Physics at Boston University
Graduate Program
Greetings from the Boston University Physics Department! We would like to present a brief introduction to our department and our graduate program in physics.

A typical incoming class is around 20 students. Through a combination of teaching fellowships, research assistantships, and University fellowships, the department provides full tuition, stipends, and basic medical insurance for all graduate students.

We have 43 full-time faculty, with an additional 17 affiliated faculty whose primary appointments are in the College of Engineering. Our faculty have been featured in numerous publications, hold high-level positions at major experiments around the world, and over half are Fellows of the American Physical Society.

Our research specialties include experimental particle physics, particle astrophysics, theoretical particle physics and cosmology, molecular biophysics, experimental biophysics, experimental condensed matter physics, theoretical quantum condensed matter physics, statistical physics, polymer physics, and computational physics. There are numerous interdisciplinary opportunities, particularly with the School of Engineering and the Center for Photonics Research.

Major resources include the Scientific Instrument Facility, the Electronics Design Facility, and state-of-the-art supercomputer clusters in the Center for Computational Science.

In addition to the resources available at Boston University, the Boston area offers a wealth of cultural, scholarly, scientific, and technological activity. We hope that you’ll consider a graduate career in physics at BU!
PROGRAM OVERVIEW

The Physics Department at Boston University offers a PhD in Physics with an optional MA degree.

The PhD degree requires the completion of 64 credit hours (equivalent to sixteen semester courses), an honors grade on the written comprehensive exam, an oral comprehensive exam, a departmental seminar, completion of a dissertation, and a dissertation oral defense. The dissertation must exhibit an original contribution to the field. Each student must satisfy a residency requirement of a minimum of two consecutive semesters of full-time graduate study at Boston University. The average time to complete a PhD degree after the bachelor’s degree is about 6 years. Additional details are provided on page 3.

The MA degree requires the completion of 32 credit hours (equivalent to eight semester courses) and a passing grade on the written comprehensive exam or the completion of a master’s thesis. The requirements for a master’s degree may be satisfied as part of the PhD degree program. Each student must satisfy a residency requirement of a minimum of two consecutive semesters of full-time graduate study at Boston University.

APPLYING

The application deadline for fall admission is the first week of January. Spring admission is possible but uncommon (interested spring applicants should contact the Director of Graduate Admissions before applying).

For admission to the graduate program, a bachelor’s degree in physics or astronomy is required; exceptional candidates from other fields are considered. Official GRE results (general and physics subject tests) are required; scores are weighed within the context of the applicant’s overall record. Official TOEFL results are required of all applicants whose native language is not English; visit our website for minimum score requirements.

FINANCIAL AID

Through a combination of teaching fellowships, research assistantships, and University fellowships, physics graduate students receive full-tuition scholarships for the duration of their studies and a monthly stipend. The annual stipend rate for 2017-18 is $33,000.
COURSES

Sixteen (16) courses are required. At least 10 must be lecture courses from the 500-850 levels, including 5 initial-sequence theoretical courses, Scholarly Methods in Physics (PY 961), Advanced Laboratory (PY581), and 2 distribution courses from outside the student’s field of specialization. Additional coursework may include directed research, directed study (2 maximum), and seminar courses (2 maximum). Students who have taken equivalent courses may petition for specific course waivers.

DEPARTMENTAL SEMINAR

The Departmental Seminar must occur within two years of the Oral Qualifying Examination and at least 6 months before the dissertation defense. A thesis proposal is due to the committee at least 2 weeks before the seminar.

ORAL QUALIFYING EXAMINATION

The Oral Qualifying Examination should be taken within one calendar year of successfully completing the Written Comprehensive Examination, but no later than January of the third year. Completion of Advanced Laboratory (PY581) is required before a student is eligible for the Oral Examination. Four committee members are selected at least 3 weeks before the examination, and a one page abstract is due to the committee at least 2 weeks before the examination.

PHD DISSERTATION AND DEFENSE

An approved thesis abstract must be received by the Graduate School at least 3 weeks prior to the defense. A draft of the thesis must be received by the thesis committee at least 2 weeks prior to the defense. Approximate deadlines: mid-April for May graduation, mid-August for September graduation, and mid-December for January graduation.

Find out where a PhD in Physics from BU can take you (page 12)
While not as inspiring as the heart or as mysterious as the brain, the stomach is just as impressive: the muscular sack churns with acid so powerful it will dissolve metal—but it doesn’t digest the organ itself.

The stomach protects itself from its own acid with a coating of mucus, a tactic that doesn’t always work against the ulcer- and cancer-causing Helicobacter pylori, the only bacterium known to colonize that harsh environment. H. pylori somehow survives the acid, swims through the mucus layer, and infects stomach cells. An estimated 50 percent of humans harbor H. pylori in their gut, but only some of them develop ulcers or stomach cancer. So understanding how H. pylori survives here is key to understanding those diseases.

Rama Bansil, a Boston University professor of physics who has studied stomach mucus for over two decades, has uncovered two factors that give the bacterium a leg up: the chemicals it secretes and its skill at swimming. Both are critical to its success.

Bansil, whose work is funded by the National Science Foundation, became curious about stomach mucus in the late 1980s. “The question back then was: The stomach produces nearly half a gallon of gastric juice a day, which is acidic and can digest nails—so why doesn’t it digest the stomach?” she says. Researchers suspected that the thin layer of mucus protected the stomach from this acid, but nobody knew exactly how it worked. Bansil, whose area of research is gels and gelation, began to study the purified protein mucin, which gives stomach mucus its ability to gel. In this early work, she and her colleagues found that it gelled only under extremely acidic conditions, below a pH of 4.

Later, she turned her attention to H. pylori. “I decided that we would actually try and see how this bacterium gets across, since this layer is probably gel-like—or at least certainly very viscous, like a soft toothpaste or petroleum jelly,” she says. “How does something swim through such a medium?”

Some researchers had hypothesized that the spiral-shaped bacterium drilled its way through the thick mucus like a corkscrew. But in laboratory experiments, Bansil and her colleagues found, surprisingly, that H. pylori, which propels itself with rotating flagella, couldn’t swim through a gel at all. “Even though it’s alive and its flagella are rotating, it doesn’t move ahead. It just stays in place,” she says.

Not so in stomach mucus. There, H. pylori secretes an enzyme called urease, which breaks down urea in the stomach into carbon dioxide and ammonia, giving the smell of ammonia to the breath of infected people. Ammonia, a base, reacts with the stomach mucus, raising its pH and liquefying it. “It de-gelled the gel, and this reversible gelation was the key to letting this bacterium get across,” says Bansil, who published this research in Proceedings of the National Academies of Sciences in 2009.
If H. pylori’s corkscrew shape didn’t help it drill through mucus, wondered Bansil and her colleagues, why did it have that shape? Another spiral-shaped bacterium called Campylobacter jejuni is able to colonize the upper part of the small intestine, so the shape must be important for something. “We wanted to find out why H. pylori has a helical body,” says Maira Constantino (GRS’17), a PhD candidate who joined Bansil’s lab in 2014. “What is the advantage there?”

Many assumed that the corkscrew-shaped body increased H. pylori’s swimming speed in general, because corkscrew shapes produce thrust when they spin. Previous experiments by other groups supported this, finding that spiral-shaped Helicobacter swam two to three times faster than rod-shaped E. coli. “But that’s not a good comparison, because you’re really comparing two different organisms,” says Bansil. She collaborated with Nina Salama, a microbiologist at the Fred Hutchinson Cancer Research Center in Seattle who had bred mutant H. pylori, the same as the original but rod-shaped.

Then they filmed them, hundreds at a time, swimming in mucus and culture broth, to see which ones swam faster. Comparing the videos, they found that, on average, helical bacteria were about 10 to 15 percent faster than their rod-shaped relatives. They published their results in Molecular Microbiology in 2015.

But those results were only averages. Constantino wanted to take the analysis further, by filming the motion and shape of single bacteria, a painstaking process. By taking video at high speed, 200 frames per second, she was able to record the speed, rotation, and body shape of individual bacteria. She and her colleagues discovered that both types of bacteria spun as they swam, about 10 to 15 body lengths per second—“a pretty good stride,” but the helix swam a little faster, says Bansil. To understand exactly why, Bansil and Constantino sent the data to colleague Henry Fu, an associate professor in the mechanical engineering department at the University of Utah, and his student Mehdi Jabbarzadeh, who used it to build a theoretical model of H. pylori swimming. The Utah scientists found that having more flagella contributed more to speed than body shape; the helical shape contributed, at most, 15 percent to the bacteria’s propulsive thrust, confirming what the scientists had found before. “The 15 percent difference doesn’t look very large, but it may be enough of an advantage that the helical one will win over the rod long-term,” says Bansil.

The results, and video evidence, were published in November 2016 in Science Advances. Bansil and her colleagues are now studying H. pylori from a cancer patient, as well as the patient’s stomach mucus, looking for clues in the specific interaction of the bacterium with mucus.

Bansil’s work may prove useful in another arena of science: drug delivery. “Many drugs cannot get across the mucus. Only very small drugs can get through, or those which can break down the mucus,” she says. It is not difficult to render H. pylori harmless by genetic manipulations, and if it can be loaded like a capsule, with, say, a chemotherapy drug, the bacterium could then use its innate ability to get across mucus and carry the treatment across, and deliver it where it’s needed. “This might be a very clever way to deliver a targeted drug orally,” says Bansil.
The Physics Department is part of Boston University’s Science and Engineering Complex, centrally located on the main Charles River Campus.

On-campus facilities include electronic and mechanical nanostructure fabrication and measurement, metastable-helium-atom probes of surface spin order and dynamics, photoemission and soft X-ray fluorescence probes of electronic structure in novel materials, X-ray diffractometers, and the optics and transport of electrons at high fields and low temperatures.

Biological physics and polymer physics labs include optical microscopy light scattering, Raman and Brillouin scattering, and ultrafast infrared and Terahertz spectroscopy as well as modern facilities for genetically manipulating biomolecules.

The high energy physics labs include facilities for the design, production and testing of key components of various particle detectors. Collaborations include the Mu2e experiment at Fermilab; the ATLAS and CMS experiments at the CERN Large Hadron Collider; the MuLan and MuSun experiments at PSI, Switzerland; the Super-Kamiokande experiment in Kamioka, Japan, including the KEK/K2K and T2K/JPARC neutrino accelerator projects; the CLEAN/DEAP dark matter experiments; CALICE calorimeter R&D for the ILC; and the neutron EDM experiment at ORNL.

The Boston University Photonics Center is a collaborative research and education center that supports physicists, engineers, chemists, and biomedical researchers to advance academic research, educational programs, commercial incubation, and photonics technology development. For additional information, visit www.bu.edu/photronics.

Boston University’s Center for Nanoscience and Nanobiotechnology is an interdisciplinary research and academic center that includes basic materials science, surface science, physics, chemistry, and engineering, and extends into molecular and cellular biology, biophysics, and the technologies of microfluidics, MEMS, and onto manufacturing. The Center’s strengths are in developing and using nanotechnology advances in materials and platforms with our capabilities in biomedical engineering to focus on applications in understanding subcellular processes, biomolecular function, and human physiology. For additional information, visit nanoscience.bu.edu.

An extensive network of computational facilities supports the research activities of the Department. For computationally intensive applications, students have access to supercomputing resources supported through the Center for Computational Science and the Office of Information Technology. The Departmental Computer Facility supports a wide range of software applications for physics data collection, analysis, simulation, and visualization.
CORE COURSES

PY 501 MATHEMATICAL PHYSICS
Introduction to complex variables and residue calculus, asymptotic methods, and conformal mapping; integral transforms; ordinary and partial differential equations; nonlinear equations; integral equations.

PY 502 COMPUTATIONAL PHYSICS
Fundamental methods of computational physics and applications; numerical algorithms; linear algebra, differential equations; computer simulation; vectorization, parallelism, and optimization. Examples and projects on scientific applications.

PY 511 QUANTUM MECHANICS I

PY 512 QUANTUM MECHANICS II
Degenerate and nondegenerate perturbation theory. Second quantization of nonrelativistic systems with applications to scattering, lifetime of excited atomic states, many-body problems. Relativistic quantum mechanics: Klein-Gordon equation, Dirac equation.

PY 521 ELECTROMAGNETIC THEORY I

PY 522 ELECTROMAGNETIC THEORY II

PY 536 QUANTUM COMPUTING
Quantum physics as a powerful computational paradigm. Quantum bits (qubits), qubit operations and quantum gates, computation, and algorithms. Computational complexity classes, and efficiency of classical vs. quantum computers. Quantum Fourier transform and Shor's factorization algorithm. Physical implementation of quantum computation.

PY 538 ECONOPHYSICS
The key concepts of the newly emerged interdisciplinary field of econophysics. The methods now available in the field of economics for analyzing large data sets, and for extracting new empirical "laws," such as the famous inverse cubic distribution of price fluctuations.

PY 541 STATISTICAL MECHANICS I

PY 542 STATISTICAL MECHANICS II

PY 543 INTRODUCTION TO SOLID STATE PHYSICS
An introduction to crystal structure; lattice vibrations; electronic energy bands and Fermi surfaces; semiconductors, conductors, and insulators; superconductivity and magnetism.

PY 551 INTRODUCTION TO PARTICLE PHYSICS

PY 561 INTRODUCTION TO NUCLEAR PHYSICS
A general introduction to nuclear physics. Topics covered include an introduction to the nucleus, nuclear forces, theories of nuclear structure, decay and reaction processes, and special topics of interest (nuclear energy, origin of nuclei, and the like).
**PY 581 ADVANCED LABORATORY**
Classical experiments in atomic and nuclear physics, development of new experiments, basic research projects. Experiments include magnetic resonance, nuclear-decay studies, Zeeman effect, holography, black-body radiation, X-ray diffraction, Mössbauer studies, and flux quantization, positron annihilation.

**ADVANCED COURSES**

**PY 621 ADVANCED SCIENTIFIC COMPUTING IN PHYSICS**
Introduction to computer programming and methods used to formulate and solve physics problems on the computer. Also touches on more advanced topics such as parallel computing and graphical visualization.

**PY 677 AN INTRODUCTION TO EVIDENCE-BASED UNDERGRADUATE STEM TEACHING**
Online course with in-person faculty-led sessions where participants learn about effective teaching strategies and the research that supports them, and apply approaches to lesson design and assignments for future teaching opportunities.

**PY 699 TEACHING COLLEGE PHYSICS I**
The goals, contents, and methods of instruction in physics. General teaching-learning issues. Required of all teaching fellows.

**PY 713 QUANTUM FIELD THEORY I**
Provides an introduction to the techniques of quantum field theory with applications to high-energy and condensed-matter physics. Topics include field equations and quantization of many-body systems; Green function and linear response theory; S-matrix and scattering theory; path integration; perturbation expansions and the Feynman rules; renormalization and effective field theories; expansion and critical exponents.

**PY 714 QUANTUM FIELD THEORY II**
A continuation of GR5 PY 713 for particle physicists. Topics include relativistic fields; LSZ formalism; the Lorentz group; quantum electrodynamics; nonabelian gauge symmetry; spontaneous symmetry breaking; Goldstone’s theorem; the Higgs mechanism; the Glashow-Weinberg-Salam model.

**PY 731 THEORY OF RELATIVITY**

**PY 741 SOLID-STATE PHYSICS I**

**PY 742 SOLID-STATE PHYSICS II**

**PY 743 LOW-TEMPERATURE PHYSICS**
Superconductivity, superfluidity, and properties of 3He and 4He at low temperatures. Techniques and measurement of physical quantities near absolute zero.

**PY 744 POLYMER PHYSICS**
Introduction to polymer physics, focusing on the structure, phase behavior, and dynamics of isolated chains, polymer solutions, and gels. Development of underlying theoretical formalism and comparison with experimental results. Discussion of applications to novel polymeric materials.

**PY 745 EXPERIMENTAL SURFACE PHYSICS AND CHEMISTRY**
Introduction to the principles and experimental techniques of surface and interface physics and chemistry. Electronic, structural, vibrational, and magnetic properties of solid surfaces and interfaces. Emphasis on how these properties are measured. Also vacuum technology and x-ray generation.
PY 747 ADVANCED STATISTICAL MECHANICS
Classical and quantum statistical ensembles and their physical interpretations; connection between statistical and thermodynamic quantities. Irreversible process: Boltzmann equation, transport theory, thermal fluctuations, introduction to stochastic process theory. Applications, e.g., imperfect gases, phase transitions, cooperative phenomena, and liquid helium.

PY 751, 752 HIGH-ENERGY PHYSICS
Yearlong course on phenomenological aspects of modern high-energy physics. Principal topics are the standard model of strong and electro-weak interactions and the physics of electro-weak symmetry breaking. Intended for both theoretical and experimental students and emphasizes current calculational techniques.

PY 771 BIOPHYSICS
Introduction to biomolecular forces, energy flow, and thermodynamics in biological systems. Hydrophobic interactions and membrane structure. Feedback and control mechanisms; allosteric enzymes. Mechanisms of transport in biological membranes. Emphasis on the physical principles underlying biological structure and function.

PY 782 ADVANCED MATERIALS CHARACTERIZATION
Introduction to the principles and applications of advanced materials characterization including study of atomic structure, electronic structure, defects, mechanical properties, transport properties and carrier dynamics.

PY 811 ADVANCED QUANTUM FIELD THEORY
Covers advanced methods in quantum field theory. Topics include QCD, confinement and chiral symmetry breaking, renormalization group, monopoles and instantons, the U(1) problem.

PY 841 SYMMETRY IN CONDENSED MATTER PHYSICS
Theories of finite groups and their irreducible representations (Irreps), symmetry projection operators. Product groups and product representations. Crystalline symmetry, symmorphic and non-symmorphic space groups and induction of their Irreps. Spin-1/2 double groups, magnetic color groups. Time-reversal symmetry and co-representations.

PY 895, 896 SPECIAL TOPICS IN THEORETICAL PHYSICS
Theoretical research topics include general relativity, quantum field theory, high energy and particle physics, phase transitions, renormalization group, laser physics, kinetic equations, biophysics, computational physics, and selected topics in mathematical physics.

PY 897 SPECIAL TOPICS IN EXPERIMENTAL PHYSICS
Surface physics; intermediate energy nuclear physics experiments; low temperature techniques, liquid and solid helium, and magnetism at low temperatures. Raman effect, gels, and biophysics. High-energy physics experimental techniques.

PY 961 SCHOLARY METHODS IN PHYSICS
Introduction to scholarly methods in physics teaching and research: Effective STEM instructional techniques; successful oral and written presentations; reading and reporting scientific literature; ethical obligations in physics teaching and research; career paths in physics. Required of first-semester doctoral students.
All around us, hiding just outside our range of vision, are miniscule machines. Tiny accelerometers in our cars sense a collision and tell the airbags to inflate. A Nintendo Wii controller’s tiny gyroscopes translate your tennis swing into movement on the screen. An iPhone’s accelerometer, gyroscope, and proximity sensor sense its location in space.

All these little machines, known collectively as microelectromechanical systems, or MEMS, have something in common: they are attached to, or very close to, a power source. For broader applications, like wireless brain implants, scientists and engineers need power from a distance. But while it’s easy to send information through the air—think radio waves—sending power, especially to a miniscule machine, can be a bit trickier.

But now a team of researchers, led by Boston University College of Engineering (ENG) PhD candidate Farrukh Mateen (ENG’18) and Raj Mohanty, a professor of physics at BU’s College of Arts & Sciences (CAS), are closing in on a solution. They have built a tiny micromechanical device and turned it on and off with one nanowatt of power—that’s a billionth of a watt—from three feet away. The device, described in the August 15, 2016, issue of Nature: Microsystems and Nanoengineering, is a miniature sandwich of gold and aluminum nitride that vibrates, or resonates, at microwave frequencies. The tiny resonator is only 100 micrometers across—a little wider than the width of a human hair.

“Wireless power is not new,” says Mateen, lead author on the paper. “Nikola Tesla demonstrated it at the 1893 World’s
Fair; but we believe this is the first time it’s been used with a micromechanical resonator.”

In a second round of experiments, the device achieved an impressive 15 percent efficiency using a higher radio frequency. Those results were published online in the August 16, 2016, issue of Applied Physics Letters.

The most promising application for this type of device lies in the emerging field of optogenetics: shining light on genetically modified brain cells to make them behave in a certain way. The field offers great potential for neuroscience research, as well as possible treatments for neurological disorders like Parkinson’s disease. But to plant a device in the body, especially the brain, is challenging. It needs to be tiny and efficient, low-power and low-radiation. Power must travel to the device quickly, through bone and brain tissue. “You don’t want to have to change batteries every day,” says Mohanty, corresponding author on both papers, “and you don’t want to fry your brain.”

There are two ways to send power without wires. The first, magnetic fields, has a short range unless large coils of wire are used, limiting their usefulness for tiny devices. The second, electric fields, has a longer range but bounces off pretty much everything. “But there are ways to work around this,” says Mateen, lead author on both papers. “We thought that optimizing the receiver may be the answer.”

The team started thinking about resonators—materials that naturally vibrate at certain frequencies—like a diving board that whips the air a certain way, or a wine glass that shimmies in response to a certain sound frequency.

“Resonators are the building blocks of all micromachines,” says Mohanty. “If we could make that work, we could build anything on top of it.”

This particular resonator consists of a layer of aluminum nitride on a silicon base. Aluminum nitride is a “piezoelectric” material—when it senses an electric field, it flexes or resonates. The problem was building a tiny antenna so that the material could sense the electricity in the air.

“We had to change our thinking,” says Mohanty. “We said, why not use the resonator itself as an antenna? That’s where the breakthrough came.” The team turned the resonator into what’s called a “patch antenna” by adding thin layers of gold to the top and bottom. The simple solution did the trick.

“I was really surprised when it worked,” says Mateen, who remembers calling to his colleague, co-author Carsten Mädler (GRS’16), when he first detected a signal. “I said, ‘Dude! You need to see this! I think we can wirelessly actuate this thing!’”

Though the technology is in its infancy, Mateen sees many potential applications, from remote sensors to improve cell phone chargers to brain implants. “The idea of a biomedical application is just awesome,” he says. “It would be great if it ended up in some kind of product that helped humanity in some way. This is one tiny step towards that.”

PhD candidate Farrukh Mateen (ENG’18) built a tiny resonator and turned it on and off with one nanowatt of power from three feet away—the length of a lab bench. The research was published in Nature: Microsystems & Nanoengineering. Photo by Jackie Ricciardi
Graduates of our program have been successful in obtaining excellent postdoctoral positions, faculty appointments, and research positions at major industrial laboratories. Some recent examples are listed below.

**POSTDOCTORAL FELLOWSHIPS**

- Argonne National Laboratory
- Boston University
- Clark University
- Fermilab
- Harvard University
- Los Alamos National Lab
- Lucent Technology
- Massachusetts General Hospital
- MIT
- National Cancer Institute
- National Institutes of Health
- National Institute of Standards and Technology
- New York University
- Northwestern University
- Rensselaer Polytechnic Institute
- Rockefeller University
- SLAC National Accelerator Laboratory
- State University of New York
- Tufts University
- UC Irvine
- UC San Diego
- University of Illinois
- University of Maryland
- University of Michigan, Ann Arbor
- University of Nevada
- UNC Chapel Hill
- University of Oregon
- University of Wisconsin, Madison
- **INTERNATIONAL**
  - Center for Particle Physics of Marseilles
  - Leiden University

- Ludwig Maximilian University
- Max Planck Institute for Complex Systems
- National Research Council (Italy)
- Scuola Normale Superiore
- Technical University of Berlin
- University of Geneva
- University of Oxford
- University of Tokyo
- University of Toronto
- University of Vienna
- University of Waterloo

**FACULTY APPOINTMENTS**

- Bloomsburg University
- Boston College
- Boston University
- Brigham and Women’s Hospital/Harvard Medical School
- Brooklyn College
- George Mason University
- Indiana University
- Kenyon College
- Northeastern University
- Northwestern University
- Randolph Macon College
- Suffolk University
- Texas A&M University
- UC Davis
- University of New Mexico
- University of Washington
- University of Wisconsin
- Virginia Tech
- **INTERNATIONAL**
  - Boğaziçi University
  - Chinese Academy of Sciences
  - Institute for Advanced Study
  - Ludwig Maximilian University
  - Macquarie University
  - Nankai University
  - National Taiwan University
  - Seoul National University
  - University of Berlin
  - University of Cambridge
  - University of Naples
  - University of Oxford
  - University of Rome

**INDUSTRIAL LABORATORIES AND CORPORATE POSITIONS**

- Ab Initio Software Corporation
- Advanced Rendering Technology
- Arcadia Healthcare Solutions
- Avant
- Bloomberg
- Brion Technologies
- D.E. Shaw
- Draper Labs
- Facebook
- Federal Aviation Administration
- Frontier Technology
- GE Global Research
- Google
- IBM
- Investment Technology Group
- LongView Group
- Mariner Investment Group
- Mobilygen Corporation
- MTPV Corporation
- Nortel Networks
- Omni Guide
- Raytheon
- Sand 9
- Science Research Laboratory
- Spectral Sciences
- Stanford Functional Genomics Facility
- Stui Group
- Wentworth Institute
- **INTERNATIONAL**
  - Barclays Bank
  - Element Six
  - Scotia Bank
WHERE ARE THEY NOW?
GRADUATE CAREER PATHS, 1995-2015

The following chart shows current fields for BU Physics graduates from the past 20 years. Graduates are grouped into 5-year cohorts. Percentages indicate the portion of a cohort in a given field.