

FROM CRACKS TO CLIMATE

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ABSTRACT

The advent of PetaFlop (and eventually ExaFlop) computational architectures opens new opportunities for simulations, equalizing their importance with experiment and theory for scientific discovery. The INCITE (Innovative and Novel Computational Impact on Theory and Experiment) program of the U.S. Department of Energy opens these facilities to all, based solely on the intellectual content of the proposed work. In such an environment, significant advances can be made in a number of scientific fields. Three are examined in this presentation: 1) Scaling from atomic displacements to cracks, 2) Systems approach to the CO₂ balance sheet, and 3) Inclusion of human behavior into integrated climate models. High end computing enables each of these areas to predict consequences of wide spread interest and impact.

AUTHOR BIOGRAPHY

RAYMOND L. ORBACH is Director of The Energy Institute at the University of Texas at Austin. He took this position in August of this year, along with joint appointments as a professor with tenure in the Department of Mechanical Engineering, Cockrell School of Engineering; the Department of Physics, the College of Natural Sciences; and the Jackson School of Geosciences. Immediately prior to his current position, he nominated by President Bush to serve as the first Under Secretary for Science at the U.S. Department of Energy (DOE). On May 26, 2006, Dr. Orbach was unanimously confirmed by the U.S. Senate and sworn in as Under Secretary on June 1, 2006.

As Under Secretary, Dr. Orbach's primary responsibility was to serve as chief scientist for DOE, and to advise the Secretary of Energy on a variety of topics. In addition to these duties, Dr. Orbach was also responsible for leading the Department's implementation of the American Competitiveness Initiative, designed to help drive continued U.S. economic growth. He was also responsible for leading the Department's efforts to transfer technologies from DOE national laboratories and facilities to the global marketplace, serving as Chair of the Technology Transfer Policy Board, responsible for coordinating and implementing the Department's technology transfer and activities.

Prior to and concurrent with serving as Under Secretary for Science, Dr. Orbach served as the 14th Director of the Office of Science at the Department of Energy, after being unanimously confirmed by the U.S. Senate on March 4, 2002 and sworn in as Director on March 14, 2002. The Office of Science is the third largest federal sponsor of basic research and the primary supporter of the physical sciences in the United States. The Office of Science also provides management oversight of the ten DOE, non-weapons national laboratories, supports researchers at more than 300 colleges and universities nationwide, and builds and operates the world's most powerful suite of scientific facilities and instruments.

From 1992 to 2002, Dr. Orbach served as Chancellor of the University of California (UC), Riverside. Under his leadership, UC Riverside doubled in size, achieved national and international recognition in research, and led the University of California in diversity and educational opportunity.

Dr. Orbach began his academic career as a postdoctoral fellow at Oxford University in 1960 and became an assistant professor of applied physics at Harvard University in 1961. He later joined the faculty of the University of California, Los Angeles (UCLA) in 1963, and served as the Provost of the College of Letters and Science at UCLA from 1982 to 1992.

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Dr. Orbach's research in theoretical and experimental physics has resulted in the publication of more than 240 scientific articles. He has received numerous honors as a scholar including two Alfred P. Sloan Foundation Fellowships, a National Science Foundation Senior Postdoctoral Fellowship at Oxford University, a John Simon Guggenheim Memorial Foundation Fellowship at Tel Aviv University, the Joliot Curie Professorship at the École Supérieure de Physique et de Chimie Industrielles de la Ville de Paris, the Lorentz Professorship at the University of Leiden in the Netherlands, the 1991-1992 Andrew Lawson Memorial Lecturer at UC Riverside, the 2004 Arnold O. Beckman Lecturer in Science and Innovation at the University of Illinois at Urbana-Champaign, and the Outstanding Alumni Award from the California Institute of Technology in 2005. He is a fellow of the American Physical Society and the American Association for the Advancement of Science, and has held numerous visiting professorships at universities around the world.