*NREL's Pete Sheldon*

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# Research Highlights . . .

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## Telomere crisis: A crucial stage in breast cancer

Researchers have established that "telomere crisis" is an important early event in the development of breast cancer, and that its occurrence can be identified with precision. In all cells, telomeres on chromosome ends regulate replication. Crisis occurs if telomeres become too short and damage-control mechanisms activate to kill unstable cells. Occasionally cells in a milk-collecting duct proliferate excessively (hyperplasia) and, rarely, may escape cell death, survive the telomere crisis, and go on to form the first stage of breast cancer (carcinoma in situ). Joe Gray, director of the Life Sciences Division at DOE's Berkeley Lab and a professor at the University of California at San Francisco, led the research team.

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## A new view from the top at Fermilab's CDF?

The production of top-antitop quark pairs at DOE's Fermilab Tevatron provides a unique arena for tests of the Standard Model and searches for new particles‹including a possible t_ particle, heavier than the top quark but with similar decay signatures. A team at the CDF collider detector, from Fermilab, Ohio State, and Rutgers, has measured the rate of top-antitop production in events with a high-energy electron or muon and three or more jets, using only the total transverse energy variable ("HT") to distinguish top events from background. A fit of the observed HT distribution to a combination of W+jets, top-antitop, and t'-anti-t' events rules out a t' quark with mass similar to the top quark. But with more data, the team will search for t' with ever-higher masses.

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## Computer tool to save archaeological treasures

A new geographic computer system sifts through mounds of data to help find and map archaeological sites at the DOE's Idaho National Engineering and Environmental Laboratory, in an effort to protect artifacts—from 12,000-year-old mammoth bones to 150-year-old pioneer homesteads—on its 890-square-mile site. To help archaeologists save time, money, and maybe some digging, computer scientists created software that links historical, anthropological, and archaeological databases with Geographic Information System technology. A mathematical model even suggests sites for exploration—using information such as rivers and old travel routes to guess where hunter-gatherer families may have left behind tangible traces of their lives.

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## 'Starfish' form on quasicrystalline substrate

Researchers at DOE's Ames Laboratory have discovered starfish "dwelling" at specific sites on the surface of quasicrytalline substrate. Using thin-film techniques to deposit an atoms-thin layer of aluminum on a clean, quasicrystalline substrate, they've found that clusters of five atoms of aluminum that gather in a star shape around 2 Å-deep holes in the surface of the materials. At this point, it's not clear if a sixth atom locates in the center hole. "The surface is dictating the nucleation," says Ames Laboratory senior chemist Pat Thiel, "and the pentagonal symmetry is not what the aluminum atoms would adopt in the bulk." The discovery holds promise in helping develop nano-scale materials with quasicrystalline properties.

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# Hotter summers in store for California, but there is a choice

In 100 years, summers in Los Angeles may be as scorching as summers in the Mojave Desert. But it doesn't have to be that way, according to a team of 19 scientists that includes Norman Miller and Larry Dale of DOE's Lawrence Berkeley National Laboratory.

In a study published in the August 16th issue of the Proceedings of the National Academy of Sciences, the research team predicted that Californians could experience substantially hotter summers by the end of the century, which may lead to an increase in heat-related deaths and water and energy shortages. Just how hot depends on what's done between now and then.

***In addition to hotter summers, global warming could lead to a significant decline in the Sierra snowpack, which would fundamentally disrupt California's water rights system.***

The researchers analyzed two greenhouse gas emission scenarios recently presented by the Intergovernmental Panel on Climate Change, a United Nations-formed organization that informs the world's policymakers on climate change and impacts. One scenario assumes an energy-use trajectory similar to the present course, meaning rapid introduction of new technologies, extensive economic globalization, and a fossil-intensive energy path. Under this scenario, there may be six times the 1990 levels of carbon dioxide in the atmosphere by 2100, causing summer temperatures in California to soar as high as 18 degrees Fahrenheit above current temperatures.

The other scenario takes into account the adoption of green alternatives such as fuel-efficient technologies, a stronger role of local governments in fostering environmentally friendly policy, and a rapid transition to service and information economies. Under this scenario, atmospheric carbon dioxide levels peak at double 1990 levels by mid-century, then slowly decline to below current-day levels. Summer temperatures in California only rise between 4 and 5 degrees Fahrenheit by 2100.

In addition to Berkeley Lab, researchers from several universities and research institutions contributed to the study, including Stanford University, the University of California at Berkeley, and the Scripps Institution of Oceanography, and the National Center for Atmospheric Research. Katharine Hayhoe of South Bend, Indiana-based ATMOS Research and Consulting is the lead author.

***Submitted by DOE's Lawrence Berkeley National Laboratory***

# New way of doing research at NREL

***Pete Sheldon***

Pete Sheldon has been spending countless hours pouring over architectural drawings. This is new territory for Sheldon, manager of the National Renewable Energy Laboratory's National Center for Photovoltaic's Measurements and Characterization Division.

During the last couple of years, Sheldon has been wearing the additional hat of Technical Project Manager for the Laboratory's new Science and Technology Facility (S&TF). This role has him, among other things, scrutinizing construction plans and timelines for the benefit of future research on solar cells, thin-film materials and nanostructures.

"This new facility will support research on thin-film photovoltaics and nanostructures in an environment designed to be a laboratory research facility first and foremost," Sheldon said. "Going into this project, our emphasis was on designing a state-of-the-art research facility with flexible laboratory space. The facility was designed around an innovative process integration concept that ultimately will reduce the time it takes to move technologies from the lab to the marketplace."

The centerpiece of the building will be the Process Development and Integration Laboratory (PDIL) – 10,170 square feet of laboratory space specifically designed to accommodate a new class of thin film photovoltaics deposition, processing and characterization tools. The process integration concept, proposed by Sheldon, will allow researchers to pass samples between equipment in a controlled way, avoiding contamination from the air. The PDIL also will allow a scientist to integrate control systems and databases in such a way that someone who is growing a sample can see results of a measurement and vice versa.

The S&TF will support new ways of doing research on several of the technologies highlighted in President Bush's National Energy Policy, including next-generation energy technologies such as hydrogen and fuel cells.

***Submitted by DOE's National Renewable Energy Laboratory***