of financial emergencies, short-term loans are available from the University's Office of Student Financial Aid.

Tuition year 2019–20:

Tuition for in-state residents

Full-time students: \$18,056 annual

Tuition for out-of-state residents

Full-time students: \$34,330 annual

Appointment as a research assistant, teaching assistant, or a fellow provides a full tuition waiver.

Credit hours per semester to be considered full-time: 8

Deferred tuition plan: Yes

Health insurance: Available at the cost of \$188 per year.

Other academic fees: A description of fees is posted at <http://registrar.illinois.edu/fee-info>. Research assistantships, teaching assistantships, and fellowships include a partial fee waiver as well as a tuition waiver.

Academic term: Semester

Number of first-year students who received full tuition waivers: 44

FINANCIAL AID

Application deadlines

Fall admission:

U.S. students: January 15

Int'l. students: January 15

Loans

Loans are available for U.S. students.

Loans are available for international students.

GAPSFAS application required: No

FAFSA application required: No

For further information

Address financial aid inquiries to: Office of Student Financial Aid.

Phone: (217) 333-0100

E-mail: finaid@illinois.edu

Financial aid website: <https://osfa.illinois.edu/>

HOUSING

Availability of on-campus housing

Single students: Yes

Married students: Yes

Childcare Assistance: Yes

For further information

Address housing inquiries to: University Housing.

Phone: (217) 333-7111

E-mail: housing@illinois.edu

Housing aid website: <http://housing.illinois.edu/>

GRADUATE DEGREE REQUIREMENTS

Master's: See Academic information on website. Thirty-two hours of satisfactory (GPA 2.75/4.0) graduate course work required. All hours must be at the 400-level or higher. Sixteen of the 32 hours must be in physics, with at least 8 hours of

them at the 500-level. At most, 8 hours of individual study may be counted toward the master's degree. At least 16 hours must be in courses meeting on the Urbana-Champaign campus; credit for graduate work taken elsewhere is by petition only. There is no foreign language requirement.

Doctorate: Ninety-six hours of satisfactory (2.75/4.0 GPA) graduate work. Part of these hours must be thesis work. There is no specific residence requirement, but 64 hours must be taken on the Urbana-Champaign campus. The qualifying examination (the "qual") tests the candidate's broad understanding of basic physics and his or her preparation to proceed to thesis research. A student must take and pass the qual by the beginning of the third semester of enrollment in our graduate program. The preliminary examination (the "prelim") reviews the feasibility and appropriateness of a candidate's thesis research proposal. The prelim must be taken within the first two years of joining a research group. The thesis is a comprehensive publication describing the independent research project and its results. The final defense is an oral examination conducted by the candidate's thesis committee and based on the thesis, at which the candidate presents the results of his or her research. There are no foreign language requirements.

Other Degrees: The Medical Scholars Program, which allows students to earn joint M.D./Ph.D. degrees, combines cutting edge research in physics with individualized clinical training in medicine. All graduate and medical training is done at the Urbana-Champaign campus. Only U.S. citizens and permanent residents are eligible for admission.

Thesis: A thesis is required.

SPECIAL EQUIPMENT, FACILITIES, OR PROGRAMS

The Department of Physics offers world-class facilities. In addition to state-of-the-art laboratories in Loomis Laboratory, physics faculty and students also carry out research in other specialized campus facilities. These include the Beckman Institute for Advanced Science and Technology, the National Center for Supercomputing Applications, the Frederick Seitz Materials Research Laboratory, the Holonyak Micro and Nano Technology Laboratory, the Institute for Genomic Biology, and the Roy J. Carver Biotechnology Center.

For a complete description of physics facilities, please consult our website, <http://physics.illinois.edu/research/groups-and-centers/>.

Table B—Separately Budgeted Research Expenditures by Source of Support

Source of Support	Departmental Research	Physics-related Research Outside Department
Federal government	\$19,586,000	\$1,006,000
State/local government	\$56,000	
Non-profit organizations	\$1,219,000	\$31,000
Business and industry	\$121,000	
Other	\$1,132,000	
Total	\$22,114,000	\$1,037,000

Table C—Separately Budgeted Research Expenditures by Research Specialty

Research Specialty	No. of Grants	Expenditures (\$)
Astrophysics	5	\$658,000
Atomic, Molecular, & Optical Physics	17	\$2,796,000
Biological Physics	18	\$5,126,000
Condensed Matter Physics	39	\$4,394,000

Research Specialty	No. of Grants	Expenditures (\$)
High Energy Physics	13	\$2,414,000
Low Temperature Physics	15	\$2,982,000
Nuclear Physics	8	\$4,781,000
Total	115	\$23,151,000

FACULTY

Professor

- Abbamonte**, Peter, Ph.D., University of Illinois at Urbana-Champaign, 1999. Fox Family Professor of Engineering. *Condensed Matter Physics*. Experimental condensed matter physics; resonant soft X-ray scattering; electron self-organization; oxide devices; quantum phase transitions; collective excitations.
- Aksimentiev**, Aleksei, Ph.D., Institute of Physical Chemistry, Warsaw, 1999. Blue Waters Professor. *Biophysics, Computational Physics, Nano Science and Technology*. Theoretical and computational biological physics, molecular mechanics of DNA processing machinery, nanopore systems for single molecule manipulation, DNA nanotechnology, synthetic molecular motors.
- Beck**, Douglas H., Ph.D., Massachusetts Institute of Technology, 1986. Principal investigator, Nuclear Physics Laboratory. *Nuclear Physics*. Experimental nuclear and particle physics; nucleon structure; fundamental symmetries; electric dipole moments.
- Bezryadin**, Alexey, Ph.D., J. Fourier Université, 1995. *Condensed Matter Physics, Nano Science and Technology*. Experimental condensed matter physics; nanometer-scale mesoscopic physics and molecular electronics; quantum phase transitions.
- Ceperley**, David M., Ph.D., Cornell University, 1976. Founder Professor of Engineering; Blue Waters Professor; Center for Advanced Study Professor of Physics. *Computational Physics, Condensed Matter Physics*. Theoretical condensed matter physics; electronic structure; superfluidity; Monte Carlo methods; physics at high pressure.
- Chemla**, Yann R., Ph.D., University of California, Berkeley, 2001. Co-Director, Center for the Physics of Living Cells. *Biophysics*. Experimental biological physics; molecular motors; nucleic acid and protein translocases.
- Cooper**, S. Lance, Ph.D., University of Illinois at Urbana-Champaign, 1988. Associate Head for Graduate Programs. *Condensed Matter Physics*. Experimental condensed matter physics; optical spectroscopy; strongly correlated systems; superconductivity.
- Dahmen**, Karin A., Ph.D., Cornell University, 1995. *Biophysics, Condensed Matter Physics, Geophysics, Nonlinear Dynamics and Complex Systems*. Theoretical condensed matter physics; nonequilibrium dynamical systems; hysteresis; avalanches; earthquakes; population biology; disorder-induced critical behavior.
- DeMarco**, Brian, Ph.D., University of Colorado Boulder, 2001. Associate Head for Undergraduate Programs. *Atomic, Molecular, & Optical Physics, Condensed Matter Physics, Quantum Foundations*. Experimental atomic, molecular, and optical physics; quantum information science; atomic Bose–Einstein condensates and Fermi gases; optical lattices; strongly correlated systems.
- Eckstein**, James N., Ph.D., Stanford University, 1978. *Condensed Matter Physics*. Experimental condensed matter physics; atomic layer-by-layer molecular beam epitaxy; colossal magnetoresistance.
- El-Khadra**, Aida X., Ph.D., University of California, Los Angeles, 1989. *High Energy Physics*. Theoretical high-energy physics; lattice field theory; phenomenology; quark flavor physics.
- Fradkin**, Eduardo H., Ph.D., Stanford University, 1979. Donald Biggar Willett Professor of Engineering; Center for Advanced Study Professor of Physics; Director, Institute for Condensed Matter Theory. *Condensed Matter Physics*. Theoretical condensed matter physics; quantum Hall effects; strongly correlated systems; superconductors; critical phenomena; disordered systems; field theory.
- Gammie**, Charles F., Ph.D., Princeton University, 1992. Professor, Department of Astronomy. *Astrophysics, Computational Physics*. Theoretical and computational astrophysics; star formation; planet formation; relativistic accretion flows.
- Giannetta**, Russell W., Ph.D., Cornell University, 1980. *Condensed Matter Physics*. Experimental condensed matter physics; superconductivity; magnetic resonance; organic superconductors.
- Goldenfeld**, Nigel D., Ph.D., University of Cambridge, 1982. Swanlund Chair; Center for Advanced Study Professor of Physics; Director, NASA Institute for Astrobiology; Theme Leader, Institute for Genomic Biology. *Biophysics, Condensed Matter Physics, Statistical & Thermal Physics*. Theoretical condensed matter physics; non-equilibrium statistical physics; multiscale modeling of materials dynamics; pattern formation; physics of living systems; microbial ecology; evolutionary biology; astrobiology; complex biological systems and communities; fluid mechanics and turbulence.
- Golding**, Ido, Ph.D., Tel Aviv University, 2001. *Biophysics*. Experimental biological physics; systems biology; physics of living systems; single-cell biology; bacteria and viruses; stochastic gene expression; cellular decision-making.
- Gollin**, George D., Ph.D., Princeton University, 1981. *Physics and other Science Education*. Higher education policy; physics education research.
- Grosse Perdekamp**, Matthias, Ph.D., University of California, Los Angeles, 1995. Department Head. *Nuclear Physics*. Experimental high-energy nuclear physics; nucleon structure, including spin structure and nuclear effects; spin-dependent hadron fragmentation.
- Holder**, Gilbert, Ph.D., University of Chicago, 2001. Fortner Chair in Theoretical Astrophysics. *Astrophysics, Computational Physics, Cosmology & String Theory*. Observational and theoretical cosmology, dark matter, early universe.
- Hughes**, Taylor L., Ph.D., Stanford University, 2009. *Condensed Matter Physics*. Theoretical condensed matter physics; topological insulators/superconductors; use of quantum information/entanglement techniques to characterize quantum condensed matter systems.
- Kwiat**, Paul G., Ph.D., University of California, Berkeley, 1993. Bardeen Chair of Physics and of Electrical and Computer Engineering. *Atomic, Molecular, & Optical Physics, Quantum Foundations*. Experimental quantum optics; optical approaches to quantum information; foundations of quantum mechanics.
- Leggett**, Anthony J., D.Phil., University of Oxford, 1964. John D. and Catherine T. MacArthur Chair; Center for Advanced Study Professor of Physics; Nobel Laureate in Physics (2003). *Atomic, Molecular, & Optical Physics, Condensed Matter Physics, Low Temperature Physics, Quantum Foundations*. Foundations of quantum mechanics; superfluidity; high-temperature superconductivity; Bose–Einstein condensation; low-temperature properties of glasses; topological quantum computation.
- Leigh**, Robert G., Ph.D., University of Texas at Austin, 1991. *Condensed Matter Physics, Cosmology & String Theory, High Energy Physics*. Theoretical high-energy physics; quantum field theory, supersymmetric gauge theory; superstring theory.

- Madhavan**, Vidya, Ph.D., Boston University, 2000. *Condensed Matter Physics*. Experimental condensed matter physics; topological insulators, topological crystalline insulator and topological superconductors, Weyl semi-metals, transition metal dichalcogenides, correlated electron systems, high temperature superconductivity; thin film growth by molecular beam epitaxy (MBE), low-temperature scanning tunneling microscopy (STM), spectroscopy (STS), and spin-polarized STM.
- Makins**, Naomi C.R., Ph.D., Massachusetts Institute of Technology, 1994. *Nuclear Physics*. Experimental nuclear physics; proton and neutron spin.
- Mason**, Nadya, Ph.D., Stanford University, 2001. *Condensed Matter Physics, Nano Science and Technology*. Experimental condensed matter physics; quantum properties of nanostructures; superconductivity; quantum phase transitions.
- Mouschovias**, Telemachos Ch, Ph.D., University of California, Berkeley, 1975. Professor of Astronomy. *Astrophysics*. Theoretical astrophysics; astrophysical magnetohydrodynamics; astrophysical fluid dynamics; cosmic magnetic fields; star formation; numerical astrophysics.
- Nayfeh**, Munir H., Ph.D., Stanford University, 1974. *Atomic, Molecular, & Optical Physics, Nano Science and Technology*. Experimental atomic, molecular, and optical physics; laser atomic spectroscopy; silicon nanotechnology.
- Neubauer**, Mark, Ph.D., University of Pennsylvania, 2001. *High Energy Physics*. Experimental particle physics; particle astrophysics; neutrino physics; heavy flavor physics; Higgs boson; electroweak diboson physics.
- Peng**, Jen-Chieh, Ph.D., University of Pittsburgh, 1975. *Nuclear Physics*. Experimental medium- and high-energy nuclear physics; parton structures of the nucleons and nuclei; neutrino physics.
- Phillips**, Philip W., Ph.D., University of Washington, 1982. *Condensed Matter Physics*. Theoretical condensed matter physics; strongly correlated electronic low-dimensional systems; quantum Hall effect; quantum critical phenomena; quantum magnetism; entanglement; gauge-gravity duality.
- Pitts**, Kevin T., Ph.D., University of Oregon, 1994. Vice Provost for Undergraduate Education, Office of the Provost. *High Energy Physics*. Experimental high-energy physics; heavy quark decays; precision muon physics.
- Seidel**, H. Edward, Ph.D., Yale University, 1988. Vice President for Economic Development and Innovation, University Administration; Founder Professor, Departments of Physics and of Astronomy. *Astrophysics, Computational Physics, Relativity & Gravitation*. High-performance computing; numerical relativity.
- Selen**, Mats A., Ph.D., Princeton University, 1989. *Physics and other Science Education*. Physics education research.
- Selvin**, Paul R., Ph.D., University of California, Berkeley, 1990. *Biophysics*. Experimental biological physics; structure and dynamics of biological macromolecules; super-resolution fluorescence microscopy.
- Shapiro**, Stuart L., Ph.D., Princeton University, 1973. Professor of Astronomy; Senior Research Scientist, NCSA. *Astrophysics, Computational Physics, Relativity & Gravitation*. Theoretical astrophysics and general relativity; physics of black holes and neutron stars; gravitational collapse; generation of gravitational waves; stellar dynamics; magnetohydrodynamics; numerical relativity.
- Song**, Jun, Ph.D., Massachusetts Institute of Technology, 2001. Founder Professor of Physics. *Biophysics*. Computational biological physics; systems biology; biostatistics; machine learning.
- Stelzer**, Timothy J., Ph.D., University of Wisconsin-Madison, 1993. *Physics and other Science Education*. Physics education research, educational technology, online learning, adaptive learning.
- Stone**, Michael, Ph.D., University of Cambridge, 1976. *Condensed Matter Physics*. Theoretical condensed matter physics; quantum Hall effect; superconductivity and superfluidity; mathematical physics.
- Van Harlingen**, Dale J., Ph.D., The Ohio State University, 1977. Donald Biggar Willett Professor of Engineering; Center for Advanced Study Professor of Physics. *Condensed Matter Physics, Low Temperature Physics, Quantum Foundations*. Experimental condensed matter physics; superconductor device physics; unconventional superconductivity; topological materials and devices; quantum information science.
- Vishveshwara**, Smitha, Ph.D., University of California, Santa Barbara, 2002. *Atomic, Molecular, & Optical Physics, Condensed Matter Physics*. Theoretical condensed matter physics; strongly correlated systems; phase transitions and critical phenomena; disorder and localization physics; superconductivity; quantum Hall systems; Luttinger liquids and edge states; nanophysics; topological systems; cold atom physics.
- Willenbrock**, Scott S., Ph.D., University of Texas at Austin, 1986. *Energy Sources & Environment*. Energy and the environment; renewable energy; energy efficiency; sustainability.
- Yunes**, Nicolas, Ph.D., The Pennsylvania State University, 2008. *Relativity & Gravitation*. Theoretical astrophysics and general relativity; physics of black holes and neutron stars; generation and propagation of gravitational waves; analytical relativity and post-Newtonian theory; experimental relativity and gravitational wave tests; modified theories of gravity.

Associate Professor

- Adshead**, Peter, Ph.D., Yale University, 2010. *Astrophysics, Cosmology & String Theory*. Theoretical astrophysics; inflation and early universe cosmology; theoretical cosmology.
- Lorenz**, Virginia O., Ph.D., University of Colorado, Boulder, 2007. *Atomic, Molecular, & Optical Physics, Quantum Foundations*. Experimental quantum optics; atomic and molecular spectroscopy; optical magnetometry.
- Noronha**, Jorge, Ph.D., Goethe Universität Frankfurt, 2007. *Nuclear Physics*. Theoretical high-energy nuclear physics; quantum chromodynamics; quark-gluon plasma; non-Abelian gauge theories in and out of equilibrium; ultrarelativistic heavy-ion collisions; neutron stars; relativistic fluid dynamics/kinetic theory in curved spacetime; AdS/CFT correspondence.
- Sickles**, Anne M., Ph.D., University of New York at Stony Brook, 2005. *Nuclear Physics*. Experimental high-energy nuclear physics; relativistic heavy ion collisions; quark gluon plasma.
- Yang**, Liang, Ph.D., Harvard University, 2006. *Nuclear Physics*. Experimental low-energy nuclear physics; neutrino physics; low-background detectors; neutrinoless double beta decay; fundamental properties of neutrinos and testing fundamental symmetries.

Assistant Professor

- Bradlyn**, Barry, Ph.D., Yale University, 2015. *Condensed Matter Physics*. Theoretical condensed matter physics; topological insulators and semimetals; quantum Hall effect, geometric response in condensed matter; symmetry.
- Clark**, Bryan, Ph.D., University of Illinois at Urbana-Champaign, 2009. Blue Waters Professor. *Computational Physics, Condensed Matter Physics*. Computational condensed matter physics; many-body and strongly correlated physics.
- Draper**, Patrick I., Ph.D., University of Chicago, 2011. *Astrophysics, Cosmology & String Theory, High Energy Physics*. Theoretical high-energy physics; particle physics beyond the

standard model; quantum field theory; early universe cosmology.

Faulkner, Thomas, Ph.D., Massachusetts Institute of Technology, 2009. *Condensed Matter Physics, High Energy Physics*. Theoretical condensed matter physics; high-energy physics and string theory.

Filippini, Jeffrey P., Ph.D., University of California, Berkeley, 2008. *Astrophysics*. Experimental astrophysics and observational cosmology; cosmic microwave background; dark matter; astrophysical and non-accelerator probes of fundamental physics; instrumentation development.

Gadway, Bryce R., Ph.D., Stony Brook University, 2012. *Atomic, Molecular, & Optical Physics, Condensed Matter Physics*. Experimental atomic, molecular, and optical physics; degenerate Bose and Fermi gases; dipolar quantum matter; optical lattices.

Goldschmidt, Elizabeth A., Ph.D., University of Maryland, College Park, 2014. *Atomic, Molecular, & Optical Physics, Condensed Matter Physics, Quantum Foundations*. Experimental quantum optics; quantum information science.

Hooberman, Benjamin, Ph.D., University of California, Berkeley, 2009. *High Energy Physics*. Experimental high-energy particle physics; beyond-the-standard-model physics; supersymmetry; weakly interacting massive particles; dark matter.

Kahn, Yonatan, Ph.D., Massachusetts Institute of Technology, 2015. *High Energy Physics*. Theoretical high energy physics; dark matter detection; light weakly-coupled new forces beyond the standard model.

Kim, Sangjin, Ph.D., Harvard University, 2010. *Biophysics*. Experimental biological physics; single molecule biophysics; gene expression dynamics in live cells.

Kuehn, Seppe, Ph.D., Cornell University, 2007. *Biophysics*. Experimental biological physics; microbial population dynamics in closed ecosystems; phenotypic variation of microbial behavior.

MacDougall, Gregory, Ph.D., McMaster University, 2008. *Condensed Matter Physics*. Experimental condensed matter physics; neutron scattering and muon spin rotation measurements of unconventional superconductors, geometrically frustrated magnets, and multiferroics; single crystal growth of new materials.

Mahmood, Fahad, Ph.D., Massachusetts Institute of Technology, 2016. *Condensed Matter Physics*. Experimental condensed matter physics; ultrafast optical and THz spectroscopy, time and angle resolved photoemission spectroscopy (Tr-ARPES); strongly correlated materials, unconventional superconductors, topological phases of matter and frustrated magnets.

Noronha-Hostler, Jacquelyn, Ph.D., Goethe Universität Frankfurt, 2010. *Nuclear Physics*. Theoretical high-energy nuclear physics; ultrarelativistic heavy-ion collisions; high performance computing; computational relativistic hydrodynamics; jet and heavy flavor energy loss in heavy-ion collisions; equation of state and critical phenomena of quantum chromodynamics; hadronic physics.

Shelton, Jessie, Ph.D., Massachusetts Institute of Technology, 2006. *Astrophysics, High Energy Physics*. Theoretical high-energy physics; particle physics beyond the standard model; dark matter; top quarks; Higgs boson.

Wagner, Lucas K., Ph.D., North Carolina State University, 2006. *Computational Physics, Condensed Matter Physics*. Theoretical and computational condensed matter physics; high-performance computing; quantum Monte Carlo.

Professor Emeritus

Debevec, Paul T., Ph.D., Princeton University, 1972. *Energy Sources & Environment, Nuclear Physics*. Experimental nuclear physics; photonuclear interactions; precision muon physics; energy and the environment.

Gladding, Gary E., Ph.D., Harvard University, 1971. *Physics and other Science Education*. Physics education research.

Mestre, Jose, Ph.D., University of Massachusetts, 1979. Professor, Department of Educational Psychology. *Physics and other Science Education*. Physics education research; cognitive processes in learning; role and interaction of language in problem solving; educational technologies.

Nathan, Alan M., Ph.D., Princeton University, 1975. *Nuclear Physics, Other*. Experimental nuclear physics; physics of sports, especially baseball.

Oono, Yoshitsugu, Ph.D., Kyushu University, 1976. *Statistical & Thermal Physics*. Nonequilibrium statistical physics/dynamical systems; system reduction/asymptotic analysis, including reduction of large data sets.

Stack, John D., Ph.D., University of California, Berkeley, 1965. *High Energy Physics*. Theoretical physics.

Thaler, Jon J., Ph.D., Columbia University, 1972. *Astrophysics*. Observational cosmology, focusing on the properties of dark matter and dark energy, as well as neutrino masses and diverse phenomena.

Weaver, Richard L., Ph.D., Cornell University, 1977. *Acoustics, Condensed Matter Physics, Nonlinear Dynamics and Complex Systems*. Condensed matter physics; stochastic waves, disordered and complex structures, quantum chaos, random matrix theory, ultrasonics, structural acoustics.

Weissman, Michael B., Ph.D., University of California, San Diego, 1976. *Condensed Matter Physics, Physics and other Science Education*. Experimental condensed matter physics; 1/f noise, spin glasses, amorphous materials; "Ask the Van" informal science education.

Research Professor

Baym, Gordon, Ph.D., Harvard University, 1960. *Astrophysics, Atomic, Molecular, & Optical Physics, Condensed Matter Physics, History & Philosophy of Physics/Science, Nuclear Physics*. Theoretical physics; Bose-Einstein condensation in trapped atomic systems and excitons; superfluid helium; matter under extreme conditions; neutron stars.

Chiang, Tai-Chang, Ph.D., University of California, Berkeley, 1978. *Condensed Matter Physics*. Experimental condensed matter physics; quantum electronic properties of surfaces, single atomic and molecular layers, and thin film structures.

Research Assistant Professor

Riedl, Caroline K., Ph.D., Friedrich-Alexander-Universität Erlangen, 2005. *Nuclear Physics*. Experimental nuclear physics; nucleon structure; exclusive processes.

DEPARTMENTAL RESEARCH SPECIALTIES AND STAFF

Theoretical

Astrophysics. Astrophysics at Illinois encompasses problems in star formation, planet formation, stellar dynamics, astrophysical fluid dynamics, the physics of compact objects, and theoretical and observational cosmology. Physics faculty in the astrophysics group work closely with colleagues in the high-energy physics group, the Department of Astronomy, the Department of Chemistry, the National Center for Supercomputing Applications, and the program in Computational Science and Engineering, and many hold joint appointments. Adshad, Baym, Draper, Gammie, Holder, Kahn, Mouschovias, Seidel, Shapiro, Shelton, Yunes.

Atomic, Molecular, & Optical Physics. Theoretical research in ultracold atomic systems focuses on quantum many-body physics and intersections with electronic solids and high-density nuclear matter. Research topics include numerical simulations of lattice gases, the BEC-BCS crossover in Fermi

gases, artificial gauge fields and rotating superfluids, and analogs with QCD and nuclear matter. Baym, Ceperley, Fradkin, Leggett, Vishveshwara.

Biological Physics. Theoretical and computational biological physics research at Illinois includes such topics as biomolecular modeling of molecular motors, multiscale modeling of pattern formation, cellular mechanics, multiscale modeling of cells, biocomplexity, and bionanotechnology. Aksimentiev, Dahmen, Goldenfeld, Oono, Song.

Condensed Matter Physics. Theoretical research in condensed matter physics focuses on the collective properties of matter in its solid and liquid forms, the emergence of novel and unusual states, and the behavior of complex systems. Illinois has long been a leader in research on superconductivity, superfluidity, and strongly correlated systems, and it is known for its close and fruitful collaborations of theorists and experimentalists. Every area of modern-day condensed matter physics is represented at Illinois, together with numerous interdisciplinary projects in atomic, molecular and optical physics, quantum information, string theory, materials science, theoretical and applied mechanics, chemistry, biology, and computer science and engineering. Current topics include high-temperature superconductivity, nonequilibrium dynamical systems, pattern formation, Bose–Einstein condensation, quantum phase transitions and quantum critical phenomena, strongly correlated and low-dimensional systems, quantum entanglement, topological insulators and superconductors, and nanoscale physics. Baym, Bradlyn, Ceperley, Clark, Dahmen, Faulkner, Fradkin, Goldenfeld, Hughes, Leggett, Leigh, Oono, Phillips, Stone, Vishveshwara, Wagner, Weaver.

High Energy Physics. Theoretical research in high-energy physics at Illinois covers a very diverse set of topics, including lattice field theory and quark flavor physics, collider phenomenology and simulations, top quark and Higgs physics, and dark matter phenomenology, as well as quantum field theory, duality, and string theory. There is close collaboration with the high-energy experimental group, as well as the astrophysics and condensed matter groups. There are also overlapping interests with the math department in string theory research as well as with the National Center for Supercomputing Applications in computational physics. Adshead, Draper, El-Khadra, Faulkner, Kahn, Leigh, Shelton, Stack.

Nuclear Physics. Theoretical research in nuclear physics focuses on the novel properties displayed by quantum chromodynamics under extreme conditions in and out-of-equilibrium. A prime example is the quark-gluon plasma, an exotic phase of matter that existed microseconds after the Big Bang. Another example involves the hot and ultradense matter formed in neutron stars. Current research topics include quantum chromodynamics in and out-of-equilibrium, quark-gluon plasma, relativistic fluid dynamics in heavy-ion collisions and in neutron star mergers, jet energy loss in heavy-ion collisions, high performance computing applications in nuclear theory, search for critical phenomena in quantum chromodynamics, holographic duality and its applications in strongly coupled gauge theories, equation of state of nuclear matter with applications to neutron stars, pairing in hot nuclear matter, transport properties of quantum fluids with application to experimental searches for a neutron electric dipole moment. We work in close connection with colleagues from the experimental nuclear physics group at Illinois to address outstanding problems in nuclear physics. Baym, Noronha, Noronha-Hostler.

Relativity & Gravitation. The Illinois Relativity group focuses on the application of Einstein's theory of general relativity to forefront problems in relativistic astrophysics. The development and application of numerical relativity to tackle problems by computational means are major activities. The

merger of binary compact objects (including binary black holes) leading to the generation of gravitational waves and, in some cases, electromagnetic radiation, are areas of great interest. Seidel, Shapiro, Yunes.

Experimental

Astrophysics. Experimental astrophysics research at Illinois seeks to measure the properties of the universe and its constituents using methods of observational astronomy and experimental physics. Our group pursues a broad range of current problems in cosmology, including measurements of the properties of dark matter and dark energy (which comprise 96% of the universe), astrophysical measurements of neutrino mass, and observational probes of the inflationary epoch. The group's efforts span instrumentation development, data analysis, and observations of the universe at optical, infrared, and millimeter wavelengths. Major current projects include the Dark Energy Survey, the Large Synoptic Survey Telescope, and observations of the cosmic microwave background (CMB) with SPIDER and related instruments. We work in close collaboration with colleagues in the theory group, high-energy physics, the astronomy department, NCSA, and other institutions worldwide. Filippini, Thaler.

Atomic, Molecular, & Optical Physics. Experimental AMO physics at Illinois focuses on four general areas: quantum information science using entangled photons, quantum simulation using ultracold atoms trapped in optical lattices, quantum light-matter interactions, and optical spectroscopy of atomic and condensed matter dynamics. Current research topics include experimental studies of quantum nonlocality and the development of advanced resources for quantum computation, quantum cryptography, and quantum metrology. We also study cooling, dynamics, and phase transitions in strongly correlated and disordered quantum gases, and we work closely with condensed matter colleagues at Illinois to address outstanding problems in many-body physics and the foundations of quantum mechanics. DeMarco, Gadway, Goldschmidt, Kwiat, Lorenz.

Biological Physics. Experimental biological physics groups at Illinois use a variety of single-molecule and single-cell techniques, including single-molecule fluorescence microscopy and spectroscopy, optical trapping, and microfluidics to investigate molecular motors, DNA-protein interactions, gene regulation, cellular decision-making, intracellular transport, and the structure and dynamics of biological macromolecules. Chemla, Golding, Kim, Kuehn, Selvin.

Condensed Matter Physics. Condensed matter experiment at Illinois ranges from the design and growth of new materials, to the development of novel methods to elucidate and control quantum phenomena, to the design and construction of ground-breaking new instruments for fundamental physics research. Experimentalists work closely with theorists and across disciplines to address outstanding problems in condensed matter physics. Examples of current projects include imaging electron dynamics in the attosecond regime, detecting nuclear spins with attonewton force sensitivity, engineering solid-state qubits, measuring and controlling the magnetic and superconducting properties of nanodevices and nanostructure arrays, growing epitaxial heterostructures and bulk single crystals of strongly correlated materials, and elucidating the novel phases of magnetic and superconducting materials using neutron, light, and electron spectroscopies. Illinois condensed matter researchers carry out experiments in state-of-the-art facilities at the Frederick Seitz Materials Research Laboratory, the Micro and Nanotechnology Laboratory, the Beckman Institute, and U.S. and international laboratories, as well as in their own well-equipped laboratories.

Abbamonte, Bezryadin, Chiang, Cooper, Eckstein, Giannetta, Lorenz, MacDougall, Madhavan, Mahmood, Mason, Nayfeh, Van Harlingen, Weissman.

High Energy Physics. High-energy experiment at Illinois encompasses accelerator-based experiments at the Energy Frontier and the Intensity Frontier. At the former, the group works at the CDF experiment at Fermilab and the ATLAS experiment at the Large Hadron Collider, studying the properties of top and bottom quarks and the Higgs boson, measuring the CKM matrix elements, and searching for rare phenomena and physics beyond the standard model. At the Intensity Frontier, the group is involved in three planned experiments at Fermilab: $g-2$, which makes precision measurements of the muon g -factor; Mu2e, which will search for the forbidden lepton-number-violating decay of a muon into an electron; and ORKA, which will make a precision measurement of a rare kaon decay. Opportunities exist in all these projects for detector development and operation as well as data analysis. Hooberman, Neubauer, Pitts.

Nuclear Physics. The experimental nuclear physics group at Illinois carries out research in four major directions: the precision measurement of the electric dipole moment of the neutron, a broad program studying the structure and formation of hadrons, exploring the physics of hot quark matter in ultra-relativistic heavy ion collisions, and searching for neutrinoless double beta decay. Our group focuses on discovery in fundamental nuclear physics, using modern data analysis techniques and advanced instrumentation. We have significant state-of-the-art infrastructure to design and build scientific instrumentation in Urbana, which is then installed at national

and international laboratory facilities. Our faculty are currently contributing to the following international physics experiments: ATLAS and COMPASS at CERN, EXO-200 and nEXO at WIPP in New Mexico, nEDM at Oak Ridge National Laboratory, SeaQuest at Fermi National Accelerator Laboratory, and sPHENIX at Brookhaven National Laboratory. By carefully balancing our research portfolio among experiments at different stages—R&D, construction, data taking, and data analysis—our group provides students with a broad spectrum of research opportunities. Beck, Grosse Perdekamp, Makins, Peng, Riedl, Sickles, Yang.

Physics and other Science Education. Physics education research (PER) investigates the learning, understanding, and teaching of physics and the application of physics knowledge. The Illinois PER group has pioneered the application of technology to physics teaching, including development of the i-clicker® student-response system, web-based multimedia learning modules, and a personal, hand-held device that can measure acceleration, spatial orientation, magnetic fields, electrical signals, frequency spectra, and time constants and perform other introductory physics laboratory tasks. Research interests include the role of mathematics and reflection in physics learning, the organization and deployment of physics knowledge by experts and novices, transfer studies, the design and implementation of web-based instruction, curriculum reform, and the evaluation of educational assessments. Experimental techniques and analyses used include eye-tracking, video analysis, student interviews, web-based log data analysis, and analysis of exam data. Gladding, Gollin, Mestre, Selen, Stelzer.

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.