General University Information

President: Barbara Snyder
Dean of Graduate School: Charles E. Rozek
University website: http://www.cwru.edu
Control: Private
Setting: Urban
Total Faculty: 2,745
Total number of Students: 9,837
Total number of Graduate Students: 5,610

Department Information

Department Chairman: Kathleen Kash, Chair
Department Contact: Corbin E. Covault, Director of the Graduate Program
Total full-time faculty: 25
Total number of full-time equivalent positions: 22
Full-Time Graduate Students: 60
First-Year Graduate Students: 12
Female First-Year Students: 3
Total Post Doctorates: 15

Department Address
Rockefeller Building
2076 Adelbert Road
Cleveland, OH 44106-7079
Phone: (216) 368-4000
Fax: (216) 368-4671
E-mail: admissions@phys.case.edu
Website: http://physics.cwru.edu

ADMISSIONS

Admission Contact Information
Address admission inquiries to: Admissions Director, Physics
E-mail: admissions@phys.case.edu
Admissions website: http://www.phys.case.edu/grad/apply.php

Application deadlines
Fall admission:
U.S. students: January 15
Int'l. students: January 15

Application fee
U.S. students: $8

Admissions information
For Fall of 2012:
Number of applicants: 179
Number admitted: 54
Number enrolled: 12

Admission requirements
Bachelor’s degree requirements: Bachelor’s degree in physics, mathematics, or related field is required.
Minimum undergraduate GPA: 3.0

GRE requirements
The GRE is required.

Advanced GRE requirements
The Advanced GRE is required.

TOEFL requirements
The TOEFL exam is required for students from non-English-speaking countries.
PBT score: 557
iBT score: 90

Other admissions information
Additional requirements: No minimum acceptable GRE score is specified.
Undergraduate preparation assumed: Taylor, Classical Mechanics; Griffiths, Electrodynamics; Kittel, Thermal Physics; Griffiths, Quantum Mechanics; or equivalent textbooks; one or two years of advanced laboratory courses.

TUITION

Tuition year 2012–13:
Tuition for out-of-state residents
Full-time students: $27,828 annual
Part-time students: $1,546 per credit
Credit hours per semester to be considered full-time: 9
Deferred tuition plan: Yes
Health insurance: Available at the cost of $1,452 per year.
Academic term: Semester
Number of first-year students who receive full tuition waivers: 12

Teaching Assistants, Research Assistants, and Fellowships
Number of first-year Teaching Assistants: 10
Research Assistants: 2
Average stipend per academic year
Teaching Assistant: $22,860
Research Assistant: $22,860
Fellowship student: $22,860

FINANCIAL AID

Application deadlines
Fall admission:
U.S. students: January 15

Loans
Loans are available for U.S. students.
Loans are available for international students.
GAPSFAS application required: No
FAFSA application required: No

For further information
Address financial aid inquiries to: Director of Admissions.
E-mail: admissions@phys.case.edu

HOUSING

Availability of on-campus housing
Single students: No
Married students: No

For further information
Address housing inquiries to: Dean, Graduate Studies.
Housing aid website: http://gradstudies.case.edu/prospect/area/housing.html
Table A—Faculty, Enrollments, and Degrees Granted

<table>
<thead>
<tr>
<th>Research Specialty</th>
<th>2011–12 Faculty</th>
<th>2012 Enrolment Spring</th>
<th>Number of Degrees Granted 2011 (2005––11)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Master’s</td>
<td>Doctorate</td>
<td>Master’s</td>
</tr>
<tr>
<td>Applied Physics</td>
<td>2</td>
<td>1</td>
<td>4(1)</td>
</tr>
<tr>
<td>Astrophysics</td>
<td>7</td>
<td>1</td>
<td>16(0)</td>
</tr>
<tr>
<td>Atomic, Molecular, &amp;</td>
<td>5</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Optical Physics</td>
<td>2</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Biophysics</td>
<td>10</td>
<td>–</td>
<td>17(2)</td>
</tr>
<tr>
<td>Condensed Matter Physics</td>
<td>2</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Fluids, Rheology</td>
<td>2</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Low Temperature Physics</td>
<td>1</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Medical, Health Physics</td>
<td>2</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Nano Science and Technology</td>
<td>8</td>
<td>–</td>
<td>4(4)</td>
</tr>
<tr>
<td>Optics</td>
<td>10</td>
<td>–</td>
<td>5(10)</td>
</tr>
<tr>
<td>Polymer</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Physics/Science</td>
<td>4</td>
<td>–</td>
<td>1(4)</td>
</tr>
<tr>
<td>Relativity &amp; Gravitation</td>
<td>4</td>
<td>–</td>
<td>4(4)</td>
</tr>
<tr>
<td>Statistical &amp; Thermal</td>
<td>4</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Physics</td>
<td>3</td>
<td>–</td>
<td>1(3)</td>
</tr>
<tr>
<td>Surface Physics</td>
<td>–</td>
<td>2</td>
<td>–</td>
</tr>
<tr>
<td>Non-specialized</td>
<td>–</td>
<td>2</td>
<td>–</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>4</td>
<td>54(48)</td>
</tr>
</tbody>
</table>

GRADUATE DEGREE REQUIREMENTS

Master’s: 27 graduate credit hours in approved program including six required hours; Master’s exam required; thesis option; no residence or language requirement.

Doctorate: Up to 36 hours of coursework is required (may be reduced by graduate coursework done elsewhere); comprehensive and topical exams, dissertation, and dissertation exam required; one year residency; no language exam required. See http://www.phys.cwru.edu/grad/phd.php.

Thesis: Thesis may be written in absentia.

SPECIAL EQUIPMENT, FACILITIES, OR PROGRAMS

A wide range of facilities is available in surface physics and in optics. Among the collaborative programs are experimental and theoretical studies of phase transitions in polymers and of liquid crystals, photovoltaic materials, surface physics, the physics of imaging, fluid physics, dark matter detection, and measurements of fundamental parameters in cosmology.

Departmental computing facilities are extensive and are used in both research and courses. Weekly specialized seminars in particle/astrophysics and condensed matter physics take place, in addition to a weekly departmental colloquium.

The Physics Department has been recognized six times by the U.S. Dept. of Education as meeting vital national needs. Special graduate fellowships are available.

In addition to a traditional physics program, the Department maintains a Physics Entrepreneurship Masters degree program. The program is designed to empower physicists as entrepreneurs and to enable students and graduates to build on their physics skills to start new high-tech businesses or to launch new product lines in existing companies.

Special Programs

Center for Education and Research in Cosmology and Astrophysics: A new center created in collaboration with the Cleveland Museum of Natural History’s Shafran Planetarium and CWRU’s Astronomy Department to promote research and education in cosmology and astrophysics. http://cerca.case.edu

Institute for Advanced Materials: The Institute for Advanced Materials brings together internationally recognized faculty researchers to engage in multi-disciplinary efforts on a broad range of materials that not only are ubiquitous in everyday life, but are cornerstones to many key technology areas. Specifically, IAM focuses on strategic research that impacts national needs in human health, energy, and the environment. The four focus areas are: Fundamental Materials Research, Materials for Human Health, Materials for Energy, and Materials for Sustainability. http://iam.case.edu

The Institute for the Science of Origins ISO is a collaborative team of faculty members and researchers from diverse scientific disciplines seeking to understand how complex systems emerge and evolve, from the universe to the mind, from microbes to humanity http://www.case.edu/origins

The Michelson Postdoctoral Lectureship is an annual prize sponsored by Case Western Reserve University. It is awarded to an outstanding recent Physics Ph.D. based on an international competition. The winner spends one week in residence in the Department, and delivers several seminars and a departmental colloquium on his/her research.

Physics Entrepreneurship Masters Degree: To empower physicists as entrepreneurs and enable graduate students to build on their physics skills to start new high-tech businesses or to launch new product lines in existing companies.

Workshops and Conferences: The Department regularly holds national and international meetings on a variety of topics. Recent conferences have included: The Future of Cosmology, Future Physics and Future Facilities, The Cosmic Microwave Background, Great Lakes Cosmology Workshop, the American Vacuum Society Conference, International Workshop on MRI, Einstein’s Legacy, and Confronting Gravity.

Outreach: The Department works with high school teachers and students to improve science education locally and nationally. The Department also hosts a web site of a national program in astronomy education called Ask an Astronomer.

International Programs: The department spearheaded three university-wide student and faculty exchange programs with the University of Calabria Italy, Nagaoka University of Science and Technology Japan and Universite’ Pierre et Marie Curie U. Paris 6, France.

Table B—Separately Budgeted Research Expenditures by Source of Support

<table>
<thead>
<tr>
<th>Source of Support</th>
<th>Departmental Research</th>
<th>Physics-related Research</th>
<th>Outside Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal government</td>
<td>$13,265,697</td>
<td></td>
<td></td>
</tr>
<tr>
<td>State/local government</td>
<td>$3,288,461</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-profit organizations</td>
<td>$4,663,590</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Business and industry</td>
<td>$1,881,029</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>$521,720</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$23,599,497</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table C—Separately Budgeted Research Expenditures by Research Specialty

<table>
<thead>
<tr>
<th>Research Specialty</th>
<th>No. of Grants</th>
<th>Expenditures ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Astrophysics</td>
<td>18</td>
<td>$10,014,288</td>
</tr>
<tr>
<td>Condensed Matter Physics</td>
<td>32</td>
<td>$10,545,342</td>
</tr>
<tr>
<td>Medical, Health Physics</td>
<td>5</td>
<td>$908,976</td>
</tr>
<tr>
<td>Other</td>
<td>10</td>
<td>$2,130,891</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>65</strong></td>
<td><strong>$23,599,497</strong></td>
</tr>
</tbody>
</table>

FACULTY

Professor


Brown, Robert W., Ph.D., Massachusetts Institute of Technology, 1968. Medical, Health Physics, Particles and Fields. Theoretical physics; elementary particles; imaging physics.


Kash, Kathleen, Ph.D., Massachusetts Institute of Technology, 1982. Experimental condensed matter physics; optics; mesoscopic physics.


Tien, Norman, Ph.D., University of California, San Diego, 1993. Microelectromechanical systems.

Associate Professor


Assistant Professor


Gao, Xuan, Ph.D., Columbia University, 2003. Condensed Matter Physics, Nano Science and Technology. Experimental condensed matter physics; Applied physics; electronic properties of low dimensional nanostructures; semiconductor nanowires; nanosensors.


Zehavi, Idit, Ph.D., Hebrew University of Jerusalem, 1999. Cosmology & String Theory. Theoretical astrophysics; cosmology; large-scale structure; galaxy and structure formation.

DEPARTMENTAL RESEARCH SPECIALTIES AND STAFF

Theoretical
Electronic Properties of Metals and Semiconductors. Electronic properties of metals and semiconductors; photovoltaics, crystal growth; transport properties in ordered and disordered materials; band structure; deformation potentials; localization, thermo-electricity; interface and surface physics; lattice vibrations. Lambrecht, Mathur, Petschek, Philip Taylor.

Imaging Physics. Algorithm development; bio-data acquisition and analysis; rf coil theory; inverse scattering theory; diagnostic imaging. Brown, Martens.

Liquid Crystals. Phase transitions, dynamics, symmetry and surface effects, nonlinear behavior. Petschek, Philip Taylor.

Particle Astrophysics. Cosmology and Gravitational Physics. Neutrino astrophysics; early universe cosmology; dark matter; dark energy; large scale structure; gravitational lensing; black hole evaporation; stellar evolution; cosmic strings; cosmic microwave background. de Rham, Starkman, Cyrus Taylor, Tolley.

Particle Physics. Electroweak theory; standard model; cosmology; black hole physics; superstring theory SSC physics; supersymmetry, field theories at finite temperature; quark-gluon plasma; diffractive excitation mechanisms. de Rham, Kowalski, Mathur, Starkman, Cyrus Taylor, Tolley.

Polymer Physics/Science. Equations-of-state; phase transitions; dynamical behavior; piezoelectric effects; polymer liquid crystals. Petschek, Philip Taylor.

Statistical & Thermal Physics. Statics and dynamics of phase transitions; pattern formation and dendritic growth; liquid crystals, polymeric liquid crystals, complex fluids; oscillatory chemical reactions; membrane noise. Petschek, Philip Taylor.

Experimental

Electronic Structure of Materials. Electronic structure of metals and alloys; surfaces; crystal growth; thin films; amorphous films; dielectric and cohesive properties; dielectric and mechanical relaxation; organic electronics; transport properties of nano-structures, quantum wells, mesoscopic systems, fuel cells; soft matter. Berezovsky, Gao, Kash.

Experimental Particle Astrophysics. Dark matter; low temperature detectors; neutrino experiments; cosmic microwave background; high energy cosmic rays; gamma ray astrophysics. Akerib, Covault, Ruhl, Shutt.

Fluid Physics. Interface instabilities, magnetic levitation. Rosenblatt.


Liquid Crystals and Complex Fluids. Phase transitions; optical, magnetic, and electrical properties; microgravity; nanostructured LCs, symmetry effects. Chottiner, Rosenblatt.


Polymer Physics/Science. Phase transformations; dielectric properties; magnetic and electric field effects; optical mechanical properties. Rosenblatt, Shan, Singer.

Surface Physics. Surface magnetization; secondary electron emission; surface analysis; physi- and chemisorption. Chottiner.

View additional information about this department at www.gradschoolshopper.com