Pat Thiel
DOE's Ames Laboratory

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Research Highlights . . .

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Magnetic Refrigeration Makes a Cool Debut at the Ames Laboratory

Future refrigerators may owe their "cool" to a scientific discovery at DOE's Ames Laboratory in Iowa. Scientists Karl Gschneidner and Vitalij Pecharsky and their team have developed a magnetic refrigerator that uses gadolinium metal as the refrigerant material. When magnetized, gadolinium warms up; when demagnetized it cools. Heat transfer is provided by a water-antifreeze solution, eliminating harmful CFCs, HCFS or ammonia used in today's refrigerators/ freezers and air conditioners. A test refrigerator has operated approximately 1,200 hours, achieving 20 to 100 times greater cooling power than other magnetic refrigerators. Additional testing of the intermetallic compound, gadolinium-silicon-germanium, demonstrates even greater cooling power than gadolinium.

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Sunscreens That Stop Sunburn Don't Always Prevent Skin Cancer

Just because a sunscreen protects you from sunburn doesn't mean it will prevent all skin cancers, a researcher from DOE's Brookhaven National Laboratory in New York reported at the annual meeting of the American Association for the Advancement of Science. In fact, says noted radiation effects researcher Richard Setlow, the use of sunscreens that don't block both kinds of ultraviolet light in sunlight - known as UV A and UV B - may actually be partly to blame for the steady five percent annual rise in melanoma rates among whites. Setlow's research on sun-sensitive fish shows that UV A packs 90 percent of sunlight's melanoma-causing effect.

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Fermilab Scientists Discover the Last Meson

Fifty years after the discovery of the first meson, DOE's Fermilab (Illinois) scientists, speaking at a March 5 laboratory seminar, announced the discovery of what is likely to be the last of these subatomic particles. The newly minted B_c meson consists of a bottom quark and a charm antiquark. Of the 15 possible quark-antiquark combinations that make up the mesons, only this one remained still at large–until now. Despite the B_c's mere picosecond lifetime, its discoverers from the CDF (for Collider Detector at Fermilab) collaboration said the particle is a very useful structure for studying quarks, antiquarks and the strong forces that bind them.

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Argonne-developed Process Makes Low-cost, Environmentally-friendly Solvents

Millions of pounds of toxic industrial solvents could be replaced by environmentally friendly solvents, thanks to a new cost-cutting process developed at DOE's Argonne National Laboratory in Illinois. Argonne has reduced the cost of producing ethyl lactate by dropping the number of steps needed to manufacture the solvent. The major breakthough, however, is a new, patented purification-separation system which increases the purity of the product from 60 percent to nearly 100 percent. NTEC, Inc. of Mount Prospect, Ill., is developing a commercial demonstration plant that will produce about 10 million pounds of ethyl lactate each year. The research was funded by DOE's Office of Industrial Technologies.

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DOE Pulse highlights work being done at the Department of Energy's national laboratories. DOE's laboratories house world-class facilities where more than 30,000 scientists and engineers perform cutting-edge research spanning DOE's science, energy, national security and environmental quality missions. ***DOE Pulse*** is distributed twice each month. For more information, please contact Jeff Sherwood (jeff.sherwood@hq.doe.gov, 202-586-5806).

Collaboration: ESnet - A Unique Jewel in the Global R&D Community

As recently as 15 years ago, researchers at such far-flung Department of Energy facilities as Jefferson Lab in Newport News, Virginia, and Berkeley Lab in Berkeley, California, would have had immense trouble sharing data via computer or using computer time at one another's facilities. Delays in data transmissions, unreliable connections, and incompatible networks plagued the researchers. That's where DOE and its Office of Energy Research (OER) stepped in. A state-of-the-art "backbone" network, that is, a network that interconnects other networks, was created and funded by OER to support multiple-program, open scientific research within the country and around the world. This Energy Sciences Network — or ESnet — has become a leader in Internet design and innovation, and provides a major piece of the "Information Superhighway" in the United States.

ESnet's mission is providing a highly capable and reliable communications infrastructure with leading-edge network services to the researchers at ER laboratories. The program maximizes advanced network and distributed computing capabilities needed for forefront scientific research, thus enhancing national competitiveness and accelerating development of future communication and computing technologies. Participating DOE programs and their partners actively contribute to enhance their computing and research capabilities.

Managed through its operations center at Berkeley, ESnet is truly collaborative in nature and involves all of the R&D national laboratories and a number of other DOE supported sites. In terms of participating sites, ESnet represents one of the DOE's largest and most successful collaborations. Argonne National Laboratory and Jefferson Lab have specific steering and coordinating committee roles. ESnet ventures in the support of critical infrastructure have been very successful; they include an effective standard for interfacing multiple internet networks, video-conferencing, collaboratory tools and a distributed computing environment allowing scientists at multiple sites to collaborate for computing.

By providing the infrastructure for effective and economical remote collaboration among researchers, ESnet is playing a vital role in DOE research activities, including, for example, the successful search for the Top Quark at Fermilab. During the search, the remote Top Quark collaborators conducted face-to-face meetings without leaving their home institutions using the video-conferencing capabilities of ESnet. The collaborators also collected Top Quark experimental data from Fermilab at their own places of work, saving on travel dollars, and shared their results and analysis with each other, all via ESnet.

Seamless access by scientists, engineers, and university-based researchers to DOE's unique world-class accelerator, fusion, environmental, energy, computational and related facilities have been made possible through the collaborative efforts of the ESnet community. ESnet has saved time and money, and improved communications and the quality of research by providing better networking and computing power. The complex interactions of all of these services are overseen by an effective, efficient committee structure whose hallmarks are cooperation and synergy. Indeed, ESnet is a shining example of how labs and the Department of Energy work together for a common goal - sharing ideas and information.

Visit the ESnet website at http://www.es.net

Submitted by Ernest Orlando Lawrence Berkeley National Laboratory and Thomas Jefferson National Accelerator Facility.

Bring Us More Pat Thiels

Pat Thiel's research for the Department of Energy literally keeps her on top of things. For 15 years she has investigated the activities of atoms and molecules that exist at the surfaces of materials.

Thiel directs the Ames Laboratory's Materials Chemistry Program and is also a professor of chemistry at Iowa State University. She's passionate about her field of surface chemistry, an emotion betrayed by the exuberant smile that spontaneously appears when she's asked to talk about her work. And that work could potentially affect many current technologies and several yet to come. For as Thiel might gently remind us, everything has a surface, and surfaces can get a lot of abuse.

Currently, Thiel is most enthusiastic about her group's work on the surface properties of quasicrystals, a class of metal alloys with an exotic atomic structure, which is associated with an unusual array of physical properties. These properties, such as high hardness and low coefficients of friction, are promising for some industrial applications. Thiel is focusing on those properties which relate to surface phenomena, but is also laying a fundamental groundwork for thinking about surfaces of quasicrystals. Another area of intense activity for her group is the dynamics by which metal surfaces rearrange or "heal" with time. For example, she and her co-workers discovered that large metal clusters containing hundreds of atoms can diffuse long distances over the surface, intact.

Through her dedicated and diligent work, Thiel has earned her well-deserved status as one of the best surface chemists in the world. If Ames Lab Director Tom Barton could clone a few chemists, Pat Thiel would definitely be among the chosen. "Pat represents creativity in research, excellence in teaching and is an outstanding model for women in science," he says. "Bring us more Pat Thiels."

Submitted by Ames Laboratory