CURRENT RESEARCH ACTIVITIES

• Astronomy and Astrophysics. Current research involves 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.

• Atomic, molecular, and optical physics. Research topics include atomic and molecular spectroscopy and collision processes. Recent work has addressed transfer of population and orientation in atom-molecule collisions, velocity-changing collisions, bound-bound and bound-free molecular transitions, molecular hyperfine structure, and electron recombination with molecular ions.

• Biophysics. Current research topics include both experimental and theoretical studies of living cells. Kinetics of crystallization of globular and membrane proteins. Cell mechanics, cell signaling, and cell-cell communication. Dynamics of the cytoskeleton during cell division and cell motion. Laser tweezers, Raman scattering, photoluminescence, advanced 3-D optical imaging techniques and computational image analysis are integrated for investigating structural and dynamical properties.

• Computational physics. Several of the above areas involve the use of state-of-the-art computers to address large-scale computational problems. Areas of interest include atom-atom collisions, simulations of tokamak plasmas, the statistical behavior of ensembles of many particles, the calculation of electronic wave functions for molecules and solids, and the multi-scale modeling of electronic/optoelectronic devices, probes, nano-bio systems.

• Condensed matter physics. Areas of interest include the optical and electronic properties of defects in semiconductors and insulators, quantum phenomena in semiconductor devices, collective dynamics of disordered solids, structural phase transitions in ferroelectrics and superconducting crystals. Quantum physics of matter, field and their interactions at the nanoscale; physics of electronic and optoelectronic devices and nano-bio systems.

• Nonlinear Optics and Photonics. Research topics include nonlinear light-matter interaction that enable the control of light with light, four-wave mixing, phase conjugation, resonant Brillioun scattering, ferroelectric domain patterning for quasi phase matching, waveguides, photonic crystals, holey and other specialty fibers, and the application of photonics to biological systems, near-field optics and thermal radiation.

• Plasma physics. Computational studies of magnetically confined toroidal plasmas address anomalous thermal and particle transport, large scale instabilities, and radiofrequency heating. Laboratory studies address collisional and collisionless phenomena of supercritical laser-produced plasmas.

• Soft condensed matter and complex fluids. Polymers in aqueous solutions, colloidal suspensions, and surfactant solutions are investigated using techniques such as “laser tweezers,” microrheology, and laser light scattering. Areas of interest include the structures of polymers at liquid-solid interfaces and micro-rheology of confined macromolecules. Recent work also includes biological materials.

• Statistical physics. Investigation is underway of nonequilibrium fluctuations in gases, chaotic transitions and 1/f dynamics, light-scattering spectroscopy, colloidal suspensions, and pattern formation in nonequilibrium dissipative systems, including the kinetics of phase transitions, nucleation theory, and spatiotemporal chaos.

THE GRADUATE PROGRAM

Approximately 41 graduate students are enrolled in the Physics department, which has 18 faculty members. Resources include a machine shop, electronics shop, and networked computer facilities including PCs, workstations, and super-computer access via Internet-II.

The department offers programs in physics leading to the M.S. and Ph.D. degrees. These programs may be structured to prepare students for careers in industrial or academic research or in college or university teaching.

The master’s degree program requires thirty hours of course work. This includes a research project normally done during the summer after the first year.

The Ph.D. degree program requires a minimum of 39 credit hours of course work. In addition, the Ph.D. candidate is expected to take a variety of specialized courses both within and outside the department in consultation with the dissertation committee. The student normally takes Ph.D. qualifying examinations after the first year of study. At a later date (generally within the third year) the student takes an oral general examination. A dissertation, based on original work, is required for the Ph.D.

FINANCIAL AID

Most entering physics graduate students are supported as half-time teaching assistants starting at $25,128 (2012-2013 one-year stipend) plus tuition remission. Students making satisfactory progress are normally supported through the attainment of the Ph.D. degree. Students working on a Ph.D. dissertation normally hold research assistantships, although some fellowships are available. To address the health care needs of our graduate students, Lehigh University offers sickness and injury insurance to all full-time graduate students, and a subsidy that currently covers 50% of the annual premium. Additionally, the department has three GAANN fellowships from the US Department of Education which offer up to $30,000 (based on financial need) as well as tuition remission.

ACCOMMODATIONS

Graduate students at Lehigh live in a wide variety of accommodations. These range from apartments and rooms within walking distance of campus to country houses and modern garden apartments within a few miles.

Expenses can be reasonable, especially if accommodations are shared. The university operates a 148-unit, five-building garden apartment complex for married and graduate students, located on the Goodman Campus in Saucon Valley. Free bus service to the main campus is provided every half hour.

FACILITIES/RESOURCES

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. Lehigh researchers in astrophysics have a significant amount of observation time partners in the SMARTS Consortium that operates four telescopes in Cerro Tololo, Chile.

Instruments used for experimental studies include a wide variety of laser systems and microscopes. These range 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 0.05K and magnetic fields up to 9 Tesla, a facility for luminescence microscopy, a cell culture facility, and a laser-tweezers system for studies of cells and complex fluids. 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 Photonics and Nanoelectronics (http://www.lehigh.edu/~incpn/) 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. World-class electron microscopy facilities are available at Lehigh’s Center for Advanced Materials and Nanotechnology. Members of the department also participate in Lehigh’s Emulsions Polymer Institute and the Bioengineering Program.

Extensive up-to-date computer facilities are available on campus and in the department. High Performance Computing facilities (http://www.lehigh.edu/computing/hpc/) can be accessed directly from graduate student and faculty offices through a high speed backbone.

THE UNIVERSITY

Lehigh is an independent, coeducational university located in Bethlehem, Pennsylvania. Founded in l865 as a predominantly technical four year school also offering the liberal arts, the University now has approximately 4,870 undergraduates within its three major units — the College of Arts and Science, the College of Engineering and Applied Science, and the College of Business and Economics — and approximately 2,000 students enrolled in graduate programs offered by the Graduate School and the graduate level College of Education. Lehigh employs some 2,000 persons, including over 450 full-time faculty members. There are more than 2,000 courses offered at Lehigh.

Most of the University’s more than one hundred buildings are located on a 360 acre wooded campus on the north slope of South Mountain, overlooking the historic City of Bethlehem. The adjacent 740 acres of land atop South Mountain, which includes most of the buildings that were once Bethlehem Steel’s Homer Research Laboratories, house various research activities, Chemical Engineering, Biological Sciences, and the College of Education. The Goodman Campus, comprising 500 acres, is located on the south side of South Mountain in Saucon Valley and includes a field house, playing fields, 16,000-seat football stadium, the 5,600 seat Stabler Athletic and Convocation Center, and a complex of garden apartments for graduate students. Lehigh is the home of the National Engineering Research Center for Advanced Structural Systems (ATLSS).

The University affords a wide range of athletic facilities and presents a varied program of concerts, theater, films, lectures, art exhibitions, and sporting events.

Bethlehem is fifty miles north of Philadelphia and seventy-five miles southwest of New York City, making the cultural, entertainment, and transportation facilities of these cities easily accessible. Founded by Moravians seeking religious freedom in 1741, Bethlehem has its own rich cultural heritage. Dozens of historic buildings and locales have been remarkably preserved and are in current use, giving the community a charming colonial atmosphere. The Lehigh Valley is also an important commercial and industrial center, with administrative, research, and manufacturing facilities for several major companies.

FACULTY

PROFESSORS

Volkmar Dierolf, Chairman, (Ph.D., Utah, '92) Experimental solid state physics and near field optics.
Ivan Biaggio, (Ph.D., Swiss Federal Institute of Technology, ETH, '93) Experimental solid state physics and optics.
Gary G. DeLeo, Associate Chairman, (Ph.D., Connecticut, '79) Theoretical solid state physics; astrophysics.
James D. Gunton, (Ph.D., Stanford, '67) Condensed matter theory.
A. Peet Hickman, (Ph.D., Rice, '73) Theoretical atomic, molecular, and optical physics.
John P. Huennekens, (Ph.D., Colorado, '82) Experimental atomic, molecular, and optical physics.
Alvin S. Kanofsky, (Ph.D., Pennsylvania, '66) High energy experimental physics.
Yong W. Kim, (Ph.D., Michigan, '68) Statistical physics of fluctuations; atomic physics of nonideal plasmas.
Arnold H. Kritz, (Ph.D., Yale, '61) Theoretical plasma physics.
George E. McCluskey, Jr., (Ph.D., Pennsylvania, '65) Theoretical astrophysics.
H. Daniel Ou-Yang, (Ph.D., UCLA, '85) Complex fluids, soft matter and biophysics
Jeffrey M. Rickman, (Ph.D., Carnegie Mellon, '89) Computational solid state physics.
Michael Stavola, (Ph.D., Rochester, '80) Optical spectroscopy of solids, defects in semiconductors.
Jean Toulouse, (Ph.D., Columbia, '81) Experimental solid state physics and nonlinear optics.

ASSOCIATE PROFESSORS

Jerome C. Licini, (Ph.D., M.I.T., '87) Experimental solid state physics.
Slava V. Rotkin, (Ph.D., Ioffe Institute, St. Petersburg, Russia, '97) Quantum physics of nanoscale devices and materials, and functionality of nano-bio complexes (theory, simulation and experiment).
Dimitrios Vavylonis, (Ph.D., Columbia, '00) Modeling of cell biological processes.

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ASSISTANT PROFESSORS

M. Virginia McSwain, (Ph.D. Georgia State University, '04) Observational astrophysics.

ACTIVE EMERITI FACULTY

Robert T. Folk, (Ph.D., Lehigh, '58) Theory of very light nuclei. Elastic properties of solids.
W. Beall Fowler, Professor Emeritus, (Ph.D., Rochester, '63) Theory of electronic and optical properties of insulating solids.
Russell A. Shaffer, Professor Emeritus, (Ph.D., Johns Hopkins University, '62) Theory of elementary particles.

RESEARCH SCIENTISTS AND VISITORS

Jinxin Fu, (Ph.D., Institute of Physics, Chinese Academy of Sciences, '11) Nanophotonics.
Joel Cohen, (Ph.D., University of the Pacific) Soft Condensed Matter and Biophysics.
Eugene Iolin, (Ph.D., Estonian Academy of Sciences, '78) Condensed Matter.
Andrei Nemilentsau, (Ph.D., National Academy of Sciences, '09) Electrodynamics and quantum optics of nanostructures.
Tariq Rafiq, (Ph.D., Chalmers University of Technology, '04) Plasma physics.
Gillian Ryan, (Ph.D., Dalhousie University, '09) Biophysics.
Varun Tangri, (Ph.D., Devi Ahyiliya University '06) Plasma physics

FOR ADDITIONAL INFORMATION CONTACT:

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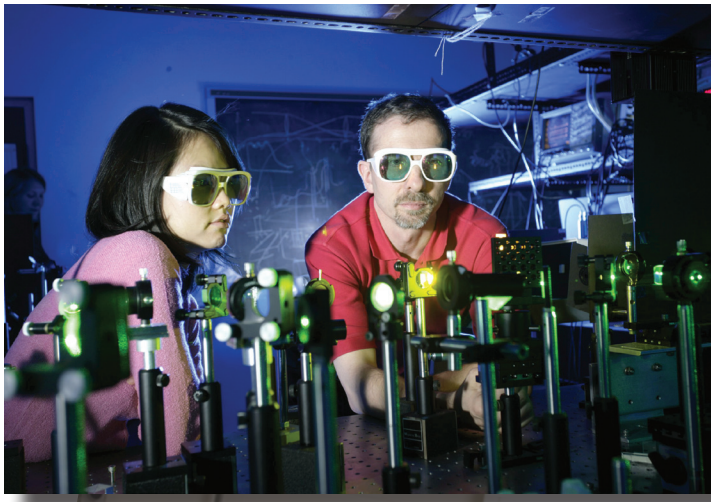
LEHIGH UNIVERSITY

Graduate Study and Research in Physics



http://www.physics.lehigh.edu