

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

DEPARTMENT OF PHYSICS LOOMIS LABORATORY OF PHYSICS

1110 West Green Street
Urbana, Illinois 61801-3080
<http://www.physics.uiuc.edu/>

| Students Accepted For Degree | FIELDS | | |
|---------------------------------|---------|-----------|----------------|
| | Physics | Astronomy | Related Fields |
| Doctorate | X | | |
| Master's | X | | |

1. General

President: B. Joseph White
Dean of Graduate College: Richard Wheeler
Head of Physics: Dale J. Van Harlingen
Department Telephone Number: (217) 333-3761
Type of Institution: University
Control: Public
Setting: Suburban
Total Faculty: 2,978
Total Graduate Faculty: 2,726
Total Students: 42,728
Total Graduate Students: 11,256
Annual Graduate Tuition:
In-state residents: Full-time—\$11,804
Out-of-state residents: Full-time—\$24,644
Tuition rates for: 2007–08
Deferred tuition plan: Yes
Other Fees: \$2490 (includes health insurance)
Term: Semester

2. Number of Faculty in Department

The combined total of full-time faculty in the three professorial ranks is 65. The combined total of full-time, part-time, and other faculty at all ranks is 67.

3. Admission, Financial Aid, and Housing

Address admission inquiries to: Graduate Records Secretary, Department of Physics, 1110 W. Green St., Urbana, IL 61801-3080 or through our website. General information and application forms are available at <http://www.physics.uiuc.edu>.

Graduate application fee required: \$60 for domestic applicants \$75 for foreign applicants

Admission deadline (Fall admission): 1/15 (10/15 for January admission)

Admission information: For 2008 fall admission, 44 students were admitted from 500 applicants.

Admission requirements: For admission to the graduate programs, a bachelor's degree in physics or a related field is required with a minimum undergraduate GPA of 3.0/4.0. On the last 60 hours of work, 20 semester hours of physics beyond elementary physics is also required. The GRE is required. No definite minimum score is set. The average GRE Advanced score for 2008 admissions was 832. Students from non-English speaking countries are required to demonstrate proficiency in English via the TOEFL or ILETS exam. Minimum acceptable score for admission is 79 on the internet-based TOEFL, 213 on the computer-based TOEFL, and 550 on the paper-based TOEFL, and 6.5 for the ILETS. Other exams for admission required of foreign teaching assistants

are the Test of Spoken English (TSE) (minimum score of 50), the internet-based TOEFL speaking section (minimum score of 24), or the local SPEAK examination.

Undergraduate preparation assumed: Although preparation will vary, we generally expect one year of mechanics (Fowles and Cassiday, Marion plus Resnick), one year of electricity and magnetism (Griffith or Reitz, Milford, and Christy), one semester of optics (Hecht or Klein and Furtak), one semester of statistical and thermal physics (Reif or Kittel and Kroemer), and one year of some combination of atomic, nuclear, and quantum mechanics (Griffiths or Park). Also, one or two years of laboratory courses are expected.

Address financial aid inquiries to: Graduate Records Secretary, Department of Physics, 1110 W. Green St., Urbana, IL 61801-3080.

GAPSFAS application required: No

Financial aid deadline: 1/15

Loans available: Yes

Address housing inquiries to:

www.housing.uiuc.edu/options/grad/. For information by mail: Housing Division, 200 Clark Hall, 1203 S. Fourth, Champaign, IL 61820

On-campus graduate student housing available: Yes

Cost/term: \$4,258–5,788/acad. yr.

On-campus, married student housing available: Yes

Cost/month: \$502–751/mo

Table A—Faculty, Enrollments, and Degrees Granted

| Research Specialty | 2007–08 Faculty | Enrollment ¹ Fall 2007 | | No. of Degrees Granted 2007–08 (2003–08) | | | Median No. of Years for 2007–08 Ph.D.'s |
|---|--------------------|--------------------------------------|----------------|--|---------------------------|----------------|---|
| | | Mas- ter's | Doc- torate | Mas- ter's | Termi- nal Master's | Doc- torate | |
| Astrophysics | 5 | 0 | 12 | 0(14) | 0(0) | 2(23) | – |
| Atomic, Molecular, & Optical Physics | 4 | 0 | 12 | 0(10) | 0(0) | 1(11) | – |
| Biophysics | 8 | 0 | 39 | 4(26) | 0(4) | 11(57) | – |
| Condensed Matter Physics | 24 | 0 | 137 | 5(125) | 0(6) | 15(217) | – |
| Complex Systems & Nonlinear & Dy- namics | 2 | 0 | 10 | 2(14) | 0(0) | 4(29) | – |
| Nuclear Physics | 7 | 0 | 20 | 0(18) | 0(5) | 2(38) | – |
| Particles & Fields | 12 | 0 | 22 | 1(20) | 0(4) | 3(30) | – |
| Physics Education | 3 | 0 | 3 | 0(0) | 0(2) | 0(0) | – |
| Non-specialized¹ | N/A | 3 | 40 | 5(19) | 2(9) | N/A | – |
| Total | 65 | 3 | 295 | 12(246) | 2(32) | 38(405) | – |
| Full-time Grad. Stud. | | 3 | 295 | | | | |
| Part-time Grad. Stud. | | 0 | 0 | | | | |
| First-year Grad. Stud. | | 0 | 38 | | | | |
| Median Years (2006-07 Dgrs) | 6.0 | | | | | | |
| Graduate Degrees, 2006–07(2003–08): | 57(683)0 | | | | | | |

¹Beginning students who have not yet selected a research area or thesis adviser.

4. Graduate Degree Requirements

Master's: See Academic Information at [www](http://www.physics.uiuc.edu) address. 32 hours¹ of satisfactory (GPA 2.75/4.0) graduate course work required.

12 hours must be at the 400-level. 12 of the 32 hours must be in Physics, with at least 12 hours of them at the 500-level. At most, 8 hours of individual study may be counted toward the master's degree. A thesis is not ordinarily written for a master's degree, but may be. 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 and no special examination.

Doctorate: 96 hours¹ of (2.75/4.0 GPA) satisfactory graduate work. Part of these hours may be thesis work. There is no specific residence requirement, but 64 hours must be taken on the Urbana-Champaign campus. A qualifying examination is required, usually at the beginning of the second year; a preliminary examination is required, usually in the fifth or sixth semester. A thesis and a final examination on the thesis are required. There are no foreign language requirements.

Other Programs: The Medical Scholars Program, which allows students to earn joint MD/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 US citizens and permanent residents are eligible for admission.

Thesis: Theses may be written *in absentia*.

Special Equipment, Facilities, or Programs: The Department of Physics offers world-class research facilities in traditional areas of physics, including condensed matter, nuclear, particle, and optical physics, as well as state-of-the-art instruments for quantum information, nanoscale science and engineering, and biological physics. For a complete description of physics facilities, please consult our website.

Table B—Appointments to Graduate Students, 2007–08

| Title of Appointee | Appointments | | Academic Load Allowed in Credit Hours | Hours of Service Per Week | Stipend for Academic Year ^a (9 months) ^b |
|--------------------------------------|-----------------|------------|---------------------------------------|---------------------------|--|
| | Total | First year | | | |
| | Semester | | | | |
| Teaching Assistant | 115 | 27 | 14 | 20 | 15,804–16,479 |
| Research Assistant | 135 | 2 | 14 | 20 | 15,804–16,479 |
| Fellowship | 19 | 9 | 14 | 0 | varies |
| Self-supporting (foreign government) | 2 | 0 | 14 | 0 | varies |
| Combination TA/RA | 22 | 0 | 14 | 20 | 15,804–16,479 |
| Total | 293 | 38 | | | |

^aFor beginning students; stipends increase as students advance toward degree. For academic year 2007–08, the starting stipend for a nine-month academic year appointment is \$15,804.

^bMost students also receive a two-month (\$3,410 for 2007) summer research or teaching appointment.

5. Personnel Engaged in Separately Budgeted Research, 7/05–6/06

| | |
|--------------------------------|------------|
| Professorial faculty | 65 |
| Other faculty | 2 |
| Postdoctoral appointments | 59 |
| Graduate students | 135 |
| Undergraduate students | 38 |
| Nonteaching research personnel | 15 |
| Total | 314 |

6. Separately Budgeted Research Expenditures by Source of Support

| | Departmental Research | Physics-related Research Outside Department |
|-----------------------------------|-----------------------|---|
| Federal government | \$14,821,000 | \$1,744,000 |
| State and local government | 81,000 | – |
| Other government | – | – |
| Private, non-profit organizations | 973,000 | – |
| Business and industry | 133,000 | – |
| Other | 950,000 | – |
| Total | \$16,958,000 | \$1,744,000 |

7. Separately Funded and Managed Laboratories

Physics faculty-related research projects funded through the Materials Research Laboratory are included in Part 6 and Table C.

Table C—Separately Budgeted Research Expenditures

| Research Specialty | No. of Grants | Expenditures (\$) |
|--------------------------------------|---------------|-------------------|
| Astrophysics | 10 | 1,012,000 |
| Atomic, Molecular, & Optical Physics | 8 | 1,027,000 |
| Biophysics | 19 | 2,924,000 |
| Condensed Matter Physics | 34 | 4,109,000 |
| Low Temperature Physics | 11 | 1,525,000 |
| Nuclear Physics | 10 | 3,437,000 |
| Particles & Fields | 8 | 2,848,000 |
| Other Theoretical/Math. | 1 | 76,000 |
| Total | 101 | 16,958,000 |

Table D—Physics-related Research Outside Department

| Field and Unit Outside Department | No. of Grants | Expenditures (\$) |
|-----------------------------------|---------------|-------------------|
| Biophysics: | | |
| Beckman Institute | 2 | 1,357,000 |
| Institute for Genomic Biology | 2 | 187,000 |
| Condensed Matter Physics: | | |
| NCSA | 1 | 200,000 |
| Total | 5 | 1,744,000 |

FACULTY

Professors

Baym, Gordon, Ph.D., Harvard, 1960. George and Ann Fisher Distinguished Professor of Engineering and Center for Advanced Study Professor of Physics. Bose–Einstein condensa-

- tion in trapped atomic systems and excitons, superfluid helium, matter under extreme conditions, quark-gluon plasma and other relativistic matter, ultrarelativistic heavy ion collisions, neutron stars.
- Beck**, Douglas H., Ph.D., MIT, 1986. Experimental nuclear and particle physics; nucleon structure; fundamental symmetries; electron dipole moments.
- Ceperley**, David M., Ph.D., Cornell, 1976. Founder Professor of Engineering. Quantum simulations, electronic structure, low-temperature physics, superfluidity, Monte Carlo methods, physics at high pressure.
- Chang**, Yia-Chung, Ph.D., Harvard, 1980. Electronic structure, density functional theory, strongly correlated electron systems, low-dimensional electronic systems.
- Chiang**, Tai-Chang, Ph.D., California, Berkeley, 1978. Experimental condensed matter physics; atomically uniform films; electronic properties of impurities, surfaces, and quantum structures.
- Clegg**, Robert M., Ph.D., Cornell, 1974. Experimental biological physics; dynamic, structural, and thermodynamic studies of functional biological systems.
- Cooper**, S. Lance, Ph.D., Illinois, 1988. Experimental condensed matter physics; optical spectroscopy; strongly correlated systems; superconductivity.
- Eckstein**, James N., Ph.D., Stanford, 1978. Experimental condensed matter physics; atomic layer-by-layer molecular beam epitaxy; colossal magnetoresistance.
- El-Khadra**, Aida X., Ph.D., UCLA, 1989. Theoretical high-energy physics; lattice field theory; quantum chromodynamics; phenomenology.
- Errede**, Steven M., Ph.D., Ohio State, 1981. Experimental high-energy physics; interactions of the electroweak gauge bosons; physics of music.
- Flynn**, C. Peter, Ph.D., Leeds, 1960. Experimental condensed matter physics; epitaxy; defects and diffusion; magnetism.
- Fradkin**, Eduardo H., Ph.D., Stanford, 1979. Quantum Hall effects, strongly correlated systems, superconductors, critical phenomena, disordered systems, field theory.
- Gammie**, Charles F., Ph.D., Princeton, 1992. Theoretical and computational astrophysics; star formation; planet formation; relativistic accretion flows.
- Giannetta**, Russell W., Ph.D., Cornell, 1980. Experimental condensed matter physics; superconductivity; magnetic resonance; nanostructures; organic superconductors.
- Gladding**, Gary E., Ph.D., Harvard, 1971. Associate Head for Undergraduate Programs. Experimental high-energy physics; mixing of charmed mesons; physics education research.
- Goldbart**, Paul M., Ph.D., Imperial College, London, 1985. Theoretical condensed matter physics, random systems (polymer networks and glasses); mesoscopic physics; superconductivity and superfluidity.
- Goldenfeld**, Nigel D., Ph.D., Cambridge, 1982. Swanlund Chair. Pattern formation; high-temperature superconductivity; statistical physics; biocomplexity, microbial ecology, evolution.
- Gollin**, George D., Ph.D., Princeton, 1980. Experimental high-energy physics; CP violation in K-decay; rare B decays.
- Greene**, Laura H., Ph.D., Cornell, 1984. Swanlund Chair. Experimental condensed matter physics; thin-film growth and tunneling in novel superconducting materials.
- Ha**, Taekjip, Ph.D., Berkeley, 1996. Howard Hughes Medical Investigator. Experimental biological physics; single molecule fluorescence microscopy and spectroscopy; DNA protein interactions; molecular biology.
- Hertzog**, David W., Ph.D., William and Mary, 1983. Experimental nuclear physics; precision measurements of the muon's anomalous magnetic moment, lifetime, and capture in H.
- Katz**, Sheldon, Ph.D., Princeton, 1980. Mathematical physics; string theory and mirror symmetry; geometric engineering of quantum field theories; algebraic geometry.
- Kwiat**, Paul G., Ph.D., California, Berkeley, 1993. Bardeen Chair of Physics. Experimental quantum optics; optical approaches to quantum information; foundations of quantum mechanics.
- Lamb**, Frederick K., D.Phil., Oxford, 1970. Fortner Chair for Theoretical Astrophysics. Theoretical astrophysics; plasma, magnetohydrodynamic, and high-energy processes.
- Leggett**, Anthony J., D.Phil., Oxford, 1964. John D. and Catherine T. MacArthur Chair. Center for Advanced Study Professor of Physics. Foundations of quantum mechanics; superfluidity; high-temperature superconductivity; Bose-Einstein condensation.
- Leigh**, Robert G., Ph.D., Texas, Austin, 1991. Theoretical high-energy physics; quantum field theory, supersymmetric gauge theory; superstring theory.
- Liss**, Tony M., Ph.D., California, Berkeley, 1984. Experimental high-energy physics; production and decay of the top quark.
- Makins**, Naomi C.R., Ph.D., MIT, 1994. Experimental nuclear physics; proton and neutron spin.
- Mestre**, Jose, Ph.D., U. Massachusetts, 1979. Physics education research; cognitive processes in learning; role and interaction of language in problem solving; educational technologies.
- Mouschovias**, Telemachos, Ph.D., California, Berkeley, 1974. Theoretical astrophysics; dynamics of interstellar clouds; stellar evolution.
- Nathan**, Alan M., Ph.D., Princeton, 1975. Experimental nuclear physics, physics of baseball.
- Nayfeh**, Munir H., Ph.D., Stanford, 1974. Atomic, molecular, and optical physics; laser atomic spectroscopy.
- Oono**, Yoshitsugu, Ph.D., Kyushu, 1976. Nonequilibrium statistical physics/dynamical systems; system reduction/asymptotic analysis, including reduction of large data sets.
- Peng**, Jen-Chieh, Ph.D., U. Pittsburgh, 1975. Experimental medium- and high-energy nuclear physics; parton structures of the nucleons and nuclei.
- Phillips**, Philip W., Ph.D., U. Washington, 1982. Strongly correlated electronic low-dimensional systems; quantum Hall effect; quantum critical phenomena; quantum magnetism.
- Schulten**, Klaus J., Ph.D., Harvard, 1974. Swanlund Chair. Theoretical biophysics; physics of the living cell; computational physics.
- Selen**, Mats A., Ph.D., Princeton, 1988. Experimental high-energy physics; experimental astrophysics; decays of the charmed quark.
- Selvin**, Paul R., Ph.D., California, Berkeley, 1990. Experimental biological physics; structure and dynamics of biological macromolecules; fluorescence.
- Shapiro**, Stuart L., Ph.D., Princeton, 1973. Theoretical astrophysics and general relativity; physics of black holes and neutron stars; gravitational collapse; generation of gravitational waves.
- Stack**, John D., Ph.D., California, Berkeley, 1965. Associate Head for Graduate Programs. Theoretical high-energy physics; lattice field theory; quantum chromodynamics.
- Stone**, Michael, Ph.D., Cambridge, 1976. Quantum Hall effect, superconductivity, and superfluidity.
- Thaler**, Jon J., Ph.D., Columbia, 1972. Observational cosmology, focusing on the properties of dark matter and dark energy, as well as neutrino masses and diverse phenomena.
- Van Harlingen**, Dale J., Ph.D., The Ohio State University, 1977. Dept. Head, Willett Professor of Engineering, and Center for Advanced Study Professor of Physics. Experimental con-

- densed matter physics; non-equilibrium superconductivity; superconductor device physics; superconductor materials, including classic, high T_c , and heavy fermion superconductors.
- Weissman**, Michael B., Ph.D., California, San Diego, 1976. Experimental condensed matter physics; $1/f$ noise, spin glasses, amorphous materials.
- Weaver**, Richard L., Ph.D., Cornell University, 1977. Condensed matter physics; stochastic waves, disordered and complex structures, quantum chaos, random matrix theory, ultrasonics, structural acoustics.
- Willenbrock**, Scott S., Ph.D., Texas, Austin, 1986. Theoretical high-energy physics; phenomenology; electroweak symmetry breaking; top quark physics; Higgs phenomena.
- Wiss**, James E., Ph.D., California, Berkeley, 1977. Experimental high-energy physics; photoproduction of charmed mesons; precision study of the B meson.

Associate Professors

- Bezryadin**, Alexey, Ph.D., J. Fourier Université, 1995. Experimental condensed matter physics; nanometer-scale mesoscopic physics and molecular electronics; quantum phase transitions.
- Dahmen**, Karin A., Ph.D., Cornell, 1995. Nonequilibrium dynamical systems; hysteresis; avalanches; earthquakes; population biology; disorder-induced critical behavior.
- Errede**, Deborah M., Ph.D., Michigan, 1987. High energy particle physics; precision measurements of the W mass.
- Grosse Perdekamp**, Matthias, Ph.D., California, Los Angeles, 1995. Experimental high-energy nuclear physics; nucleon structure; spin-dependent structure of the proton; quark transversity and fragmentation functions.
- Hubler**, Alfred W., Ph.D., Munich, 1987. Nonlinear dynamics and complex systems.
- Lamb**, Susan A., D. Phil., Oxford University, 1973. Theoretical astrophysics, computational astrophysics; galaxy collisions and star formation.
- Mohr**, Joseph J., Ph.D., Harvard, 1995. Observational and theoretical X-ray astronomy; cosmology.
- Pitts**, Kevin T., Ph.D., University of Oregon, 1994. Experimental high-energy physics; CP violation in bottom quark decays.
- Wandelt**, Benjamin D., Ph.D., D.I.C., Imperial College, London, UK, 2002. Theoretical cosmology; cosmic microwave background; structure formation; dark matter.

Assistant Professors

- Abbamonte**, Peter, Ph.D., U. of Illinois at Urbana-Champaign, 1999. 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, Poland, 1999. Theoretical and computational biophysics; biomolecular modeling, molecular motors, mechanical proteins, silicon biotechnology, membrane transport.
- Budakian**, Raffi O., Ph.D., California, Los Angeles, 2000. Experimental condensed matter physics; magnetic resonance force microscopy; micro- and nanomechanical devices.
- Chemla**, Yann, R., Ph.D., California, Berkeley, 2001. Experimental biological physics; molecular motors; nucleic acid and protein translocases.
- DeMarco**, Brian, Ph.D., U. Colorado, 2001. Experimental atomic, molecular, and optical physics; quantum information science; atomic Bose-Einstein condensates and Fermi gases.
- Golding**, Ido, Ph.D., Tel Aviv University, 2002. Experimental biological physics; spatio-temporal dynamics in living cells; real-time studies having single-event resolution.

- Lev**, Benjamin, Ph.D., Caltech, 2005. Experimental ultracold atomic and molecular physics; quantum optics; quantum information science.
- Mason**, Nadya, Ph.D., Stanford University, 2001. Experimental condensed matter physics; quantum properties of carbon nanotubes, superconductivity, quantum phase transitions.
- Neubauer**, Mark, Ph.D., Pennsylvania, 2001. Experimental particle physics; particle astrophysics; neutrino physics; heavy flavor physics; Higgs boson; electroweak diboson physics.
- Vishveshwara**, Smitha, Ph.D., California, Santa Barbara, 2002. Theoretical condensed matter physics; strongly correlated systems; localization physics; phase transitions; superconductivity.

Emeriti

- Debevec**, Paul T., Ph.D., Princeton, 1972. Intermediate energy physics; photonuclear interactions; few-body systems; precision measurements of muon properties.
- Granato**, Andrew V., Ph.D., Brown, 1955. Professor. Experimental condensed matter physics; amorphous materials.
- Klein**, Miles V., Ph.D., Cornell, 1961. Center for Advanced Study Professor Emeritus, research professor of physics. Experimental condensed matter physics; Raman scattering; optical effects in solids.
- Martin**, Richard M., Ph.D., Chicago, 1969. Electronic structure; density functional theory; dielectric phenomena; simulations using molecular dynamics and Monte Carlo methods.
- Pines**, David, Ph.D., Princeton, 1950. Center for Advanced Study Professor Emeritus; research professor of physics. Superconductivity; complex adaptive matter; superfluidity.
- Ravenhall**, D. Geoffrey, Ph.D., Birmingham, 1950. Professor. Theoretical nuclear physics; high-energy physics; electron scattering.
- Simmons**, Ralph O., Ph.D., Illinois, 1957. Professor. Experimental condensed matter physics; noble gas crystals.
- Slichter**, Charles P., Ph.D., Harvard, 1949. Center for Advanced Study Professor of Physics and Chemistry; research professor of physics. Experimental condensed matter physics; nuclear magnetic resonance.
- Sullivan**, Jeremiah D., Ph.D., Princeton, 1964. Science and public policy; comprehensive nuclear test ban and arms control verification; science-based stockpile stewardship.
- Watson**, William D., Ph.D., MIT, 1968. Professor; theoretical astrophysics; interstellar medium; atomic and molecular processes.
- Wolfe**, James P., Ph.D., California, Berkeley, 1971. Experimental condensed matter physics; optical properties of semiconductors; phonon physics.

RESEARCH SPECIALTIES AND STAFF

Theoretical

Astrophysics and General Relativity. Relativistic astrophysics; general relativity; the physics of supernovae, black holes and neutron stars; computational astrophysics and galaxy formation; star formation; planet formation; stellar evolution; theory of interstellar medium; astrophysical gas dynamics; cosmic magnetic fields, stellar dynamics; and collisional and radiative processes for atoms and molecules. Baym, Gammie, F. Lamb, S. Lamb, Mouschovias, Ravenhall, Shapiro, Wandelt, Watson. 4 postdoctoral research associates.

Atomic and Molecular Physics. Collisional and radiative processes for atoms and molecules in astrophysics. Watson.

Biophysics. Theoretical and computational studies of the living cell; transcription mechanics; cell mechanics; cell morphogenesis; membrane processes; development of tools employing high-performance parallel computers and high-end graphics for research in structural biology; non-equilibrium statistical mechanics; stochastic quantum mechanics; device theory in bionanotechnology. Aksimentiev, Schulten, 1 visiting research scientist, 4 research programmers, 8 postdoctoral research assistants.

Complex Systems and Nonlinear Dynamics. Controls of complex dynamics; data analysis to model dynamics; statistical descriptions of complex systems; spatiotemporal dynamics of fluids, liquid crystals, and cellular systems; quantum chaos; patterns far-from-equilibrium; multiple-attractor systems; dynamics of learning and adaptation; evolutionary processes. Dahmen, Goldbart, Goldenfeld, Hubler, Oono, R. Weaver. 4 visiting faculty and postdoctorals.

Condensed Matter Physics. Superconductivity, including high temperature superconductivity; superfluidity in ^3He and ^4He , including topological defect dynamics and turbulence; Bose-Einstein condensation in trapped atomic gases and in excitons; computational physics of quantum systems, including Monte Carlo methods and molecular dynamics; physics at high pressure; electronic structure; density functional theory; dielectric phenomena; strongly correlated electron systems; low-dimensional electronic systems, including organic conductors; metal-insulator transitions; quantum Hall effects; quantum impurities; quantum critical phenomena; field theory and topology in condensed matter; mesoscopic physics; geometric quantal phases; foundations of quantum mechanics; statistical physics; soft matter, including liquid crystals and polymers; critical phenomena in disordered systems; vulcanized matter; glassy systems; nonequilibrium statistical physics and dynamical systems; hysteresis; avalanches and earthquakes; pattern formation; modeling of complex systems; biological issues, including population dynamics and taxonomy. Baym, Ceperley, Chang, Dahmen, Fradkin, Goldbart, Goldenfeld, Johnson, Leggett, Martin, Oono, Phillips, Pines, Stone, Vishveshwara, R. Weaver. 3 visiting faculty and 10 postdoctoral research associates.

Nuclear Physics. Microscopic many-body theories of nuclei and of hot, dense matter; applications to neutron stars; nuclear structure, reactions, and electron-nucleus interactions; relativistic heavy-ion collisions and the quark-gluon plasma; nuclear forces and quark models of hadrons. Baym, Ravenhall. 1 postdoctoral research associate.

Particle Physics and Cosmology. Quantum chromodynamics; lattice gauge theory; semi-leptonic form factors of mesons; quark masses; quarkonia; strong coupling constant; confinement; chiral symmetry breaking; glueballs; monopoles; vortices; finite temperature, density, and chemical potential; domain-wall fermions; quantum gravity; weak interaction; Higgs boson; electroweak symmetry breaking; top quark; radiative corrections; event generation; grand unification; string theory; supersymmetry; duality, D-branes; black holes; supersymmetry breaking; early universe; dark matter; dark energy; cosmic microwave background radiation; large-scale structure; gravitational lensing. El-Khadra, Katz, Leigh, Stack, Stelzer, Wandelt, Willenbrock. 3 postdoctoral research associates.

Experimental

Astrophysics. The Dark Energy Survey (DES) at Cerro Tololo and the Large Synoptic Survey Telescope (LSST) at Cerro Pachon. The properties of dark matter and dark energy; the expansion history of the universe; effects of neutrino mass on large scale structure; search for evidence of primordial inflation. Selen and Thaler. 1 postdoctoral research associate.

Atomic, Molecular, Optical, and Quantum-Information Physics. Laser atomic spectroscopy; chaotic behavior in quantum mechanical systems; preparation and characterization of silicon nanoparticles. Nonlinear optics; quantum optical tests of fundamental quantum mechanics, including experiments on non-locality, entanglement generation, the quantum Zeno effect, and wave-particle duality; experimental quantum cryptography; quantum state synthesis; experimental quantum simulation; atomic Bose-Einstein condensation; adaptive optics; ultracold atom gases; atomic collisions; optical lattices; quantum computation; quantum metrology. DeMarco, Kwiat, Nayfeh, 1 visiting faculty, 2 postdoctoral research associates.

Biological Physics. Investigation of the physics of biological macromolecules and cells with a wide variety of techniques: multi-dimensional single molecule spectroscopy and manipulation, ultrahigh resolution optical tweezers, *in vivo* fluorescence imaging of single events, fluorescence lifetime imaging and spectroscopy. Chemla, Clegg, Golding, Ha, Selvin. 15 visiting faculty and postdoctoral research associates.

Condensed Matter Physics. Surface physics, including photoemission spectroscopy; optical properties of insulators, semiconductors, metals, magnetic materials, and superconductors, including Raman and Brillouin scattering and infrared reflectivity; growth by molecular beam epitaxy of metals, semiconductors, and oxides; mesoscopic and nanoscale physics; high-temperature superconductivity, including tests of the symmetry and mechanism; electronic, thermal, and magnetic transport properties of magnetic and superconducting systems; superconductor device physics, including quasiparticle and Josephson tunneling; scanning probe microscopy; nuclear magnetic resonance; statistical physics; fluctuation phenomena and noise in electronic systems; phonon and ultrasonic imaging; intrinsic and extrinsic defects; structural and dynamical properties of quantum solids; strongly correlated electronic systems; X-ray diffraction and scattering processes. Abbamonte, Bezryadin, Budakian, Chiang, Cooper, Eckstein, Flynn, Giannetta, Granato, Granick, Greene, Holonyak, Mason, Nayfeh, Simmons, Slichter, Van Harlingen, J. Weaver, Weissman. 1 research scientist and 31 visiting faculty and postdoctoral research associates.

Nuclear Physics. Flavor and spin structure of the nucleon, the quark structure of nucleon, and nuclei at short distances; parity-violating elastic electron scattering, asymmetry measurements of semi-inclusive strangeness and charm electroproduction; gluon contribution to nucleon spin; precision muon physics measurements ($g-2$, lifetime, capture); neutron EDM; neutrino mixing angle θ_{13} ; Beck, Grosse Perdekamp, Hertzog, Kammel, Makins, Nathan, Peng, and Williamson. 6 postdoctoral research associates.

Particle Physics. Experiments at the Fermi National Accelerator Laboratory (CDF) and Large Hadron Collider (ATLAS); the properties of the bottom and top quarks; measurement of the CKM matrix; studies of rare processes; search for the Higgs boson: searches for new phenomena, such as anomalous gauge couplings and mixing in the charm system. D. Errede, S. Errede, Gollin, Liss, Neubauer, Pitts, Selen, and Wiss. 2

research scientists and 6 visiting faculty and postdoctoral research associates.

Physics Education. Study of curriculum and pedagogy related to improved student conceptual understanding of physics and problem-solving strategies; development and dissemination of instructional materials based on the Illinois model; assessment of student learning, physics education research. Glad-

ding, Mestre, Selen, Stelzer. 1 postdoctoral researcher. Statistical Physics. Experimental studies of $1/f$ noise. Weissman.

FACULTY PUBLICATIONS

In 2006–2007, faculty in the Physics Department published approximately 371 journal articles, 4 book chapters, 4 books, and 2 videos.