Fall 2000

The Adolph C. and Mary Sprague Miller Institute for Basic Research in Science
University of California, Berkeley

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Miller Institute News

Deadlines To Note

Monday, October 2:
Miller Professorship application deadline. Term of appointment in 2001-2002.

Thursday, October 5:
Miller Fellow nomination deadline. Term of appointment 2001-2004.

Monday, October 9:
Visiting Miller Professorship nomination deadline. Term of appointment in 2001-2002.

Wednesday, October 25:
Miller Fellow applications and support letters due. Terms of appointment in 2001-2004.

More information for each program is available on the Miller Institute website: http://socrates.berkeley.edu/~4mibrs

All materials are due in the Miller Institute office by 4:00 pm of deadline.

The Miller Institute is "dedicated to the encouragement of creative thought and the conduct of research and investigation in the field of pure science...and investigation in the field of applied science in so far as such research and investigation are deemed by the Advisory Board to offer a promising approach to fundamental problems."

Miller Fellow Focus: Stephen Zatman

Third year Miller Fellow Dr. Stephen Zatman works on a number of topics within "solid Earth geophysics." He is hosted by Professor Mark Richards of the Department of Earth and Planetary Science. Since he became a Miller Fellow, Dr. Zatman has been working on topics in "geodynamics"- understanding the deformation of the Earth's upper layers.

Dr. Zatman's work in geomagnetism has concentrated on using observations of the magnetic field from surface magnetic observatories and satellites to better constrain the dynamics at work in the Earth's core. Although it is commonly taught in school that the Earth's magnetic field is akin to that of a bar magnet, this is only approximately true: in detail there are knots and irregularities in the field that can be revealed by careful measurement and analysis, and these features change over time. This variation is caused by the flow of molten metal within the core, including the churning motions that generate the flow in the first place. A picture of this motion can be built at the top of the core using knowledge of the magnetic field at the Earth's surface and its change over time. Typical motions within the core occur at rates of several tenths of a millimeter per second.

Using such models of flows at the top of the core, Dr. Zatman was able to interpret the behavior over time in terms of different types of oscillatory motions within the core. In the Earth's atmosphere there are motions, such as El Nino, that vary on time scales of years and faster motions, such as storms, that vary on time scales of days. And then there are motions on very short time scales such as tornados. Each of these motions relates to a different type of dynamic at work in the atmosphere. Similarly, Dr. Zatman interprets core flows in terms of different dynamics. Since the best observations of the Earth's magnetic field come from after 1900, he is particularly interested in looking for oscillations in the Earth's core on time scales of decades.

These dynamics can then relate to other observables that can be detected at the Earth's surface. In particular, Zatman thinks that the Earth's core is dynamically coupled to the overlying layer of solid rock – the mantle, which means that the core and the mantle exchange forces with each other.

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Miller Fellow Focus: Stephen Zatman

This can be observed in extremely high precision measurements of the Earth's rate of rotation. The length of the day varies by small amounts - on the order of milliseconds - that occasionally cause a need for an extra second to be added to the calendar. Some of this is due to the slowing of the Earth's rotation due to gravitational interactions with the moon, but a large part of this is due to dynamic interactions between the Earth's core and mantle. In fact, the variations in the Earth's rotation can be correlated with the waves of motion in the Earth's core that are revealed by variations in the magnetic field. Dr. Zatman's research involves the determination of the time scales on which the mantle and core seem to be dynamically coupled in this fashion.

Dr. Zatman's geodynamic interests are more superficial in that they relate to the deformation of the Earth's surface that can be pictured directly. One interest is in the crumpling of areas of the ocean floor - so called "diffuse plate boundaries". The theory of plate tectonics suggests that the Earth's surface is divided into rigid plates, and that all deformation occurs at the margins of these plates. We know this to be an approximation: for the most part it is true, but there is increasing evidence that there are large portions of the Earth that are being continuously deformed. One such example is the Indian Ocean, south of India and northwest of Australia. Observations of the crumpling seem to indicate the importance of pivots within the zones of deformation, and Dr. Zatman became interested in building theoretical models of this pivoting. His interests were fortuitously aided by the Miller Institute when they brought the preeminent figure in the subject of diffuse plate boundaries - Richard Gordon - to Berkeley on a Visiting Miller Professorship.

Inspired both by the local expertise and the surroundings, Dr Zatman has also been working on an aspect of the dynamics of the San Andreas fault system. Although his work is primarily theoretical rather than observational, Dr. Zatman chose a part of the San Andreas that is relatively safe - the creeping portion that makes up much of the fault between the Bay Area and Los Angeles. This area is where the fault is slipping more or less continuously rather than episodically during earthquakes.

Dr. Zatman can be reached at zatman@seismo.berkeley.edu

New Staff

The Miller Institute is pleased to announce the addition of Donata Hubert to the staff. Donata will be working closely with all aspects of the competition processes. Please join us in welcoming her.

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Members' Recent Publications

Miller Professor William Arveson completed a paper during his term (academic year 1999-2000) with the Miller Institute: "Interactions in Noncommutative Dynamics," Comm. Math. Phys, 211, (2000) 68-83.

Miller Professor David Chandler wrote three papers during his term (academic year 1999-2000) with the Miller Institute entitled: "Ab Initio Analysis of Proton Transfer Dynamics in $(H_2O)_3H^+$," with P. L. Geissler, C. Dellago, J. Hunter, and M. Parrinello, Chem. Phys. Lett. 321, 225(2000), "Reaction Coordinates of Biomolecular Isomerization," with P. G. Bolhuis, and C. Dellago, Proc. Nat. Acad. Sciences 97, 5877(2000), and "Cavity Formation and the Drying Transition in a Lennard-Jones Fluid," with D. M. Huang, Phys. Rev. E61, 1501(2000).

Visiting Miller Professor Dale Haidvogel published a paper during his term (Fall 1999) with the Miller Institute: "Coastal Ocean Modeling: Processes and Real-Time systems," with D. B. Blanton, J. C. Kindle and D. R. Lynch, Oceanography, 13(1), 35-46.

Miller Professor Edward Lee wrote a paper during his term (Fall 1999) with the Miller Institute: "Embedded Software - An Agenda for Research," ERL Technical Report UCB/ERL No. M99/63, Dept. EECS, University of California, Berkeley, CA 94720, December 15, 1999.

Miller Professor Jeremy Thorner had a prolific term (academic year 1999-2000) with the Miller Institute publishing six papers: "Functional Counterparts of Mammalian Protein Kinases PDK1 and SGK in budding yeast," with A. Casamayor, P. D. Torrance, T. Kobayashi , and D. R. Alessi (1999), Current Biol. 9:186-197, "Yeast Homologue of Neuronal Frequenin is an Regulator of Phosphatidylinositol 4-Kinase," with K. B. Hendericks, B. Q. Wang, and E. A. Schneiders (1999), Nature Cell Biology 1:234-241, "Hs17 Localizes to a Septin Ring and Serves as an Adaptor in a Regulatory Pathway that Relieves Tyrosine Phosphorylation of Cdc28 Protein Kinase in Saccharomyces Cerevisiae," with M. J. Shulewitz , and C. J. Inouye (1999), Mol. Cell Biol. 19:7123-7137, "Direct Involvement of Phosphatidylinositol 4-Phosphate in Secretion in the Yeast Saccharomyces Cerevisiae," with H. Hama, E. A. Schneiders, J. Y. Takemoto, and D. B. DeWald (1999), J. Biol. Chem. 274:34294-34300, "Random Mutagenesis and Functional Analysis of the Ran-Binding Protein, RanBP1," with C. Peterson, N. Orem, J. Trueheart, and I. G. Macara (2000), J. Biol. Chem. 275:4081-4091, and "Purification and Enzymic Properties of Mot1 ATPase, a Regulator of Basal Transcription in the Yeast Saccharomyces Cerevisiae," with J.I. Adamkewicz, C. G. F. Mueller, K. E. Hansen, and W. A. Prud'homme, J. Biol. Chem. 275:21158-21168.

Miller Professor William Jack Welch completed three papers during his term (academic year 1999-2000) with the Miller Institute: "Unveiling the Circumstellar Envelope and Disk: A Sub-Arcsecond Survey of Circumstellar Structures," with L. W. Looney and L. G. Mundy, Ap. J. , 529, 477, "The Structure and Evolution of Envelopes and Disks in Young Stellar Systems," with L. G. Mundy and L. W. Looney (2000), Protostars and Planets IV, V. Mannings, A. P. Boss and S.S Russell. Eds, University of Arizona Press, Tucson, and "High Resolution Observations of SVS13 at Î»1.3mm: Evidence for Grain Growth in Circumstellar Disks," presented at Star Formation Workshop, NASA Ames Research Institute, May 19, 2000.

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Awards & Honors

Current Miller Professor ('00-'01) **J. C. Séamus Davis** of the Department of Physics at the University of California, Berkeley, and his colleagues built a one-of-a-kind, high resolution scanning tunneling microscope that works at low temperatures.

Former Visiting Miller Professor (Spring '98) **Hans Queisser** was invited as "Distinguished Lecturer" to the National University of Singapore in February 2000. Channel News Asia also conducted a 50 minute television interview with him.

Former Miller Professor ('87-'88) **Paul Richards** of the Department of Physics at the University of California, Berkeley received the 2000 Frank Isakson Prize for Optical Effects in Solids from the American Physical Society in recognition of his development of innnovative infrared techniques and pioneering research in far-infrared spectroscopy.

Former Miller Fellow ('96-'98) **Adam Riess** was featured in Time magazine (August 7, 2000) for his outstanding work in the field of Astrophysics. His calculations show that the universe seems to be expanding ever faster, suggesting the existence of the antigravity force first proposed, then abandoned, by Einstein.

Former Miller Professor ('85-'86, Spring 98) **Richard Saykally** of the Department of Chemistry at the University of California, Berkeley was honored March 28th, 2000 by the American Chemical Society for shedding new light on the world's most common yet mysterious substance: water. He will receive the Irving Langmuir Award in Chemical Physics from the society at its national meeting in San Francisco.

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