Ames Lab's Adam Kaminski

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# Research Highlights . . .

DOE Pulse

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## Making it possible to search for life on Mars

Scientists at DOE's Idaho National Laboratory have developed a new technique that pushes the limits of our ability to find signs of life. Researchers studied jarosites, minerals common on Earth and discovered on Mars in 2004. Using Laser-Desorption Mass Spectrometry, scientists detected smaller quantities of biomolecules than with any existing method. This technique can be used on large, nonuniform samples. In addition, the "single-shot" approach doesn't average over different locations, so it allows researchers to detect a single speck of evidence for life. The results were presented in August at the Joint International Symposia for Subsurface Microbiology and Environmental Biogeochemistry. The project is funded by the NASA Astrobiology Institute's Exobiology and Evolutionary Biology program.

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## Fermilab researchers looking for $^{S}$Top signs

Scientists at DOE's Fermilab are searching for supersymmetric particles including the $^{S}$Top, the superpartner for the Top quark, which was discovered at Fermilab in 1995. Supersymmetry (SUSY) is an extension of the current Standard Model of particle physics, with superpartners for all the known particles. SUSY particles could make up part of the mysterious dark matter of the universe, and further the quest to unify the forces of nature. A first search for the $^{S}$Top at the DZero detector experiment has focused on final states of decays of the Standard Model Z boson with two muons. Although no sign of SUSY has yet been observed at low $^{S}$Top masses, a higher range of $^{S}$Top masses will soon be explored.

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## Simulating first stars

Researchers at DOE's Los Alamos National Laboratory and the University of California San Diego recently performed a massive computer simulation of the first stars in the universe. According to the model, the first star lived for 2.5 million years, ionized a huge region of space (roughly 15,000 light-years across) around where it formed, including all of the neighboring halos, and then collapsed into a black hole. The collaborators theorize that the ionization of gas in the neighboring halos actually spurs star formation by catalyzing the formation of molecular hydrogen, which allows primordial stars to form in halos that would ordinarily be too small for the process to occur.

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## Journey to the Center of the Earth, 2005

Results from KamLAND, an underground neutrino detector in central Japan, have shown that anti-electron neutrinos emanating from the earth, so-called geoneutrinos, can be used as a unique window into the center of our planet, revealing information that is hidden from other probes. "This is a significant scientific result," said Stuart Freedman, a Lawrence Berkeley National Laboratory physicist and co-spokesperson for the U.S. team at KamLAND. Measurements of uranium and thorium isotopes, the two main sources of terrestrial radiation, were found to be in close agreement with the predictions of the leading geophysical models of our planet's thermal activities.

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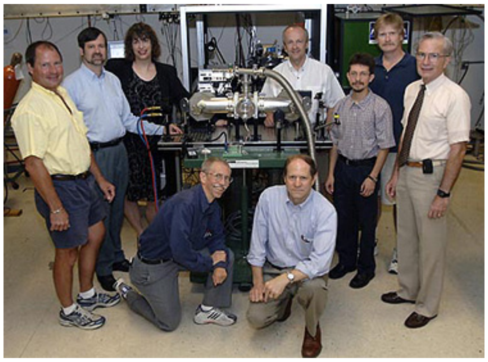
***DOE Pulse*** highlights work being done at the Department of Energy's national laboratories. DOE's laboratories house world-class facilities where more than 30,000 scientists and engineers perform cutting-edge research spanning DOE's science, energy, national security and environmental quality missions.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

# Jefferson Lab research drives technology

The Free-Electron Laser (FEL) at DOE's Jefferson Lab has shattered nearly every high-power laser record in the infrared, terahertz and ultraviolet wavelength regimes of light.



*The team includes: (kneeling, from left), George Neil, Fred Dylla and (standing, from left) Kevin Jordan, Steve Benson, Michelle Shinn, George Biallas, Carlos Hernandez-Garcia, David Douglas, and Richard Walker. The FEL is principally funded by the Office of Naval Research.*

The FEL team is composed of nine scientists and engineers who were involved in the initial design and construction of the FEL. Based on the superconducting radiofrequency (SRF) technology developed for the nuclear physics program at Jefferson Lab, the FEL generates intense beams of laser light that can be tuned to a precise wavelength and are more powerful than beams from a conventional laser.

The FEL continues to open up exciting new avenues for scientific exploration with laser light. It's being used to investigate new applications in materials science, photobiology, photochemistry and high sensitivity spectroscopy by researchers from Harvard University, the College of William & Mary and the Universitaet Goettingen, to name a few.

For instance, the FEL is capable of producing record quantities of pure, single-wall carbon nanotubes. Nanotubes show promise as an ultra-strong, super-light building material for such diverse products as nano-circuits, airplanes and bridges.

Laser treatment of skin disorders is another promising application for FEL tunable light. It may allow for the prevention of acne by the select removal of sebaceous glands, the removal of skin cancer tumors and the study of the process that causes skin cancer.

Now the team that designed, built and tested the machine has been honored for its work with an R&D 100 award from R&D Magazine. The FEL has been named one of R&D Magazine's picks for the 100 most technologically significant new products of 2005.

***Submitted by DOE's Jefferson Lab***

# The Desire to Know How

Ames Laboratory researcher Adam Kaminski was destined to become a physicist from the time he was a five-year-old in Poland and a physics teacher colleague of his mother's showed him a steam jet engine. "I took it apart to look for the springs like those that propelled my other mechanical toys, but, of course, I couldn't find any," he says.

***Adam Kaminski will lead Ames Laboratory's Physics of Toys Workshop to help celebrate the 2005 World Year of Physics.***

The young Kaminski wondered if steam could work, how else might the engine be powered. These early musings were telltale signs of a physicist in the making.

Kaminski later earned a master's degree in experimental physics, but he craved more. "I decided to look for opportunities in the United States, the unofficial capital of physics," he says.

Kaminski went on to earn a Ph.D. in physics from the University of Illinois at Chicago. His desire to know how things work was a perfect fit for his fascination with high-temperature superconductors and his efforts to determine what force or forces cause the electrons to superconduct.

"What I like most about my work is that I am given an opportunity to provide the pieces of a puzzle that with time will answer the question of how high-temperature superconductivity works," says Kaminski. His Ames Laboratory position affords Kaminski the perfect means to discover those elusive puzzle pieces. He's constructing a laboratory-based high-precision Angle Resolved Photoemission Spectroscopy system as well as working on commissioning the high flux Iowa State University beam line at the Synchrotron Radiation Center in Stoughton, Wis.

Kaminski has not forgotten that, as a child, it was the simple objects he encountered daily—his toys—that inspired his desire to know how things work. Hoping to spark a similar interest in youngsters today, he will lead an Ames aboratory 2005 World Year of Physics event—The Physics of Toys Workshop—at the Ames Public Library in August.

***Submitted by DOE's Ames Laboratory***