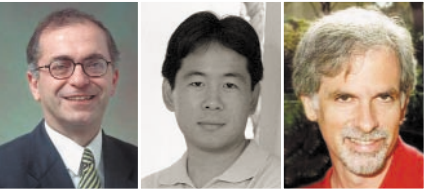


## Influx of Talent: Division Grows by Nine

Six new professors have joined the Division and Caltech over the past several months, bringing fresh insights and new research directions our way.



Also new to the Division are three faculty members already part of the Caltech community: (pictured from left to right) Charles Elachi, Director of the Jet Propulsion Laboratory, joins Electrical Engineering; Hideo Mabuchi is now a member of both the Physics faculty and the Control and Dynamical Systems Option; and Michael Roukes, also a member of the Physics faculty, joins both the Applied Physics and Bioengineering Options.

### Marc Bockrath: Assistant Professor of Applied Physics

Professor Bockrath's interests are in nanofabrication, and the electronics and mechanics of systems that have critical dimensions on the nanometer scale, which represents the ultimate limit to miniaturization. These systems include materials such as carbon nanotubes and individual molecules. Currently, he is interested both in investigating the new and interesting transport phenomena that arise in nanostructured materials, and in investigating the properties of nanostructures that have mechanical degrees of freedom. Potential applications include nanoscale switches, logic gates, and sensors.

Bockrath received a BS degree in Physics from the Massachusetts Institute of Technology in 1993, and a PhD in Physics from UC Berkeley in 1999. Most recently he was a postdoctoral fellow at Harvard University.



### Michael Dickinson: Professor of Bioengineering

Professor Dickinson's primary research interests concern the physiology and mechanics of flight behavior in insects. Specifically, he has focused on the flight-control system of flies—arguably the most aerodynamically sophisticated of all flying animals. His research strategy is to tackle flight behavior using approaches from such disparate disciplines as neurobiology, structural engineering, and aerodynamics. Thus, Professor Dickinson's lab attempts to study flight-control behavior at several levels of analysis simultaneously, from the physiological properties of individual neurons and circuits to the skeletal mechanics of wing motion and the production of aerodynamic forces. This multi-level approach is challenging and yet rewarding, as novel insight is often gained by addressing a problem simultaneously from several perspectives.

Dickinson received his ScB degree from Brown University in 1984 and a PhD in Zoology from the University of Washington in 1989. He comes to Caltech from UC Berkeley, where he was the Williams Professor of Integrative Biology.



### Alexei Kitaev: Professor of Theoretical Physics and Computer Science

Professor Kitaev's research area is quantum computation, which includes quantum algorithms, error correction, and quantum complexity classes. Professor Kitaev has devised a phase-estimation algorithm and topological quantum codes, as well as an efficient classical algorithm for the approximation of unitary operators by products of generators. He has also studied complexity classes BQNP and QIP. His other important idea is error correction at the physical

level, in particular fault-tolerant quantum computation by anyons. He is currently working on physical models that would make this scheme feasible.

Kitaev received an MS degree from the Moscow Institute of Physics and Technology in 1986, and a PhD from the L.D. Landau Institute for Theoretical Physics in 1989. He worked at the L.D. Landau Institute until 1998, then spent a year at Caltech as a visiting researcher and lecturer, two years at Microsoft as a researcher, and came back to Caltech as a senior research associate in fall 2001.

Professor Kitaev has a joint appointment in the Division of Engineering and Applied Science and the Division of Physics, Mathematics, and Astronomy.

## Nadia Lapusta: Assistant Professor of Mechanical Engineering

**Professor Lapusta's** research interests are in continuum mechanics, computational modeling, fracture and frictional processes, and the mechanics and physics of earthquakes. Her work is directed towards understanding fracture and frictional phenomena on all scales, from frictional failure in earthquakes and dynamic cracks in solid structural components to tribological processes on micron-sized asperities and complex atomic and molecular interactions at crack tips. A significant effort is devoted to developing efficient computational techniques applicable to such nonlinear, dynamic, and multiscale problems. Her current studies include nucleation and dynamics of frictional instabilities, models of earthquake sequences, dynamic fracture on bimaterial interfaces, and shear heating effects during rapid slips.

Lapusta received her Diploma in Mechanics and Applied Mathematics from Kiev State University (Ukraine) in 1994, and both her SM (1996) and PhD (2001) degrees in Engineering Sciences from Harvard University.



## Tapio Schneider: Assistant Professor of Environmental Science and Engineering

**Professor Schneider's** research interests are in the dynamics of the global circulation of the atmosphere and in large-scale atmospheric turbulence and turbulent transport. His current research focuses on developing theories concerning the turbulent fluxes of heat, mass, and water vapor that contribute to maintaining such basic climatic features as the pole-to-equator surface-temperature gradient, the thermal stratification of the atmosphere, and the distribution of atmospheric water vapor.

Schneider received his PhD from Princeton University in 2001, and did his undergraduate work at Freiburg University (Vordiplom, 1993).

Professor Schneider has a joint appointment in the Division of Engineering and Applied Science and the Division of Geological and Planetary Sciences.



## Chris Umans: Assistant Professor of Computer Science

**Professor Umans's** research area is theoretical computer science, in particular complexity theory. He has studied the computational complexity of fundamental optimization problems from application areas such as circuit design and learning theory. His recent work centers on basic questions regarding the power of randomness in computation. Other research interests include explicit combinatorial constructions, hardness of approximation, coding theory, and algorithms for problems from graph theory and algebra.

Umans received a BA degree in Computer Science and Mathematics from Williams College in 1996, and a PhD in Computer Science from UC Berkeley in 2000. Before joining Caltech, he was a postdoctoral scholar in the Theory Group at Microsoft Research.

Center photos, clockwise from top left: Marc Bockrath, Nadia Lapusta, Tapio Schneider, Chris Umans, Alexei Kitaev, and Michael Dickinson.