ADMISSIONS

Admission Contact Information
Address admission inquiries to: Graduate Records Secretary, 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/grad/apply.asp

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 2016:
Number of applicants: 700
Number admitted: 167
Number enrolled: 52

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.

Minimum undergraduate GPA: 3.0

GRE requirements
The GRE is required.
Mean GRE score range (25th–75th percentile): 870
Both the Graduate Record Examination (GRE) and the GRE Physics Subject Test, administered by the Educational Testing Service (ETS) are required. While the application form asks that you provide these scores, your official score must be sent from ETS directly to the Department of Physics by the application deadline (January 15, 2017). Please list your GRE registration number on your application. The department does not set a minimum General GRE score.

Advanced GRE requirements
The Advanced GRE is required.
Minimum accepted Advanced GRE score: 550
Mean Advanced GRE score range (25th–75th percentile): 790–950
No definite minimum score is set for the GRE, but applicants must demonstrate mastery of upper-level undergraduate physics concepts. The average GRE Physics subject score for 2016 admissions was 870.

TOEFL requirements
The TOEFL exam is required for students from non-English-speaking countries.
PBT score: 50
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 consider your grade-point average, GRE scores, research experiences, 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

Tuition year 2016–17:
Tuition for in-state residents
Full-time students: $17,834 annual
Tuition for out-of-state residents
Full-time students: $32,628 annual
Illinois

Appointment as a research or teaching assistant includes a full tuition waiver.
Credit hours per semester to be considered full-time: 8
Deferred tuition plan: Yes
Health insurance: Available
Other academic fees: A description of fees is posted at http://registrar.illinois.edu/fee-info. Research and teaching assistantships include full tuition and partial fee waivers.
Academic term: Semester
Number of first-year students who received full tuition waivers: 52

Teaching Assistants, Research Assistants, and Fellowships
Number of first-year
Teaching Assistants: 47
Research Assistants: 2
Fellowship students: 3
Average stipend per academic year
Teaching Assistant: $22,264
Research Assistant: $22,264
Fellowship student: $25,000
The rates quoted above are for the 11-month calendar year (9-month academic year plus 2-month summer term). 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.

FINANCIAL AID

Application deadlines
Fall admission: 
U.S. students: January 15  Int'l. students: January 15
Loans
Loans are not available for U.S. students.
Loans are not available for international students.
GAPSFAS application required: No
FAFSA application required: No
For further information
Address financial aid inquiries to: Graduate Records Secretary, Department of Physics, 1110 W. Green St., Urbana, IL 61801-3080.
Phone: (217) 333-3645
E-mail: grad@physics.illinois.edu

HOUSING

Availability of on-campus housing
Single students: Yes
Married students: Yes
For further information
Address housing inquiries to: Housing Division, 200 Clark Hall, 1203 S. Fourth, Champaign, IL 61820.
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 (2.75/4.0 GPA) satisfactory 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: The thesis may be written in absentia.

U. of Illinois at Urbana-Champaign, Phys.

SPECIAL EQUIPMENT, FACILITIES, OR PROGRAMS
The Department of Physics offers world-class research facilities in many research areas. For a complete description of physics facilities, please consult our website, http://physics.illinois.edu.

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>$15,800,000</td>
<td>$2,396,000</td>
</tr>
<tr>
<td>State/local government</td>
<td>$126,000</td>
<td></td>
</tr>
<tr>
<td>Non-profit organizations</td>
<td>$965,000</td>
<td>$200,000</td>
</tr>
<tr>
<td>Business and industry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>$998,000</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>$17,891,000</td>
<td>$2,596,000</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>Astrophysics</td>
<td>4</td>
<td>$761,000</td>
</tr>
<tr>
<td>Atomic, Molecular, &amp; Optical Physics</td>
<td>9</td>
<td>$1,407,000</td>
</tr>
<tr>
<td>Biological Physics</td>
<td>12</td>
<td>$5,684,000</td>
</tr>
<tr>
<td>Condensed Matter Physics</td>
<td>56</td>
<td>$5,497,000</td>
</tr>
<tr>
<td>High Energy Physics</td>
<td>10</td>
<td>$1,838,000</td>
</tr>
<tr>
<td>Low Temperature Physics</td>
<td>11</td>
<td>$1,253,000</td>
</tr>
<tr>
<td>Nuclear Physics</td>
<td>6</td>
<td>$3,862,000</td>
</tr>
<tr>
<td>Physics Education Research</td>
<td>2</td>
<td>$205,000</td>
</tr>
<tr>
<td>Total</td>
<td>110</td>
<td>$20,487,000</td>
</tr>
</tbody>
</table>
FACULTY

Professor

Abbamonte, Peter, Ph.D., University of Illinois at Urbana-Champaign, 1999. Condensed Matter Physics. Experimental condensed matter physics; resonant soft X-ray scattering; electron self-organization; oxide devices; quantum phase transitions; collective excitations.


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.


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.

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.


DeMarco, Brian, Ph.D., University of Colorado Boulder, 2001. 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.


Fradkin, Eduardo H., Ph.D., Stanford University, 1979. Donald Biggar Willett Professor of Engineering; 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 physics and complexity; pattern formation; statistical physics; microbiology and evolutionary biology; fluid mechanics; materials theory; quantitative finance.

Gollin, George D., Ph.D., Princeton University, 1981. High Energy Physics. Experimental high-energy physics; CP violation; lepton number violation; axion production; higher education policy.

Grosse Perdekamp, Matthias, Ph.D., University of California, Los Angeles, 1995. Nuclear Physics. Experimental high-energy nuclear physics; nucleon structure, including spin structure and nuclear effects; spin-dependent hadron fragmentation.


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.


Madhavan, Vidy, Ph.D., Boston University, 2000. Condensed Matter Physics. Experimental condensed matter physics; correlated electron systems (including cuprates and pnictides) and magnetic systems; low-temperature scanning tunneling microscopy (STM), spectroscopy (STS), and spin-polarized STM.


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.

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.

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

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.


Pitts, Kevin T., Ph.D., University of Oregon, 1994. Associate Dean for Undergraduate Programs, College of Engineering. High Energy Physics. Experimental high-energy physics; heavy quark decays; precision muon physics.


Schulten, Klaus J., Ph.D., Harvard University, 1974. Swanlund Chair; Center for Advanced Study Professor of Physics; Blue Waters Professor; Director, NIH Center for Macromolecular Modeling and Bioinformatics; Co-Director, Center for the Physics of Living Cells. Biophysics, Computational Physics. Theoretical and computational biological physics; physics of the living cell.


Selen, Mats A., Ph.D., Princeton University, 1989. Associate Head for Undergraduate Programs. Physics and other Science Education. Physics education research.


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; Professor of Bioengineering. Biophysics. Computational biological physics; systems biology; biostatistics.


Van Harlingen, Dale J., Ph.D., The Ohio State University, 1977. Department Head; 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; superconductivity; superconductor device physics; foundations of quantum mechanics; quantum information.

Willenbrock, Scott S., Ph.D., University of Texas at Austin, 1986. High Energy Physics. Theoretical high-energy physics; phenomenology; electroweak symmetry breaking; top quark physics; Higgs phenomena.


Associate Professor


Ryu, Shinsei, Ph.D., University of Tokyo, 2005. Condensed Matter Physics. Theoretical condensed matter physics; nanoscale physics; strongly correlated systems.

Vishveshwar, 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.

Assistant Professor

Adshead, Peter, Ph.D., Yale University, 2010. Astrophysics, Cosmology & String Theory. Theoretical astrophysics; inflation and early universe cosmology; theoretical cosmology.


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.

Hooberman, Benjamin, Ph.D., University of California, Berkeley, 2009. High Energy Physics. Experimental high-energy physics; condensed matter physics; quantum foundations; superconductivity; superconductor device physics; foundations of quantum mechanics; quantum information.
particle physics; beyond-the-standard-model physics; supersymmetry; weakly interacting massive particles; dark matter.

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


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.

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.


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.

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.

**Professor Emeritus**

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.

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

Errede, Steven M., Ph.D., The Ohio State University, 1981. High Energy Physics. Experimental high-energy physics; interactions of the electroweak gauge bosons; physics of music.


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.


Wolfe, James P., Ph.D., University of California, Berkeley, 1971. Condensed Matter Physics, Physics and other Science Education. Experimental condensed matter physics; imaging and thermodynamics of excitonic matter in semiconductors; the teaching of thermal physics.

**Research Professor**


**Research Associate Professor**


**Research Assistant Professor**


**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. Adshead, Baym, Gammie, Holder, Lamb, Mouschovias, Seidel, Shapiro, Shelton.

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, Schulten, 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, Ceperley, Clark, Dahmen, Faulkner, Fradkin, Goldenfeld, Hughes, Leggett, Leigh, Oono, Phillips, Ryu, 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, 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 theory 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. El-Khadra, Faulkner, Leigh, Shelton, Stack, Stelzer, Willenbrock.

Nuclear Physics. Theoretical research in nuclear physics focuses on phase structure of ultrahot and dense hadronic matter; ultrarelativistic heavy ion collisions; hot nuclear matter, pairing in nuclear matter, and equation of state of nuclear matter, with applications to neutron stars; and transport properties of quantum fluids with application to experimental searches for a neutron electric dipole moment. Baym.

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.

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 three general areas: quantum information science using entangled photons, quantum simulation using ultracold atoms trapped in optical lattices, 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, Kwiat, Lorenz.

Biological Physics. Experimental biological physics groups at Illinois use a variety of single-molecule techniques, including single-molecule fluorescence microscopy and spectroscopy, optical trapping, and microfluidics to investigate molecular motors, DNA–protein interactions, gene regulation, intracellular transport, and the structure and dynamics of biological macromolecules. Chemla, Kuehn, Kuhlman, 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 attowatt 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, Budakian, Chiang, Cooper, Eckstein, Giannetta, Hubler, MacDougall, Madhavan, Mason, Nayfeh, Schiffer, Van Harlingen, Weissman, Wolfe.

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. Errede, Gollin, Hooberman, Martinez Outschoorn, Neubauer, Pitts, Wiss.

Nuclear Physics. The Nuclear Physics Laboratory (NPL) at Illinois focuses on discovery in fundamental nuclear physics using advanced instrumentation and modern data analysis techniques that are developed and built at NPL. The group develops instruments for novel experimental approaches in four main areas of nuclear physics: the precision measurement of the electric dipole moment of the neutron; a broad program studying structure and formation of hadrons; studies of the quark-gluon plasma at RHIC and the LHC; and precision studies of neutrino properties (mass hierarchy, CP-violating phase) and the search for neutrinoless double-beta decay. Recent and current examples of instrumentation developed at...
Illinois include wire chambers for the COMPASS experiment at CERN, the Drell-Yan muon-trigger scintillator hodoscopes for the SeaQuest experiment at Fermi National Accelerator Laboratory, the W-trigger RPCs for the PHENIX experiment at Brookhaven National Lab, component demonstration for the He-3 system in, and development of NV-diamond magnetic and electric field sensors for the neutron EDM experiment, the electronics upgrade for EXO 200, and PMTs for the Daya Bay neutrino experiment. 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, Mestre, Selen, Stelzer.