LEHIGH UNIVERSITY

DEPARTMENT OF PHYSICS

Bethlehem, Pennsylvania 18015

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

1. General

President: Alice P. Gast
Department Chairman: Volkmar Dierolf
Department Telephone Number: (610) 758-3930
Department web page: www.physics.lehigh.edu
Type of Institution: University
Control: Private
Setting: Small city
Total Faculty: 440 full-time
Total Graduate Faculty: 440
Total Students: 7,000
Total Graduate Students: 2,190
Annual Graduate Tuition:
All Graduate Students: $1,185/credit
Tuition rates for: 2010–11
Deferred tuition plan: Yes
Other Fees: None
Term: Semester

2. Number of Faculty in Department

The combined total of full-time faculty in the three professorial ranks is 20. The combined total of full-time, part-time, and other faculty at all ranks is 29.

3. Admission, Financial Aid, and Housing

Address admission inquiries to: Graduate Admissions Officer, Lehigh University, Dept. of Physics, 16 Memorial Drive, East, Bethlehem, PA 18015. E-mail: LG00@lehigh.edu
Graduate application fee required: $75
Admission deadline (Fall admission): March 15
Admission information: For fall admission, 2009–10, 15 students were accepted from 98 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. The GRE is required. The minimum acceptable score suggested for admission is verbal–550; quantitative–650; total–1,200. The GRE Advanced is required. The minimum acceptable score suggested for admission is 600. Students from non-English speaking countries are required to demonstrate proficiency in English via the TOEFL exam and the University SPEAK test for teaching assistants. Applicants are normally expected to have minimum TOEFL scores as follows: 600 for paper based; 213 for computer based (250 preferred); 85 for iBT composite (25 writing, 24 speaking, 21 reading, 15 listening).
Undergraduate preparation assumed: Intermediate mechanics, electricity and magnetism, atomic and quantum physics, thermodynamics, and laboratory experience. Mathematics through partial differential equations. Typical texts include Symon, Griffiths, Eisberg and Resnick, Merzbacher, Reif, and Van Ness. Able students with inadequate preparation may take a limited number of remedial courses after enrollment.
Address financial aid inquiries to: Graduate Admissions Officer, Lehigh University, Dept. of Physics, 16 Memorial Drive, East, Bethlehem, PA 18015
GAPSFAS application required: No
Financial aid deadline: 3/15
Loans available: No
Address housing inquiries to: Residence Operations Office, Lehigh University, Rathbone Hall, 63 University Drive, Bethlehem, PA 18015
On-campus, single student housing available: Yes
Cost/month: $595*, efficiency $505*
On-campus, married student housing available: Yes
Cost/month: $505*–670*

*Plus utilities

Table A—Faculty, Enrollments, and Degrees Granted

Research Specialty	2009–10 Faculty[3]	Enrollment[1] Fall 2009		No. of Degrees Granted[2] 2009–10 (2005–10)			Median No. of Years for 2009–10 Ph.D.'s
		Master's	Doctorate	Master's	Terminal Master's	Doctorate	
Astrophysics & Astronomy	3	0	4	2(4)	0(0)	0(3)	
Atomic, Molecular, & Optical Physics	2	0	5	0(4)	0(1)	1(5)	5
BioPhysics	1	0	4	3(5)	0(2)	0(3)	
Condensed Matter Physics	6	0	10	5(10)	0(1)	1(8)	5
Nano-science	1	0	2	0(1)	0(0)	0(1)	
Optics	2	0	9	4(9)	0(1)	1(4)	6
Plasma Physics & Fusion	4	0	2	1(2)	0(0)	0(2)	
Polymer Physics/ Science	1	0	3	2(3)	0(0)	1(1)	5
Statistical & Thermal	1	0	1	0(2)	0(1)	0(1)	
Non-specialized	0	1	7	0(0)	0(0)	0(0)	
Total		1	47	17(40)	0(6)	4(28)	
Part-time Grad. Stud.		0	0				
First-year Grad. Stud.		1	8				
Median Years in Grad. Study (2009–10 Degrees)							5.3
Undergraduate Degrees, 2009–10 (2005–10): 8(39)							

[1]Students not yet committed to a research specialty are entered under non-specialized.
[2]Five-year totals in parentheses.
[3]Each faculty member is assigned to only one specialty in this chart. However, since many faculty work in multiple fields, these numbers underrepresent activity in several areas.

4. Graduate Degree Requirements

Master's: 30 credit hours required, including a research project. No minimum grade average, but more than four grades below B cause a student to become ineligible for further graduate work. All work for M.S. must be done in residence at Lehigh. No foreign language requirement, and no requirement for comprehensive/qualifying exam or thesis.
Doctorate: 9 credits of course work beyond M.S. required, but Ph.D. programs usually include 20 or more credits beyond M.S. Minimum time requirement of two years, at least one

year in residence. Qualifying exam, general exam, and thesis defense required. No departmental or university language requirements.

Other Programs: The additional interdepartmental areas of research include materials science, surface science, photonics, and geophysics.

Thesis: Thesis may be written *in absentia*.

Special Equipment, Facilities, or Programs: Research facilities are housed in the Sherman Fairchild Center for the Physical Sciences, containing Lewis Laboratory, the Sherman Fairchild Laboratory for Solid State Studies, and a large connecting research wing. Well-equipped laboratory facilities are available for experimental investigations in research areas at the frontiers of physics. Instruments used for experimental studies include a wide variety of laser systems ranging from femtosecond and picosecond pulsed lasers to stabilized single-mode cw Ti-sapphire and dye lasers. There is also a Fourier-transform spectrometer, cryogenic equipment that achieves temperatures as low as 0.05 K and magnetic fields up to 9 Telsa, a facility for luminescence microscopy, and a laser-tweezers system for studies of complex fluids. A 3MeV van de Graaff accelerator is used to study radiation-produced defects in solids. The Fairchild Laboratory also contains a processing laboratory where advanced Si devices can be fabricated and studied. All laboratories are well furnished with electronic instrumentation for data acquisition and analysis. Several professors are members of the interdisciplinary Center for Optical Technologies that offers a wide range of state-of-the-art facilities including a fiber drawing tower, waveguide and fiber characterization labs, and a new epitaxy facility for the growth of III-V semiconductor structures and devices. Extensive up-to-date computer facilities are available on campus and in the department. All computing resources can be accessed directly from graduate student and faculty offices through a high speed backbone. Researchers have access to the national Research Internet (Internet 2) via a 155 Mbps gateway.

Table B—Appointments to Graduate Students, 2009–10

Title of Appointee	Appointments		Academic Load Allowed in Credit Hours	Hours of Service Per Week	Stipend for Calendar Year ($)
	Total	First-year			
			Semester		
Teaching Assistant	22	5	9	16	22,860–23,540
Research Assistant	22	0	9	20	22,860–23,540
Fellowship	3	3	12	0	23,300–32,000
Total	47	8			

Stipends are for 12 months

5. Personnel Engaged in Separately Budgeted Research, 7/09–6/10

Professorial faculty	21
Postdoctoral appointments	16
Graduate students	47
Undergraduate students	20
Total	104

6. Separately Budgeted Research Expenditures by Source of Support

	Departmental Research	Physics-related Research Outside Department
Federal government	$3,056,670	$2,205,240
Institutional and State	410,840	873,000
Total	$3,467,510	$3,078,240

Table C—Separately Budgeted Research Expenditures

Research Specialty	No. of Grants	Expenditures ($)
Astronomy & Astrophysics	3	$124,200
Atomic, Molecular, & Optical Physics	2	161,160
Biophysics	6	690,880
Condensed Matter Physics	10	613,680
Plasma Physics & Fusion	10	638,870
Statistical & Thermal Physics	2	202,710
Applied Optics	8	742,280
Nanosciences	5	293,730
Total	46	3,467,510

FACULTY

Professors

Biaggio, Ivan, Ph.D., ETH-Zurich, 1993. Experimental condensed matter; non-linear optics.

DeLeo, Gary G., Ph.D., Connecticut, 1979. Associate Chairperson. Astrophysics.

Dierolf, Volkmar, Ph.D., Utah, 1992. Chairperson. Experimental condensed matter; optical spectroscopy and microscopy.

Folk, Robert T., Ph.D., Lehigh, 1958. Theory of very light nuclei; elastic properties of solids.

Fowler, W. Beall, Ph.D., Rochester, 1963. Emeritus. Theory of electronic and optical properties of nonmetallic solids.

Gunton, James D., Stanford, 1967. Joseph A. Waldschmitt Professor. Condensed matter theory.

Hickman, A. Peet, Ph.D., Rice, 1973. Theoretical atomic, molecular, and optical physics.

Huennekens, John P., Ph.D., Colorado, 1982. Atomic and laser physics; molecular spectroscopy; atomic collisions; nonlinear optics.

Kanofsky, Alvin S., Ph.D., Pennsylvania, 1966. High-energy experimental physics.

Kim, Yong W., Ph.D., Michigan, 1968. Atomic physics; statistical physics.

Koch, Thomas L., Ph.D., Cal-Tech., 1982. Director, Center for Optical Technologies. Optoelectronics; photonics.

Kritz, Arnold H., Ph.D., Yale 1961. Theoretical plasma physics.

McCluskey, George E., Jr., Ph.D., Pennsylvania, 1965. Astronomy, astrophysics.

Ou-Yang, H. Daniel, Ph.D., UCLA, 1985. Soft condensed matter and biophysics.

Rickman, Jeffrey M., Ph.D., Carnegie-Mellon, 1989. Solid state theory.

Stavola, Michael J., Ph.D., Rochester, 1980. Shermain Fairchild Professor and Associate Dean, College of Arts and Sciences. Vibrational spectroscopy; defects in semiconductors.

Toulouse, Jean, Ph.D., Columbia, 1981. Nonlinear fiber optics, photonics; dielectric, Raman, and neutron scattering studies of disordered ferroelectrics.

Associate Professors

Licini, Jerome C., Ph.D., MIT, 1987. Low-temperature quantum transport phenomena in Si and GaAs devices, and nanotechnology.

Shaffer, Russell A., Ph.D., Johns Hopkins, 1962. Emeritus. Theory of elementary particles.

Assistant Professors

McSwain, M. Virginia, Ph.D., Georgia State, 2004. Astrophysics.

Rotkin, Slava, Ph.D., Ioffe Inst., St. Petersburg, 1997. Nanoscience, condensed matter theory.

Vavylonis, Dimitrius, Ph.D., Columbia, 2000. Biophysics.

Research Scientists

Bateman, Glenn, Ph.D., Princeton, 1970. Plasma physics.

Pankin, Alexei, Ph.D., Kiev, 1998. Plasma physics.

Visiting Research Scientists

Abou, Berengere, Ph.D., Universite Paris VI, 1998. Microrheology.

Chakrabarti, Amit, Ph.D., Univ. of Minnesota, 1987. Statistical physics.

Ge, Wenping, Ph.D., Shanghai Jiaotong Univ., 2003. Non-linear optics.

Ha, Chungil, M. S., Pusan National Univ., 2006. Optics.

Huang, Chien-Hua, M. S., National Cheng Kung Univ., 2004. Optics.

Iolin, Eugene, Ph.D., Estonian Acad. Sci., 1978. Condensed matter.

Lin, Aoxiang, Ph.D., Gwangju Inst. of Sci. & Tech., 2008. Condensed matter.

Liu, Ya, Ph.D., Brandeis Univ., 2009. Statistical physics.

Lopez, Antonio Perez, Ph.D., Universitat de les Illes Balears, 2009. Statistical physics.

Narendran, Manikandan, Ph.D., Indian Inst. Sci., 2007. Optics.

Rafiq, Tariq, Ph.D., Chalmers Univ. of Tech., 2004. Plasma physics.

Ryan, Gillian, M.S., Dalhousie Univ., 2006. Biophysics.

Ryasnyanskiy, Alek, Ph.D., Uzbek Acad. Sci., 2002. Non-linear optics.

Veksler, Alex, Ph.D., Ben-Gurion Univ., 2005. Biophysics.

Yusuf, Eddy, Ph.D., Florida State Univ., 2005. Biophysics.

Zhou, Liangcheng, Ph.D., Lehigh Univ., 2010. Nanophotonics.

Adjunt Faculty

Cereghetti, Paola, Ph.D., Swiss Federal Inst. of Tech., 2000. Physics.

Glueckstein, Jon, Ph.D., Wisconsin, 1997. Physics.

Loomis, John, M. S., Univ. of Massachusetts, 1973. Astronomy.

Lucic, Dragan, M. S., Univ. of Colorado, 1997. Physics.

Veltchev, Iavor, Ph.D., Vrije Universiteit Amsterdam, 2001. Physics.

RESEARCH SPECIALTIES AND STAFF

Theoretical

Astrophysics. Ultraviolet spectroscopy and gas dynamics of interacting binary systems; orbits of binary stars; N-body dynamics. DeLeo and McCluskey.

Atomic, Molecular, and Optical Physics. Charge exchange collisions; fine-structure changing collisions; optical processes in gases; molecular hyperfine spectroscopy. Hickman.

Biophysics. Physical and engineering principles involved in the assembly of actin proteins into filaments and larger scale structures. Statistical mechanics and soft matter physics applied to actin protein assemblies and the emergent collective properties. Vavylonis.

Elasticity. Solution of integral equations for mixed boundary value problems. Folk.

Physics of nano- and molecular scale systems. Quantum mechanics of one-dimensional systems, many-body effects in carbon nanotubes, physics of nanotube/nanowire devices, electron transport in molecular systems, modeling of interaction between nano- and biological systems. Rotkin.

Plasma Physics. Integrated modeling codes are developed and used to predict temperature, momentum and density profiles in magnetically confined controlled fusion plasma experiments. Theoretically derived physics models are developed for use in these codes and detailed comparisons are made between our simulations and experimental data in order to understand the physics of transport and confinement in plasmas. There are active collaborations with theory and experimental groups, both nationally and internationally. Bateman, Kritz, Pankin.

Solid State Physics. Electronic and vibrational properties of defects in semiconductors and insulators. Fowler.

Statistical Physics. Pattern formation in nonlinear, non-equilibrium systems. Kinetics of first order phase transitions focusing on crystallization of globular proteins. Cell-cell communication via calcium oscillations. Gunton.

Experimental

Astronomy. Observational studies to understand the formation and evolution of stars. Particular areas of interest are young open clusters, binary stars, X-ray binaries and pulsars, the formation of disks in Be stars, and the origin of magnetic fields in massive stars. Lehigh has a significant amount of telescope access as a partner in the SMARTS Consortium. McSwain.

Atomic Physics. Collisional processes in atomic vapors including excitation transfer and ''energy pooling,'' line-broadening, quenching, diffusion, resonance exchange and velocity-changing collisions; molecular spectroscopy of bound singlet and triplet states of alkali diatomics, photodissociation, predissociation, and bound-free emission. Huennekens.

Complex Fluids; soft condensed matter and biophysics; application of optical imaging, trapping, and manipulation for cell mechanics studies. Ou-Yang.

Electron attachment; short optical pulses; excitation transfer in gas discharges; optically assisted gas phase reactions. Kim.

Nanoscience. Quantum mechanical theory of carbon nanotubes, DNA nanotube hybrids; optics, optoelectronics & electronics of nanotube devices; nanotube-organics complexes. Rotkin.

Nonlinear Optics. Multiple orders of light-matter interactions. Time-resolved spectroscopy of second and third-order nonlinear optical effects in organic and inorganic materials. Optical frequency conversion and all-optical switching. Biaggio.

Photonics, Fiber Optics. Nonlinear effects in optical fibers and waveguides. Dierolf, Toulouse.

Physics of Fluids. Nonlinear dynamics in fluid systems; dynamics of small particle suspensions; light scattering loss spectroscopy; instabilities of interfaces. Kim.

Plasma Physics. Collisional and collisionless phenomena of very dense plasmas in or near a local thermodynamic equilibrium; anomalies in radiation transport properties; lowering of ion-

ization potentials in dense plasmas; laser-produced plasmas. Kim.

Solid State Physics. Quantum transport behavior of electrons, conduction in ultrasmall silicon MOSFETs and gallium-arsenide devices and carbon nanotubes at low temperature and high magnetic field. Licini.

Defects in semiconductors. Current interest is in defect complexes that contain light-element impurities such as H, C, O, and N. Vibrational spectroscopy and uniaxial stress techniques are used to elucidate microscopic properties. Stavola.

Raman and neutron scattering, dielectric and ultrasonic spectroscopies, collective vibrational dynamics of disordered ferroelectrics and glasses. Toulouse.

Point defects in insulating materials with ferroelectric domain walls and other dopants; optical spectroscopy under application of hydrostatic pressure, and magnetic fields; carrier localization in wide band gap semiconductors. Dierolf.

Charge transport in insulators and semiconductors; nonlinear optical spectroscopy. Biaggio.

Statistical Physics. Intrinsic fluctuations in fluids under external forcing, such as Brownian motion; chaotic transitions; light scattering from fractals; 1/f-dynamics of granular avalanches. Kim.