INDIANA UNIVERSITY, BLOOMINGTON

DEPARTMENT OF PHYSICS

Bloomington, Indiana 47405-7105
http://www.physics.indiana.edu/

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

1. General

President: Michael A. McRobbie
Vice-President: (Bloomington)
Dean of Graduate School: James Wimbush
Department Chairman: Richard J. Van Kooten
Department Telephone Number: (812) 855-1247
Type of Institution: University
Control: Public
Setting: Small town
Total Faculty: 1,441*
Total Graduate Faculty: 1,522*
Total Students: 38,990*
Total Graduate Students: 8,162*†
Annual Graduate Tuition:
In-state residents: Full-time—$291.97/credit hr.
Out-of-state residents: Full-time—$850.33/credit hr.
Tuition rates for: 2008–09
Deferred tuition plan: No
Other Fees: $431.52 per semester
Term: Semester

*Bloomington Campus
†Including professional schools

2. Number of Faculty in Department

The combined total of full-time faculty in the three professorial ranks is 40. The combined total of full-time, part-time, and other faculty at all ranks is 40.

3. Admission, Financial Aid, and Housing

Address admission inquiries to: Chairman, Graduate Admissions, Dept. of Physics
Graduate application fee required: $50 (domestic); $60 (foreign)
Admission deadline (Fall admission): 1/15 (domestic) 12/1 (foreign)
Admission information: For fall admission, 2007–08, 64 students were offered admission from 190 applicants.
Admission requirements: For admission to the graduate programs, a Bachelor's degree in physics is required with a minimum undergraduate GPA of 3.0. The GRE and GRE Advanced are required for applicants who wish to be considered for financial support. Students from non-English speaking countries are required to demonstrate proficiency in English via the TOEFL exam. The minimum score for admission is 550 paper, 213 computer based, 80 Internet based.
Address financial aid inquiries to: Chairman, Graduate Admissions, Physics Dept.
GAPSFAS application required: No
Loans available: Yes
Address housing inquiries to: Halls of Residence, 801 N. Jordan
On-campus, single student housing available: Yes
Cost/academic year: $4,346–5,758 (single rm.)
$3,778–4,338 (double rm.)
On-campus, apartment student housing available: Yes
Cost/month: $495–1,068 (furnished and unfurnished)

Table A—Faculty, Enrollments, and Degrees Granted

Research Specialty	2007–08 Faculty	Enrollment[1] Fall 2007		No. of Degrees Granted[2] 2007–08 (2003–08)			Median No. of Years for 2007–08 Ph.D.'s
		Master's	Doctorate	Master's	Terminal Master's	Doctorate	
Astrophysics (Musser)			4	0(0)	0(0)	0(1)	
Biophysics			13	0(0)	0(0)	1(3)	5
Chemical Physics			1	0(0)	0(0)	0(0)	
Condensed Matter Physics			7	0(0)	0(0)	1(15)	7
Nuclear Physics			30	0(0)	0(0)	2(8)	9
Particles & Fields			18	0(0)	0(0)	2(12)	7
Physics Education		1	0	0(0)	0(0)	0(0)	
Physics of Beams		8	11	0(4)	0(0)	3(11)	5
Other Theoretical/ Math.			2	0(0)	0(0)	0(1)	
Non-specialized			9	10(49)	2(14)	0(0)	
Total		9	95	10(53)	2(14)	9(51)	6
Full-time Grad. Stud.		1	95	10			
Part-time Grad. Stud.		8	0	0			
First-year Grad. Stud.		2	13	0			
Median Years in Grad. Study (2007–08 Degrees)			3.5yr	3yr	3.5yr		

Undergraduate Degrees, 2007–08 (2003–08): 15(68)

[1]Students not yet committed to a research specialty are entered under non-specialized.
[2]Five-year totals in parentheses.

4. Graduate Degree Requirements

http://physics.indiana.edu/~brochure/GraduateHandbook/degreeinfo.html
Master's: 30 semester hours, at least 20 in physics, 14 of which must be in courses numbered P501 and higher, passed with an average grade of "B" or higher. Physics courses numbered below P501, and passed with a grade of "B⁻" or lower do not count toward this degree. (Seminar, research, and reading courses may not be counted toward the 14 hour requirement.) Master's examination.
Master's in Beam Physics and Technology: [A national program in collaboration with the U.S. Particle Accelerator School (USPAS)] 30 credit hours, including the following: P441 (or equivalent at another institution), P506 (or equivalent), P570, one course at the 500 level or above in laboratory techniques or computational methods, and a Master's thesis course (P802). Four advanced courses in beam physics should be chosen from among the Special Topics courses P571, P671, and P672, with topics to be listed in a syllabus prepared jointly by the I.U. Physics Department and the USPAS. A grade point average of 3.0 or better must be maintained in the courses satisfying the 30 credit-hour requirement. In particular, both P441 and P506 (or equivalents) must be passed with a grade B (3.0) or above. Thesis required. Either an oral defense of the thesis or a written final examination is re-

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quired, and should take place at Indiana University. The written examination may be substituted for the oral defense only with the permission of the thesis committee.

Doctorate: 90 semester hours in course, reading, and research credits; a minimum of 9 credit hours per semester at the P501 level or above with an average grade of "B" or higher (first-year students are allowed a minimum of 7 credit hours at the P501 level or above); minor requirement can be met either outside of Physics or within Physics but outside of student's area of thesis research; written qualifying exam; thesis; final oral exam; a minimum of two consecutive semesters in residence. All candidates are required to undertake supervised teaching as an Associate Instructor for at least one semester. All first time teaching Associate Instructors must enroll in a one-hour graduate credit course, "Practicum in Physics Laboratory." Associate Instructors whose native language is not English are required to take an "Associate Instructor English Exam," which they must pass in order to be qualified to teach. This exam must be passed by the end of the second year of study.

Other Programs: Master of Arts for Teachers: 36 credit hours with a minimum of 20 in physics. *Ph.D. in Astrophysics*: If in residence in the Physics Dept., a student must pass specifically designated parts of the qualifying examinations of both departments; thesis; final oral exam. *Ph.D. in Chemical Physics*: If in residence in the Physics Dept., same qualifying exam as above; minor in chemistry with eight hours in designated courses; thesis; final oral exam. *Ph.D. in Mathematical Physics*: If in residence in the Physics Dept., same qualifying exam as above, and a special qualifying examination in the Mathematics Department; thesis; final oral exam.

Thesis: Thesis may be written *in absentia*.

Special Equipment, Facilities, or Programs: There is a large joint library for astronomy, computer science, math, and physics in the same building. The Indiana University Cyclotron Facility (IUCF) is a multipurpose laboratory that supports basic research in nuclear, particle, accelerator, and condensed matter physics, and applied reseach in proton radiation effects and medical physics. The facility operates two coupled cyclotrons used primarily for radiation effects studies at the Radiation Effects Research program (RERP) and for treatment of cancer at the Midwest Proton Radiotherapy Institute (MPRI). Also at IUCF, the new Low Energy Neutron Source (LENS) is the first pulsed cold neutron source located at a university; it will provide cold neutrons for three beamlines for small-angle neutron scattering, neutron radiography, and neutron spin echo spectroscopy. Specialized shops for scintillator, wire chamber, and target fabrication are available, with capabilities for design, construction, and testing of large or complex detector and electronics systems. Research equipment in other areas includes facilities for construction and testing of instrumentation for high-energy physics experiments. A 192-node parallel PC cluster is available for research computing. The University provides extensive supercomputing support including an IBM SP cluster with 500 CPUs and access to the High Performance Storage System (HPSS). Condensed matter and low-temperature equipment include two x-ray diffraction systems, one with a high temperature (up to 1300°C) sample chamber; a multi-source high vacuum sputtering system; a 14T superconducting solenoid, other low temperature cryostats with 8T solenoids, two dilution refrigerators, a ^{3}He refrigerator; a helium liquefier; two Auger spectrometers; three low-energy electron diffraction apparatus (LEED); three electron energy low spectrometers (EELS); two scanning tunneling microscopes (STM); microwave network analyzer; a squid magnetometer. Facilities for biophysics research include cell culture and incubation labs, cell sorter, one-photon and two-photon scanning confocal microscopes, instrumentation for multielectrical array recording and general neurophysics instrumentation, as well as access to shared core facilities at the Indiana Molecular Biology Institute. An extensive machine shop now includes a programmable (CNC) milling machine and four full-time machinists.

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 ($)
	Total	First year			
			Semester		
Teaching Assistant	17	11	12	20	1,550 (mo.)
Research Assistant	52	4	12	20	1,800 (mo.)
Other (specify)	1	1			
GAAN	3	0			
Self	9	0			
Chem	1	0			
Los Alamos	1	0			
Total	84	16			

5. Personnel Engaged in Separately Budgeted Research, 7/07–6/08

Professorial faculty	34
Postdoctoral appointments	24
Graduate students	57
Scientists (nonteaching)	11
Total	126

6. Separately Budgeted Research Expenditures by Source of Support

	Departmental Research	Physics-related Research Outside Department
State		
Federal government	$12,312,127	$2,519,762
Business and industry	103,260	$560,320
Total	$12,415,387	$3,080,082

Table C—Separately Budgeted Research Expenditures

Research Specialty	No. of Grants	Expenditures ($)
Accelerator	3	547,776
Astrophysics	3	1,031,820
Biophysics	2	398,652
Condensed Matter Physics	7	259,637
Nuclear Physics	12	8,008,676
Particles & Fields	13	2,058,826
Other (Instructional)	1	110,000
Total	41	12,415,387

Table D—Physics-related Research Outside Department

Field and Unit Outside Department	No. of Grants	Expenditures ($)
Chemical Physics Chemistry Department	21	3,080,082
Total	21	3,080,082

FACULTY

Professors

Baxter, David V., Ph.D., Cal. Tech., 1984. Condensed matter (experimental).

Berger, Michael S., Ph.D., California, Berkeley, 1991. Theoretical physics; elementary particles.

de Ruyter van Steveninck, Robert, Ph.D., Groningen, 1986. Biophysics (experimental).

Fertig, Herbert A. Ph.D., Harvard, 1988. Condensed matter theory.

Glazier, James, Ph.D., University of Chicago, 1989. Biophysics (experimental).

Gottlieb, Steven A., Ph.D., Princeton, 1978. Theoretical physics; elementary particles.

Horowitz, Charles J., Ph.D., Stanford, 1981. Nuclear theory.

Kesmodel, Larry L., Ph.D., Texas, 1974. Condensed matter experimental; surfaces.

Kostelecký, V. Alan, Ph.D., Yale, 1982. Theoretical physics; elementary particles.

Lee, Shyh-Yuan, Ph.D., SUNY, Stony Brook, 1972. Accelerator physics.

Londergan, J. Timothy, Ph.D., Oxford, 1969. Theoretical physics; nuclear theory.

Musser, James A., Ph.D., California, Berkeley, 1984. Astrophysics (experimental).

Ogren, Harold O., Ph.D., Cornell, 1970. Elementary particle physics (experimental).

Olmer, Catherine, Ph.D., Yale, 1976. Intermediate energy nuclear physics (experimental).

Oritz, Gerardo, Ph.D., Ecole Polytechnique Fédérale de Lausanne (EPFL), 1992. Condensed matter theory.

Pynn, Roger, Ph.D., Trinity College, University of Cambridge, 1969. Nuclear physics (experimental).

Serot, Brian D., Ph.D., Stanford, 1979. Nuclear theory.

Snow, W. Michael, Ph.D., Harvard, 1990. Nuclear physics (experimental).

Sokol, Paul E., Ph.D., The Ohio State University, 1981. Condensed matter physics (experimental).

Szczepaniak, Adam P., Ph.D., Washington, 1990. Theoretical physics.

Van Kooten, Richard J., Ph.D., Stanford, 1990. Elementary particle physics (experimental).

Wissink, Scott W., Ph.D., Stanford, 1986. Nuclear physics (experimental).

Professors Emeriti

Alyea, Ethan D., Ph.D., Cal. Tech., 1962. Astrophysics (experimental).

Bacher, Andrew D., Ph.D., Cal. Tech., 1967. Intermediate-energy nuclear physics (experimental).

Bent, Robert D., Ph.D., Rice, 1954. Experimental nuclear physics; nuclear structure, reactions; astrophysics.

Brabson, Bennet, Ph.D., MIT Cambridge, 1966. Elementary particle physics (experimental).

Cameron, John M., Ph.D., UCLA, 1967. Nuclear physics (experimental).

Challifour, John L., Ph.D., Cambridge, 1963. Theoretical physics; mathematical physics.

Crittenden, Ray R., Ph.D., Wisconsin, 1960. Elementary particle physics (experimental).

Dzierba, Alex R., Ph.D., Notre Dame, 1969. Elementary particle physics (experimental).

Goodman, Charles, Ph.D., Rochester, 1955. Nuclear physics (experimental).

Hake, Richard R., Ph.D., Illinois, 1955. Physics education.

Heinz, Richard M., Ph.D., Michigan, 1964. Astrophysics (experimental).

Hendry, Archibald W., Ph.D., Glasgow, 1962. Theoretical physics; elementary particles.

Lichtenberg, Don B., Ph.D., Illinois, 1955. Elementary particle physics (theoretical).

Macfarlane, Malcolm, Ph.D., Rochester, 1959. Nuclear theory.

Martin, Hugh J., Ph.D., Cal. Tech., 1956. Elementary particle physics (experimental).

Meyer, Hans Otto, Ph.D., Basel, Switzerland, 1970. Nuclear physics (experimental).

Miller, Daniel W., Ph.D., Wisconsin, 1951. Nuclear physics (experimental); nuclear reactions.

Nann, Herman, Ph.D., Goethe Univ., 1967. Intermediate energy nuclear physics (experimental).

Newton, Roger G., Ph.D., Harvard, 1953. Distinguished Professor. Theoretical and mathematical physics; scattering theory.

Pollock, Robert E., Ph.D., Princeton, 1963. Distinguished Professor. Nuclear physics; nuclear reactions; cyclotron design.

Schaich, William L., Ph.D., Cornell, 1970. Condensed matter theory.

Schwandt, Peter, Ph.D., Wisconsin, 1967. Nuclear physics (experimental).

Swihart, James C., Ph.D., Purdue, 1955. Condensed matter theory.

Walker, George E., Ph.D., CaseWestern Reserve, 1966. Theoretical nuclear physics; intermediate energy.

Wills, John G., Ph.D., Washington, 1963. Theoretical physics.

Associate Professors

Carini, John P., Ph.D., Chicago, 1988. Condensed matter (experimental).

Evans, Harold G., Ph.D., U.C.L.A., 1991. Elementary particle physics (experimental).

Messier, Mark, Ph.D., Boston University, 1999. Astrophysics (experimental).

Tayloe, Rex, Ph.D., Illinois, 1995. Nuclear physics (experimental).

Urheim, Jon, Ph.D., Pennsylvania, 1990 Astrophysics (experimental).

Associate Professor Emeritus

Lurie, Fred M., Ph.D., Illinois, 1963. Condensed matter physics; nuclear magnetic resonance.

Assistant Professors

Beggs, John, Ph.D., Yale, 1998. Biophysics (experimental).

Bossev, Dobrin, Ph.D., Institute for Chemical Research, Kyoto University, 1999. Condensed matter physics (experimental).

Hess, Mark, H., Ph.D., MIT, 2002. Accelerator physics (theory).

Liu, Chen-Yu, Ph.D., Princeton University, 2002. Nuclear physics (experimental).

Setayeshgar, Sima, Ph.D., CalTech, 1997. Biophysics (theoretical).

Shepherd, Matthew R., Ph.D., Cornell University, 2004. Elementary particle physics (experimental).

Other Graduate Faculty

Bower, Charles, Ph.D., Indiana University, 1988. Astrophysics (experimental).

Gagnon, Pauline, Ph.D., California-Santa Cruz, 1993. Elementary particle physics (experimental).

Jacobs, William, Ph.D., Washington, 1974. Nuclear physics (experimental).

Kaiser, Helmut, Ph.D., Technical University, Vienna, Austria, 1979. Nuclear physics (experimental).

Luehring, Frederick, Ph.D., Northwestern, 1986. Elementary particle physics (experimental).

Sowinski, James, Ph.D., Wisconsin, 1984. Nuclear physics (experimental).

Stephenson, Edward, Ph.D., Wisconsin, 1975. Nuclear physics (experimental).

Zieminska, Daria, Ph.D., Warsaw, 1974. Elementary particle physics (experimental).

RESEARCH SPECIALTIES AND STAFF

Theoretical

Accelerator Physics. Nonlinear beam dynamics; beam-beam interactions; transition energy problems; transverse and longitudinal coherent instabilities and Landau damping; bunched beam cooling; electron storage ring physics; spin motion in synchrotrons. Lee, Hess. 2 IUCF staff physicists. 1 research associate.

Biological Physics. Intracellular signaling networks. Waves in excitable media. Non-equilibrium systems. Biocomplexity. Theoretical neuroscience. Information theory. Setayeshgar.

Chemical Physics. Electronic transport in alloys; electron-phonon interaction in metals; electronic properties of atoms, molecules, and surfaces; photoelectron cross sections; phase transitions and self-organization; infrared photometry for adsorbates and quantum wells, phasmonics on the nanoscale. Schaich, 2 faculty in Chemistry Department.

Condensed Matter. Quantum Hall effect; superconductivity, spin transport and magnetoresistance; mesoscopics; soft matter; colloidal and biological materials; electron–phonon interaction in metals; optical and electrical properties of solids; collective excitations; many-body theory; surface electrodynamics; random alloys; quantum computation; correlated electronic materials; many-body physics, strongly correlated systems: high-T_c, heavy fermions, fermions in high magnetic fields; exotic superconductors; magnetism and spin systems; quantum fluids and solids; ultracold Fermi and Bose gases; topologically quantum ordered systems; quantum statistical mechanics and field theory methods in condensed matter; quantum information and computation; quantum measurement theory. Fertig, Ortiz, Schaich.

Elementary Particles and Fields. Phenomenology of elementary particle properties and interactions; quantum chromodynamics and electroweak interactions; lattice gauge field theory; solar neutrinos; grand-unified theories; supersymmetry; gravity and supergravity; superstring theory; CPT and Lorentz symmetry. Berger, Gottlieb, Kostelecký, 2 research associates.

Nuclear Physics. Study of nuclear structure; medium and high energy nuclear reactions; quantum chromodynamics; hadron spectra and structure, gluon dynamics, relativistic quantum hadrodynamics; neutron stars and nuclear astrophysics, stelar evolution and neutrino transport. Research performed at the Indiana University Nuclear Theory Center, Horowitz, Londergan, Serot, Szczepaniak, 2 research associates.

Experimental

Accelerator Physics. Nonlinear beam dynamics; electron cooling; properties of cooled beams; damping of transverse and longitudinal instabilities; spin motion in synchrotrons, with spin rotators (snakes); overlapping spin resonances and snake resonances. Lee, Hess, 4 IUCF physicists. 1 research associate.

Astrophysics. Magnetic monopoles; antimatter; supernovae; dark matter searches; bigbang cosmology; neutrino oscillations, dark energy, solar neutrino. Facilities include an assortment of computers, particle detectors, electronics development equipment, data acquisition systems, and spectrophotometers. Experiments are being performed at Fermi National Laboratory, Superkamiokande, and at a number of balloon launch facilities. Bacher, Bower, Heinz, Messier, Mufson (Astronomy Dept.), Musser, computer specialist, 1 postdoc and 2 technicians.

Biological Physics. Experimental and computational neuroscience. Multielectrode recordings in vitro; intracellular and extracellular neural recording in vivo. Experimental biocomplexity. Beggs, deRuyter, Glazier.

Chemical Physics. Optical properties of solids; low-temperature properties of metallic solids; chemisorption and catalysis; high-energy electron scattering; nuclear chemistry; chemical vapor deposition of ceramic and other materials; high-temperature x-ray diffraction; solid state NMR. Baxter, Carini, Kesmodel, 5 faculty in Chemistry Department.

Condensed Matter. Confined fluids, neutron scattering, surfactant systems, dynamics of membranes, atomic and electronic transport in disordered solids, compositionally modulated thin films; thin film magnetism and magnetoresistance; metastable systems; surface studies: STM, AFM, EELS; ferromagnetic semiconductors; dynamics of electrons in disordered metals and correlated electron systems; low temperature facilities; dilution refrigerators, superconducting solenoids, squid magnetometer, cryogenic microwave system. Thin film growth using sputtering and CVD soft matter and bio-materials. Baxter, Bossev, Carini, Kesmodel, Pynn, Sokol.

Elementary Particles. Searches for new particles (Higgs bosons, supersymmetric particles, exotics, hybrid systems, glueballs), heavy quark physics (top, bottom, charm), light quarks, neutrino oscillation, testing of fundamental symmetries. Detectors used include drift chambers, drift tubes, scintillating fibers, transition radiation detectors, Cerenkov counters, and calorimeters. IU facilities include data acquisition and numerous data analysis computers, detector construction areas including a high-bay area and large class-10000 cleanroom. Work on DO and MINOS at Fermilab, ATLAS at CERN, experiments at Jefferson Laboratory, and preparing for the Linear Collider. Dzierba (note: keep him in even if retired, i.e., still active in research), Evans, Messier, Musser, Ogren, Shepherd, Urheim, Van Kooten; scientists Gagnon, Luehring,

Zieminska. 1 CAD designer, 6 research associates, 2 engineers, 2 software specialists, 5 technicians.

Nuclear Physics: Nucleon structure studies: gluon spin distributions, anti-quark and sea quark contributions to nucleon properties, using the STAR detector at RHIC. Weak interaction studies with slow neutrons: precision measurements of neutron decay, */n-p/* and */n-4He/* weak interactions at NIST, LANSCE, and the new Spallation Neutron Source at Oak Ridge; methods for production of ultra-cold neutrons; search for neutrino oscillations and studies of neutrino-nucleon interactions with the MiniBooNE and SciBooNE detectors at Fermilab. Fundamental symmetry tests: searches for time-reversal violation via electric dipole moments of the electron and neutron. Formation and decay of hot nuclei, damped collisions between heavy nuclei, and nuclear fission at MSU, ATLAS and other labs. Jacobs, Liu, Long, Snow, Sowinski, Stephenson, Tayloe, Wissink. Two additional faculty (de Souza, Viola) in Nuclear Chemistry. Eight research associates and 30 staff scientists.