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DOE Announces First Awards in Scientific Discovery through Advanced Computing Program; UCSB Prof Plays Major Role

WASHINGTON, D.C. -- The Department of Energy (DOE) today announced its first awards under the new Scientific Discovery through Advanced Computing (SciDAC) program. Fifty-one projects will receive a total of $57 million this fiscal year to advance fundamental research in several areas related to the department's missions, including: climate modeling, fusion energy sciences, chemical sciences, nuclear astrophysics, high energy physics and high performance computing.

Professor Robert Sugar in the UC Santa Barbara Department of Physics will play a key role in the program, coordinating and overseeing program efforts at seven universities and three national laboratories in a project aimed at obtaining a deeper understanding of the fundamental forces of nature. This part of the SciDAC effort will be funded at $2 million per year for three years.

"A very large number of theoretical physicists are working together study quantum chromodynamics, the theory which describes the forces among quarks and gluons, the fundamental building blocks of nuclear matter," said Sugar. "This research requires very large numerical calculations and the SciDAC program is providing the resources

to build the computational infrastructure needed to carry it out."

SciDAC is an integrated program that will help create a new generation of scientific simulation codes. The codes will take full advantage of the extraordinary computing capabilities of terascale computers (computers capable of doing trillions of calculations per second) to address ever larger, more complex problems. The program also includes research on improved mathematical and computing systems software that will allow these codes to use modern parallel computers effectively and efficiently.

Additionally, the program will develop "collaboratory" software to enable geographically separated scientists to effectively work together as a team, to control scientific instruments remotely and to share data more readily. "This innovative program will help us to find new energy sources for the future, understand the effect of energy production on our environment and learn more about the fundamental nature of energy and matter," said Secretary of Energy Spencer Abraham. "A major strength of many of the projects is a partnership between scientists at the Energy Department's national laboratories and universities."

Selected from over 150 proposals, the SciDAC activities include 23 large projects that will each receive $500,000 to $4 million per year for three to five years, and 27 smaller projects, each with funding of up to $500,000 per year for three years. "These projects represent a significant change in the way we do computational research, with greater emphasis on integrated teams," said James Decker, acting director of the department's Office of Science. "Our strategy is to support coordinated efforts by the scientists working to solve complex problems in physics, chemistry and biology, and the applied mathematicians and computer scientists working to develop the computational tools required for that research."

Success of the SciDAC program requires multi-disciplinary teams from universities and laboratories to work in close partnership. Thirty-three projects are in the biological, chemical and physical sciences. Specifically, 14 university projects will advance the science of climate simulation and prediction. These projects involve both novel methods and computationally efficient approaches for simulating components of the climate system and work on the integrated "climate model of the future." Ten projects will address the areas of quantum chemistry and fluid dynamics, which are critical for modeling energy-related chemical transformations such as combustion, catalysis and photochemical energy conversion.

The scientists involved in these activities will develop new theoretical methods and efficient computational algorithms to predict complex molecular structures and reaction rates with unprecedented accuracy. Five projects are focused on developing and improving the physics models needed for integrated simulations of plasma systems to advance fusion energy science. These projects will focus on such fundamental phenomena as electromagnetic wave-plasma interactions, plasma turbulence and macroscopic stability of magnetically confined plasmas. Four projects in high energy and nuclear physics will significantly extend our exploration of the fundamental processes of nature. The projects include the search for the explosion mechanism of core-collapse supernovae, development of a new generation of accelerator simulation codes and simulations of quantum chromodynamics (QCD).

Seventeen projects are to develop the software infrastructure to support research collaboration using distributed resources and scientific simulation on terascale computers. Three Applied Mathematics Integrated Software Infrastructure Centers will take on the challenge of providing scalable numerical libraries. Four Computer Science Integrated Software Infrastructure Centers will address critical issues in high performance component software technology, large scale scientific data management, understanding application/architecture relationships for improved sustained performance, and scalable system software tools for improved management and utility of systems with thousands of processors. Four national collaboratory, two middleware, and four network research projects will have general applicability and will seek to research, develop, deploy and refine the underpinning software environment that will enable innovative approaches to scientific computing through secure remote access to shared distributed resources, large-scale transfers over high-speed networks and integration of collaborative tools with the researcher's desktop.

The projects involve collaborations among 13 DOE laboratories and more than 50 colleges and universities. DOE laboratories receiving funds are: Ames Laboratory; Argonne National Laboratory; Brookhaven National Laboratory; Fermi National Accelerator Laboratory; Lawrence Berkeley National Laboratory; Lawrence Livermore National Laboratory; Los Alamos National Laboratory; Oak Ridge National Laboratory; Pacific Northwest National Laboratory; Princeton Plasma Physics Laboratory; Sandia National Laboratories; Stanford Linear Accelerator Center; and Thomas Jefferson National Accelerator Facility. Universities receiving funds are: Auburn University; Boston University; California Institute of Technology; Carnegie

Mellon University; Clemson University; Colorado State University; Florida Atlantic University; Georgia Institute of Technology; Indiana University; Iowa State University; Massachusetts Institute of Technology; Michigan State University; New York University; North Carolina State University; Northwestern University; Ohio State University; Oklahoma State University; Old Dominion University; Princeton University; Rensselaer Polytechnic Institute; Rice University; Rollins College; Rutgers University; Scripps Institute (UCSD); Stanford University; State University New York at Stony Brook; Stevens Institute of Technology; University Corporation for Atmospheric Research; University of Arizona; University of California-Berkeley; University of California-Davis; University of California-San Diego; University of California-Santa Barbara; University of California-Santa Cruz; University of California-Los Angeles;University of Chicago; University of Colorado; University of Delaware; University of Georgia; University of Illinois; University of Illinois at Champaign-Urbana; University of Iowa; University of Maryland; University of Michigan; University of North Carolina; University of Quebec (Canada); University of Southern California; University of Tennessee; University of Texas at Austin; University of Utah; University of Washington; University of Wisconsin-Madison; Utah State University; and Wellesley College. For a complete list of SciDAC awards, principal investigators and project descriptions, see: http://www.sc.doe.gov/

About UC Santa Barbara

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