General University Information

President: C. L. Max Nikias
Dean of Graduate School: Sally (Sarah) Pratt, Vice Provost
University website: http://www.usc.edu/
School Type: Private
Setting: Urban
Total Faculty: 4,190
Total Graduate Faculty: 4,190
Total number of Students: 44,000
Total number of Graduate Students: 25,000

Department Information
Department Chairman: Prof. Stephan Haas, Chair
Department Contact: Betty Byers, Graduate Coordinator
Total full-time faculty: 40
Total number of full-time equivalent positions: 30
Full-Time Graduate Students: 77
Female Full-Time Graduate Students: 11
First-Year Graduate Students: 11
Female First-Year Students: 3
Total Post Doctorates: 6

Department Address
825 Bloom Walk
ACB 439
Los Angeles, CA 90089-0484
Phone: (213) 740-8685
E-mail: physics@dornsife.usc.edu
Website: http://dornsife.usc.edu/physics/

ADMISSIONS

Admission Contact Information
Address admission inquiries to: Department of Physics and Astronomy, University of Southern California, Los Angeles, CA 90089-0484
Phone: (213) 740-8685
E-mail: physicsgradadmis@dornsife.usc.edu
Admissions website: http://www.usc.edu/admission/graduate/

Application deadlines
Fall admission:
U.S. students: December 1
Int’l. students: December 1

Application fee
U.S. students: $90
Int’l. students: $90

Admissions information
For Fall of 2018:
Number of applicants: 157
Number admitted: 29
Number enrolled: 15

Admission requirements
Bachelor’s degree requirements: Bachelor’s degree in the Physical Sciences is required.
Minimum undergraduate GPA: 3.2

GRE requirements
The GRE is required.
Quantitative score: 160
Verbal score: 150
Analytical score: 3.0
Mean GRE score range (25th–75th percentile): 315

Subjective GRE requirements
The Subjective GRE is required.
Minimum accepted Advanced GRE score: 780
Mean Advanced GRE score range (25th–75th percentile): 900

TOEFL requirements
The TOEFL exam is required for students from non-English-speaking countries.
PBT score: 600
iBT score: 100

Other admissions information
Additional requirements: The minimum acceptable score suggested for admission is verbal—550; quantitative—750; total—1,300.
The GRE Advanced is required, the minimum acceptable score suggested for admission is 780.
A minimum TOEFL score of 100 or higher with no less than 20 on each of the four individual sections of the Internet-based TOEFL (iBT) or (600 on paper-based/250 or higher on the computer-based TOEFL) is required for Teaching Assistants.
Undergraduate preparation assumed: Reitz and Milford, Foundations of Electromagnetic Theory; Eisberg, Quantum Physics for Atoms, Molecules, Solids, Nuclei, and Particles; Saxon, Elementary Quantum Mechanics; Reif, Foundation of Statistical and Thermal Physics; Boyce and DiPrima, Elementary Differential Equations and Boundary Value Problems.

TUITION

Tuition year 2018–19:
Full-time students: $21,600 per semester
Part-time students: $1,800 per credit
Credit hours per semester to be considered full-time: 6
Deferred tuition plan: Yes
Health insurance: Available at the cost of $1,816 per year.
Other academic fees:
New Student Orientation Fee $55.00 (first semester); Student Programming Fee $40.00 per semester; Student Services Fee $14.00 per semester; Norman Topping Student Aid Fund $8.00 per semester.
Academic term: Semester

Teaching Assistants, Research Assistants, and Fellowships
Number of first-year
Fellowship students: 10
Average stipend per academic year
Teaching Assistant: $30,000
Research Assistant: $30,000
Fellowship student: $30,000
Fellowship offers can be combinations of RA, TA, and top off awards. These guarantee a minimum of $30,000 for the academic first year. Academic year covers the fall and spring semesters which is 9 months.

FINANCIAL AID

Application deadlines
Fall admission:
U.S. students: December 1
Int’l. students: December 1
### California

**Loans**
Loans are available for U.S. students.
Loans are not available for international students.

*GAPSFAS application required: No*
*FAFSA application required: No*

**For further information**
*Address financial aid inquiries to: Department of Physics and Astronomy, University of Southern California, Los Angeles, CA 90089-0484.*
*Phone: (213) 740-8685*
*E-mail: physicsgradadmis@dornsife.usc.edu*
*Financial aid website: http://dornsife.usc.edu/physics/financial-support/*

## HOUSING

**Availability of on-campus housing**
- *Single students: Yes*
- *Married students: Yes*
- *Childcare Assistance: No*

**For further information**
*Address housing inquiries to: Housing Services Office, University of Southern California, Los Angeles, CA 90089-1332.*
*Phone: (800) 872-4632*
*E-mail: housing@usc.edu*
*Housing aid website: http://housing.usc.edu/*

### Table A—Faculty, Enrollments, and Degrees Granted

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Astronomy</td>
<td>3</td>
<td>1</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Astrophysics</td>
<td>2</td>
<td>2</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Atmosphere, Space</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Physics, Cosmic</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Rays</td>
<td>1</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Atomic, Molecular, &amp; Optical Physics</td>
<td>8</td>
<td>–</td>
<td>–</td>
<td>–(1)</td>
</tr>
<tr>
<td>Biophysics</td>
<td>3</td>
<td>8</td>
<td>–</td>
<td>–(3)</td>
</tr>
<tr>
<td>Chemical Physics</td>
<td>3</td>
<td>1</td>
<td>–</td>
<td>–(1)</td>
</tr>
<tr>
<td>Computational Physics</td>
<td>1</td>
<td>13</td>
<td>–</td>
<td>–(3)</td>
</tr>
<tr>
<td>Condensed Matter</td>
<td>13</td>
<td>11</td>
<td>–</td>
<td>–(1)</td>
</tr>
<tr>
<td>Cosmology &amp; String Theory</td>
<td>6</td>
<td>2</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>2</td>
<td>5</td>
<td>–</td>
<td>1(1)</td>
</tr>
<tr>
<td>High Energy Physics</td>
<td>6</td>
<td>7</td>
<td>–</td>
<td>1(8)</td>
</tr>
<tr>
<td>Low Temperature</td>
<td>3</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Physics</td>
<td>1</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Materials Science, Metallurgy</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Nano Science and Technology</td>
<td>2</td>
<td>2</td>
<td>–</td>
<td>1(4)</td>
</tr>
<tr>
<td>Plasma and Fusion</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Quantum Foundations</td>
<td>–</td>
<td>13</td>
<td>–</td>
<td>–(2)</td>
</tr>
<tr>
<td>Statistical &amp; Thermal Physics</td>
<td>1</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Non-specialized</td>
<td>–</td>
<td>15</td>
<td>–</td>
<td>1(3)</td>
</tr>
<tr>
<td>Other</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>57</td>
<td>80</td>
<td>–(14)</td>
<td>7(41)</td>
</tr>
<tr>
<td>Full-time Grad. Stud.</td>
<td>–</td>
<td>–</td>
<td>80</td>
<td>–</td>
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<tr>
<td>First-year Grad. Stud.</td>
<td>–</td>
<td>–</td>
<td>15</td>
<td>–</td>
</tr>
</tbody>
</table>

**GRADUATE DEGREE REQUIREMENTS**

**Master’s**
- The M.S. Physics degree requires satisfactory completion of seven courses of which no more than one course may be directed research. The M.A. Physics degree requires satisfactory completion of eight courses (exclusive of directed research) plus a comprehensive exam. For all master’s degrees, a GPA of 3.0 and one-year residency is required; there is no language requirement.

**Doctorate**
- A minimum of 11 courses exclusive of dissertation and directed research courses, taken at this university and elsewhere with a minimum GPA of 3.0; comprehensive exam, qualifying exam, dissertation, and dissertation exam required; one-year residency required; there is no language requirement.

**Thesis**
- Thesis: Thesis may not be written in absentia.

## SPECIAL EQUIPMENT, FACILITIES, OR PROGRAMS

Molecular beam laboratory, low temperature laboratories, laser optics laboratories, biological physics laboratories, electron microscopy, nanofabrication laboratories, nanomaterials synthesis.

Large-scale parallel computing facilities, quantum computing (D-Wave).

### 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>$5,300,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>State/local government</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-profit organizations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Business and industry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$5,300,000</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>10</td>
<td>$1,280,000</td>
</tr>
<tr>
<td>Atomic, Molecular, &amp; Optical Physics</td>
<td>1</td>
<td>$70,000</td>
</tr>
<tr>
<td>Biophysics</td>
<td>6</td>
<td>$600,000</td>
</tr>
<tr>
<td>Computational Physics</td>
<td>15</td>
<td>$2,500,000</td>
</tr>
<tr>
<td>Condensed Matter Physics</td>
<td>6</td>
<td>$495,000</td>
</tr>
<tr>
<td>Nano Science and Technology</td>
<td>2</td>
<td>$300,000</td>
</tr>
<tr>
<td>Particles and Fields</td>
<td>7</td>
<td>$355,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>47</td>
<td>$5,600,000</td>
</tr>
</tbody>
</table>

## FACULTY

**Professor**

- **Bars, Itzhak, Ph.D., Yale University, 1971. Cosmology & String Theory, High Energy Physics, Particles and Fields, Quantum Foundations, Theoretical Physics.** High Energy Physics, Field Theory and String Theory, Cosmology, the cosmological role of the Higgs boson, Two-Time Physics, Completion of space time beyond gravitational singularities such as big bang and black holes.


United States: Geographic Listing of Graduate Programs

California


Haas, Stephan, Ph.D., Florida State University, 1995. Chair of the Department of Physics and Astronomy. Computational Physics, Condensed Matter Physics. Stephan Haas is engaged in theoretical research on the physics of strongly correlated electrons in solids. His recent interests include microscopic modeling and phenomenology of strongly correlated many-body systems, in particular the analysis of dynamical spectra and phase diagrams. He is using a range of numerical approaches to study low-dimensional antiferromagnets, spin ladders, spin-Peierls systems, and superconductors. Furthermore, his research extends to disordered quantum systems, including random-exchange antiferromagnets, dirty superconductors, and systems with impurity-induced spin and charge textures.


Associate Professor

Di Felice, Rosa, Ph.D., University of Rome Tor Vergata, 1996. National Research Council of Italy, Institute of Nanoscience, Modena, Italy (Senior Researcher, equivalent to Associate Professor). Biophysics, Chemical Physics, Nano Science and Technology. Electronic structure of biomaterials; charge transfer through DNA and proteins; molecular dynamics simulations of protein-DNA complexes.


Haselwandter, Christoph A., Ph.D., Imperial College, 2007. Biophysics, Computational Physics, Condensed Matter Physics, Statistical & Thermal Physics, Theoretical Physics. The research of the Haselwandter group focuses on the theoretical physics of biological systems.

Assistant Professor


Levenson-Falk, Eli, Ph.D., University of California, Berkeley, 2013. Quantum Foundations. The use of superconductors in quantum information science (QIS); quantum information applications, including quantum computing and quantum simulation, and studying the basic mechanisms of quantum mechanics.

Professor Emeritus

Chang, Tu-nan, Ph.D., University of California, Riverside, 1972. Atomic, Molecular, & Optical Physics. Theoretical atomic physics.


Research Professor


Research Assistant Professor


Teaching Associate Professor


Adjunct Professor

Yu, Nan, Ph.D., University of Arizona, 1988. Atomic, Molecular, & Optical Physics. Atomic frequency standards and clocks; Quantum sensors; Microwave photonics; Lasers and Optical metrology; Atomic molecular and optical physics; Molecular spectroscopy and spectrometer development.

Adjunct Associate Professor

Bretschger, Orianna, Ph.D., University of Southern California, 2008. Biophysics. Research efforts are focused on understanding the metabolism and electron transfer mechanisms within mixed microbial communities with the goal of applying this knowledge to biotechnology development.
Align the text below:

**Adjunct Assistant Professor**

Albash, Tameem, Ph.D., University of Southern California, 2010. *Computational Physics, Condensed Matter Physics, Quantum Foundations*. Quantum adiabatic algorithm, quantum annealing, quantum information theory.


**Senior Lecturer**


**Joint Appointment**

Brun, Todd, Ph.D., California Institute of Technology, 1994. Professor of Electrical Engineering, with joint appointments in Physics and Astronomy, and in Computer Science. *Atomic, Molecular, & Optical Physics, Quantum Foundations, Theoretical Physics, Other*. Quantum information and computation, decoherence and quantum error correction and general quantum theory.

Cherezov, Vadim, Ph.D., Moscow Institute of Physics and Technology, 1997. Professor of Chemistry, Bridge Institute.


Farley, Robert A., Ph.D., University of Rochester, 1975. *Biophysics, Medical, Health Physics*. The structure and mechanism of ion channels, active transport proteins, and neurotransmitter transporters; molecular dynamics simulations of ion channels and alternate access; transport proteins; electrophysiology; molecular characterization of inherited disorders of ion transport; biophysical determinants of cell membrane structure and dynamics.

Gundersen, Martin A., Ph.D., University of Southern California, 1972. Lloyd F. Hunt Professor of Electrical Power Engineering and Professor of Electrical Engineering, Physics and Astronomy, and Chemical Engineering and Materials Science at the University of Southern California. *Applied Physics, Biophysics, Electromagnetism, Energy Sources & Environment, Other*. Researches pulsed power, applications in medicine and energy. ≈350 papers, 25 graduated PhD students. Dr. Gundersen’s interests include engineering new pulsed power technology, new therapeutic methods for treatment of cancer based on intense electric field generation, diagnostic methodologies for the study of processes in biological cells and systems, including apoptosis (the generation of programmed cell death). In a very different area, nanosecond pulsed power is being researched for engine technologies for emissions reduction and improved efficiencies in gasoline, hybrid fuels, natural gas, and diesel, through generation of non-equilibrium, transient plasmas based on nanosecond pulsed power switching. A further area is agriculture, including the enhancement of juice extraction quality in wine grapes.


**U. of Southern California, Phys. & Astro.**


Pinaud, Fabien, Ph.D., University of California, Los Angeles, 2007. Assistant Professor of Biological Sciences and Chemistry. *Biophysics, Chemical Physics, Nano Science and Technology, Neuroscience/Neuro Physics, Optics, Other*. We use light-based microscopy techniques to detect, study and understand the properties of biomolecules at the cellular, subcellular and molecular levels, with spatial resolution of a few nanometers. Our lab focuses on using a variety of single molecule fluorescence microscopy techniques to study how nanoscale cellular compartments modulate the diffusion and the activity of proteins involved in normal and pathological cellular signaling and responses. We are particularly interested in understanding how plasma and nuclear membrane scaffolds, microdomains and cavities influence the diffusion an.

Povinelli, Michelle, Ph.D., Massachusetts Institute of Technology, 2004. *Applied Physics, Biophysics, Electrical Engineering, Electromagnetism, Medical, Health Physics, Nano Science and Technology, Optics*. Nanophotonics, including: optical trapping and self assembly, optofluidics for lab-on-chip, nanostructured photovoltaics, integrated photonics.

Prezioso, Oleg, Ph.D., University of Texas, Austin, 1997. Professor of Chemistry.

Rohs, Remo, Ph.D., Freie Universitat Berlin, 2003. Computational structural biology; statistical machine learning; high-throughput prediction of DNA shape; genome-wide analysis of sequence and structure; Monte Carlo simulation; electrostatics.

Shera, Christopher A., Ph.D., California Institute of Technology, 1992. *Biophysics, Medical, Health Physics, Neuroscience/Neuro Physics*. Studies how the ear amplifies, analyzes, and creates sound.

Takahashi, Susumu, Ph.D., University of Florida, 2005. Assistant Professor of Chemistry. *Biophysics, Chemical Physics, Condensed Matter Physics, Nano Science and Technology, Quantum Foundations, Solid State Physics*. We are an interdisciplinary experimental research group overlapping in the areas of Condensed Matter Physics, Chemical Physics and Biophysics. Our current research interests include, - Spin dynamics of a single nitrogen-vacancy (NV) center in diamond. - Development of single-molecule magnetic resonance techniques - Nanomagnetism in quantum molecular magnets, - Conformational dynamics in biological systems.


DEPARTMENTAL RESEARCH SPECIALTIES AND STAFF

Theoretical

Astrophysics. Theoretical solar physics uses the Sun as a plasma physics laboratory. On the one hand, this work involves state-of-the-art solar modeling and an analysis of helioseismic data. On the other hand, helioseismology is the first accurate experiment that puts strong constraints on the thermodynamic quantities of the plasma of stellar interiors. Cosmology is interested in a variety of scientific issues including dark matter and dark energy models, the early Universe, cosmological parameter determination, data analysis and interpretation. The group offers the opportunity of collaborative research with scientists at the Jet Propulsion Laboratory on current and future space missions. Pierpaoli.

Atomic, Molecular, & Optical Physics. Interactions of strong electromagnetic radiation (lasers) with matter; multiphoton processes; energy development related basic atomic transitions; many-body approach to atomic transitions; multiply excited atomic resonances; atomic optics; collective properties in atomic traps and confined Bose-Einstein condensates; atomic lithography; atoms and ions in dense stellar plasmas; interactions of high-power laser beams with matter leading to nonlinear optical phenomena; propagation of light in dense inhomogeneous plasmas; free-electron lasers; high-power unstable laser oscillators. Chang, Didkovsky, Feinberg, Gunddersen, Hellwarth, Kresin, Kunc, Shakeshaft, Takahashi, Tangayu, Wu.

Biophysics. The area is characterized by the use of quantitative methods, modeling, and physics based experimental methods to make discoveries related to biological systems. This subdiscipline anticipates the movement of both basic biological science and medical applications to areas where physics has an ever greater impact. Bretschger, El-Naggar, Farley, Haas, Haselwandter, Kalia, Madhukar.


High Energy Physics. Quantum field theory and unification of fundamental interactions; cosmology; superstring theory; M-theory; gauge theories; supersymmetry and supergravity; conformal field theory; statistical mechanics; mathematical physics; integrable models. Bars, Johnson, Nemeschansky, Pilch, Saleur, Warner.

Quantum Foundations. Use of quantum mechanical resources for computation, communication, and other information-processing tasks. Effect of noise and decoherence; quantum error correction and suppression, dynamical decoupling, and decoherence-free subsystems and subsystems; weak and continuous measurements and quantum trajectories; quantum random walks; quantification of entanglement; quantum information theory: algebraic description of quantum states and observables; quantum information and many-body physics; entanglement and quantum phase transitions; quantum algorithms for classical statistical physics; quantum process tomography; geometric phases; adiabatic, holonomic, and topological quantum computation; quantum computing implementations, using quantum dots, linear optics, and magnetic resonance force microscopy; quantum information. Brun, Campos Venuti, Haas, Levenson-Falk, Lidar, Zanardi.

Experimental

Astrophysics. Study of the overall structure, composition, origins and evolution of the Universe; analysis of cosmic microwave background data and the study of dark matter and galaxy clusters. Study of the structure and dynamics of the solar atmosphere and interior using observations and theory of solar local and global oscillations; use of helioseismology to probe properties of dense plasmas. Didkovsky, Peters, Pierpaoli, Rhodes, Wu.

Atmosphere, Space Physics, Cosmic Rays. Laser spectroscopy, highly excited atomic states, study of planetary atmospheres from space flight experiments; photoabsorption and emission in planetary atmospheres; vacuum ultraviolet radiation interacting with gaseous plasmas. Didkovsky, Wu.


Optics. Laser spectroscopy; nonlinear optical mixing; optical fibers and devices; phase-conjugation, photorefractive effect; Raman-induced Kerr effect spectroscopy; spectroscopy of glassy solids; laser plasma studies; photochemistry of simple molecular systems; interaction in wave guides. Feinberg, Hellwarth.

View additional information about this department at www.gradschoolshopper.com. Check out the “Why Choose Us?” section, find out more about the department’s culture and get links to social media networks.