CALIFORNIA INSTITUTE OF TECHNOLOGY
APPLIED PHYSICS PROGRAM (WITHIN THE DEPARTMENT OF APPLIED PHYSICS AND MATERIALS SCIENCE)
Pasadena, California 91125
http://aphms.caltech.edu

General University Information
President: Thomas Rosenbaum
Dean of Graduate School: Douglas Rees
University website: http://www.caltech.edu
Control: Private
Setting: Suburban
Total Faculty: 300
Total Graduate Faculty: 300
Total number of Students: 2,200
Total number of Graduate Students: 1,204

Department Information
Department Chairman: Prof. Kerry Vahala, Head
Department Contact: Michelle Rodriguez, Assistant to the Option Representatives
Total full-time faculty: 18
Full-Time Graduate Students: 56
First-Year Graduate Students: 10
Female First-Year Students: 1
Total Post Doctorates: 22

Department Address
1200 E California Blvd
MC 128-95
Pasadena, CA 91125
Phone: 626-395-3982
E-mail: mrodriguez@caltech.edu
Website: http://aphms.caltech.edu

ADMISSIONS

Admission Contact Information
Address admission inquiries to: Applied Physics and Materials Science Dep’t., California Institute of Technology, 1200 East California Boulevard, Mail Code 128-95, Pasadena, CA 91125
Phone: 626-395-8124
Admissions website: http://www.gradoffice.caltech.edu/admissions/applyonline

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

Application fee
U.S. students: $100   Int’l. students: $100

Admissions information
For Fall of 2016:
Number of applicants: 191
Number admitted: 46
Number enrolled: 18

Admission requirements
Bachelor’s degree requirements: Bachelor’s degree in physics or a related field.

GRE requirements
The GRE is required.

Advanced GRE requirements
The Advanced GRE is recommended.

TOEFL requirements
The TOEFL exam is required for students from non-English-speaking countries.
The following exemptions apply: Applicants who have studied in the US for two or more years. Applicants with a degree from a school whose primary instruction is in English.

TUITION

Tuition year 2016–17:
Health insurance: Available.
Academic term: Other

FINANCIAL AID

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

For further information
Address financial aid inquiries to: Caltech - Financial Aid, Mail-Code: 20-90 1200, E California Blvd, Pasadena CA 91125,
Tel: 626-395-6280, Fax: 626-564-8136.
Phone: 626-395-6280
E-mail: finaid@caltech.edu
Financial aid website: https://www.finaid.caltech.edu/

HOUSING

Availability of on-campus housing
Single students: Yes
Married students: Yes

For further information
Address housing inquiries to: Caltech - Caltech Housing, Mail-Code: 160-86, 1200 E California Blvd, Pasadena CA 91125.
Phone: 626-395-6176
E-mail: housing@caltech.edu
Housing aid website: https://www.housing.caltech.edu/

Table A—Faculty, Enrollments, and Degrees Granted

<table>
<thead>
<tr>
<th>Research Specialty</th>
<th>2015–16 Faculty</th>
<th>Enrollment Fall 2016</th>
<th>Number of Degrees Granted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mas-</td>
<td>Doctoral</td>
<td>Mas-</td>
</tr>
<tr>
<td>Applied Physics</td>
<td>18</td>
<td>-</td>
<td>56</td>
</tr>
<tr>
<td>Total</td>
<td>18</td>
<td>-</td>
<td>56</td>
</tr>
<tr>
<td>Full-time Grad. Stud.</td>
<td>-</td>
<td>-</td>
<td>56</td>
</tr>
<tr>
<td>First-year Grad. Stud.</td>
<td>-</td>
<td>-</td>
<td>10</td>
</tr>
</tbody>
</table>

GRADUATE DEGREE REQUIREMENTS

Master’s: The graduate programs in Applied Physics are designed to be a doctoral program and students are only admitted into the doctoral program. There is no separate master’s pro-
california

special equipment, facilities, or programs

IQIM - Institute for Quantum Information and Matter
The Institute for Quantum Information and Matter (IQIM) at Caltech is a Physics Frontiers Center supported by the National Science Foundation and the Gordon and Betty Moore Foundation. IQIM researchers study physical systems in which the weirdness of the quantum world becomes manifest on macroscopic scales. Their research programs span quantum information science, quantum many-body physics, quantum optics, and the quantum mechanics of mechanical systems; their faculty are drawn from Caltech’s departments of physics, applied physics, and computer science. IQIM also conducts outreach programs to acquaint high school students and the general public with the wonders of the quantum world.

KNI - The Kavli Nanoscience Institute
The KNI special emphasis is upon efforts that transcend traditional disciplinary boundaries, with two principal areas of focus: nanobiotechnology andnanophotonics. Its common methodology in these areas is large-scale integration of nanoscale devices—that is, going beyond the present nanoscience of individual structures to realize interacting systems capable of unprecedented emergent functionality.

Cleanroom Facilities
The Kavli Nanoscience Institute (KNI) clean-room facility at Caltech includes a stepper optical lithography system, a Leica EBPG-5000+ electron-beam writing system (20 nm spot size, field stitching and overlay accuracy of 30 nm), a FEI Nova 600 and Nova 200 (with mass spectrometer and x-ray materials analysis capability) Focused Ion Beam system, three dedicated ICP-RIE systems for etching silica and silicon materials with BOSCH and low temperature (T = 77K) etching capability, an FEI Tecnal-30 STEM (1.4 nm resolution, 300kV source), LPCVD SiNx and SiOx furnace bank, and a variety of other etch and deposition tools. The Micro-Nano cleanroom facility at Caltech includes a variety of lithography, wet etch and deposition systems.

faculty

Professor

Atwater, Harry A., Ph.D., Massachusetts Institute of Technology, 1987. Professor Atwater currently serves as Director of the DOE Energy Frontier Research Center on Light-Material Interactions in Solar Energy Conversion, and is also Director of the Resnick Sustainability Institute, Caltech’s largest endowed research program. He has authored or co-authored more than 400 publications cited in aggregate > 20,000 times and his group’s advances in the solar energy and plasmonics field have been reported in Scientific American, Science, Nature Materials, Nature Photonics and Advanced Materials. He is the founding Editor-in-Chief of ACS Photonics and serves as Associate Editor for the IEEE Journal of Photovoltaics.


Dimotakis, Paul E., Ph.D., California Institute of Technology, 1973. Applied Physics. Turbulent mixing and chemical reactions in subsonic and supersonic free-shear flows; hypersonic propulsion; hydrocarbon flames under variable-pressure conditions; Rayleigh-Taylor-instability flows; mixing and the geometry of surfaces and interfaces in turbulence; scalar dispersion in turbulent flows; aerothermal effects in turbulent free-shear flows; image correlation velocimetry. Space-Related Research: High-speed/hypersonic endoatmospheric flight and propulsion; high-speed and computational imaging.

Eisenstein, James P., Ph.D., University of California, 1980. Applied Physics, Physics and other Science Education. Professor Eisenstein focuses on experimental condensed-matter physics, particularly strongly correlated electrons in semiconductor heterostructures at low temperatures and high magnetic fields.

Elowitz, Michael, Ph.D., Princeton University, 1999. Professor of Biology and Bioengineering; Investigator, Howard Hughes Medical Institute; Executive Officer for Biological Engineering. Applied Physics, Biophysics. Professor Elowitz works in the areas of systems and synthetic biology. His research seeks to understand fundamental design principles underlying the architecture and dynamics of gene circuits, including the functional role that stochasticity, or ‘noise’, plays in the cell. To do so, he analyzes gene circuit behavior at the level of individual cells using time-lapse microscopy, designs and engineers synthetic genetic circuits that are sufficient to enable specific behaviors, and employs mathematical modeling.

Fultz, Brent, Ph.D., University of California, 1982. Applied Physics, Materials Science, Metallurgy. Professor Fultz focuses on materials physics and materials chemistry, presently with two emphases. One is on the origin of entropy, as studied by neutron scattering and computation. The second is on new materials for energy storage, such as Li- and H-storage materials.

Goddard III, William A., Ph.D., California Institute of Technology, 1965. Applied Physics, Materials Science, Metallurgy. Professor Goddard’s research focuses on new methodology for quantum chemistry, force fields, molecular dynamics, mesoscale dynamics, statistical mechanics; Applications of atomistic simulations to chemical, biological, and materials systems, including catalysis (homogenous and heterogeneous), protein structure prediction, drug design, polymers, semiconductors, ceramics, and metal alloys (plasticity and failure); Applications to industrial problems in oil field technology, catalysis, polymers, fuel cells, and nanotechnology.


Roukes, Michael L., Ph.D., Cornell University, 1985. *Applied Physics, Biophysics, Physics and other Science Education*. Professor Roukes’s research focuses on nanobiotecnology, nanotechnology, nanoscale physics, nanoscale and molecular mechanics.

Scherer, Axel, Ph.D., New Mexico Institute of Mining and Technology, 1985. *Applied Physics, Electrical Engineering, Physics and other Science Education*. Professor Scherer’s group focuses on the application of microfabrication to integrated microsystems. Professor Scherer has pioneered microcavity lasers and filters, and now his group works on integration of microfluidic chips with electronic, photonic and magnetic sensors. Presently, his group works on integration of microfluidic chips with electronic, photonic and magnetic sensors.

Schwab, Keith C., Ph.D., University of California, 1996. *Applied Physics*. Professor Schwab’s current focus is on the question of quantum physics at large length scales, what does it take to observe quantum phenomena with ordinary matter and the largest possible scale. The techniques used to probe this are quantum-limited measurements of motion, ultra-low temperature physics, nanotechnology and microfabrication techniques, and ultra-sensitivity microwave measurement.

Troian, Sandra M., Ph.D., Cornell University, 1987. *Applied Physics*. The Laboratory of Interfacial and Small Scale Transport (LIS2T) specializes in problems involving interface-mediated transport and "interface sculpting" in systems ranging in scale from microns to nanometers. We complement full scale experimentation with analytic work, numerical computations and non-equilibrium molecular dynamics simulations to develop physical insight for theoretical advances as well as reliable design principles for application driven work.

Vahala, Kerry J., Ph.D., California Institute of Technology, 1985. *Applied Physics*. Professor Vahala studies science and applications relating to high-Q optical microcavities. His research group has pioneered a class of devices that attain Q factors of nearly 1 billion in a compact size. They are using these devices to study optical parametric oscillators, frequency microcombs, high-coherence Brillouin lasers, reference cavities, optical-based microwave sources, and optomechanical oscillators.


**Assistant Professor**

Faraon, Andrei, Ph.D., Stanford University, 2009. *Applied Physics*. Professor Faraon’s research interests are in solid state quantum optics and nano-photonic. Applications include on-chip optical signal processing at ultra-low power levels, energy efficient sensors, bio-photonic and quantum information processing.

Minnich, Austin, Ph.D., Massachusetts Institute of Technology, 2011. *Applied Physics*. Professor Minnich researches the physics and engineering of nanoscale heat transport. Nanostructured materials have novel thermal properties with applications in energy such as for thermoelectric materials, which convert heat directly to electricity. Minnich uses experimental techniques, including ultrafast optical experiments, to study transport at the length and time scales of the energy carriers themselves. These experiments measure properties of the energy carriers that are lost at macroscopic scales, allowing for a more complete understanding of nanoscale transport physics. Minnich also uses these results to design novel materials and thermal devices, such as more efficient thermoelectric materials and devices for thermal energy storage.

Nadj-Perge, Stevan, Ph.D., Delft University of Technology, 2010. *Applied Physics*. Professor Nadj-Perge is interested in development of mesoscopic devices for applications in quantum information processing. Such devices also provide a playground for exploring exotic electronic states at (sub)-nano length scales. In his research, he is using scanning tunneling microscopy and electrical transport measurement techniques at cryogenic temperatures.

**DEPARTMENTAL RESEARCH SPECIALTIES AND STAFF**

**Theoretical**


**Experimental**


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