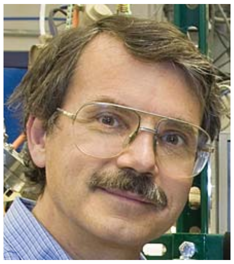

LBNL's Alex Zettl

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DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

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Research Highlights . . .

Sandia reveals role in anthrax investigation

A team of scientists at DOE's Sandia National Laboratories recently revealed their involvement in the more than six-year investigation led by the FBI surrounding anthrax spores that killed five people in the fall of 2001. Their work, using transmission electron microscopy, was the first to link the spores from several of the letters as coming from the same source and revealed that the anthrax mailed to several news media offices and two U.S. senators was not a "weaponized" form—a form engineered to disperse more readily. The information was crucial in ruling out state-sponsored terrorism and ultimately led the FBI to anthrax researcher Bruce Ivins, who committed suicide in July.

[Julie Hall, 505/284-7761, jchall@sandia.gov]

Spin origins

You'd expect that the spin of the proton would come from the spin of its building blocks. But new theory work at DOE's Jefferson Lab has shown that more than half of the proton's spin comes not from the spin of its quarks but from their orbital motion. In a paper published in the Sept. 5 issue of Physical Review Letters, JLab Chief Scientist Tony Thomas explored a theoretical model's predictions by extracting more detailed information, including how the orbital angular momentum is generated by the different quark flavors inside the proton. He found that the model is in agreement with lattice QCD calculations and with recent experimental information from HERMES and JLab.

[Kandice Carter, 757/269-7263, kcarter@jlab.org]

FGST creates first all-sky gamma-ray maps

Three months after launch, the Department of Energy and NASA have released the first images from the Fermi Gamma-ray Space Telescope (formerly the Gamma-ray Large Area Space Telescope). An all-sky map, taken with the FGST's Large Area Telescope, shows the glowing gas of the Milky Way, blinking pulsars and a flaring galaxy billions of light-years away. The map was created using only 95 hours of "first light" observations; past missions took more than a year to produce similar images. DOE's Stanford Linear Accelerator Center played a key role in assembling the LAT and now leads efforts in science operations and data processing.

[Kelen Tuttle, 650/926-2585, kelen.tuttle@slac.stanford.edu]

Cost-effective technology cleans up vadose zone

Researchers at DOE's Savannah River National Laboratory have developed a treatment technique for the vadose zone (the unsaturated zone between the land surface and the water table) that employs sustainable green chemistry to achieve a high level of sustained bioactivity and accelerated cleanup time. In "Thixotropic Gel for Vadose Zone Remediation", or VOS™, the addition of vegetable oils to the vadose zone maintains high saturation levels, sequesters the contaminants, provides food for microorganisms and stimulates biodegradation activity. The unique thixotropic nature of this gel—which means that it becomes a fluid when agitated, but resumes its gel form as it settles—allows it to form a stable suspension that will remain in place after injection into the vadose zone.

[John H. Olschon, 803/725-8125, john.olschon@srnl.doe.gov]

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).

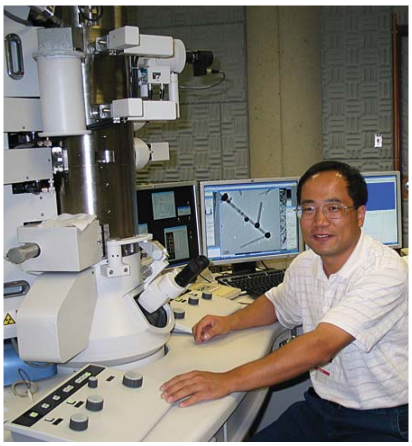
State-of-the-art microscope a lure for researchers

First of its kind in the United States, the latest generation Hitachi HF-3300 microscope is luring researchers to DOE's Oak Ridge National Laboratory.

Zhengwei Pan from the University of Georgia recently came to characterize some of the most promising materials from his latest research on new optical materials. Using the microscope, he collected incredible images of the samples he brought with him.

"It is like seeing my new born baby, very exciting," Pan said.

He has been working to synthesize optical nanowires, growing them using a new kind of catalyst. This is the first time he has been able to see how they grow, forming a complex network that may work to bridge an important gap in communications technologies. "My research can't move forward without knowing the microstructure and chemical composition of the final nanowire network, so the microscopes here at ORNL are a vital part of my studies," Pan said.



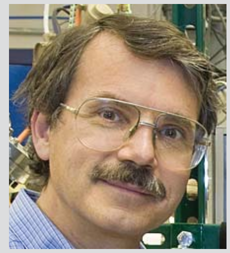
The University of Georgia's Zhengwei Pan came to ORNL to characterize promising new materials.

Researchers like Pan come to take advantage of the microscope's powerful electron beam, along with energy-dispersive x-ray sensitivity that allows them to analyze the chemical composition of spots 30,000 times smaller than a human hair, and state-of-the-art electron holography capability using not one (which is the standard), but two electron biprisms that can reconstruct the shape and profile of nanoscale structures.

"Our goal is to combine a first-rate facility plus expertise to help universities and industry perform the work they can't perform in their home institutes," said Jane Howe of the Materials Analysis User Center. "We work together with the common goals of increasing understanding, spurring discovery and solving problems in advanced materials research."

Submitted by DOE's Oak Ridge National Laboratory

Alex Zettl



Alex Zettl

Alex Zettl makes the most incredible devices you'll never see—at least not without the aid of an electron microscope. Zettl, a physicist who holds a joint appointment with Lawrence Berkeley National Laboratory (Berkeley Lab) and the University of California (UC) at Berkeley, is as close to being a modern day wizard as you will ever meet. In his laboratory, he and his research group have conjured such wonders as a motor 300 times smaller than the diameter of a human hair, a scale that can weigh individual atoms, and the world's first real nanopod—a fully functional radio made from a single carbon nanotube.

Even the most conservative seers have predicted that nanotechnology will revolutionize the production and use of materials and for over a decade Zettl has been at the forefront of nanoscale science. Working with these super hard, super strong, super useful hollow tubular macromolecules, he began by fashioning the world's smallest human-made bearings and mechanical switches, the world's smallest room-temperature diodes, and a "tube cube" electronic device with the potential to wire itself.

"To me one of the most exciting aspects of nanoscience and technology is that the best developments may not have even been thought of," Zettl says. "Like projections in the early days of lasers and integrated circuits, no matter how visionary we try to be, we will no doubt be surprised by the most successful applications that will emerge."

Zettl received his B.A. from UC Berkeley in 1978 and his Ph.D. from UCLA in 1983. Upon graduation he joined the UC Berkeley Physics Department and shortly thereafter the staff of Berkeley Lab. He is recognized as an international expert in nanoscience. However, in addition to his scientific acumen, Zettl also brings incredible enthusiasm to his research and a sheer joy in his discoveries and inventions that is out there for all to see. For example, this is what he had to say about the nanoradio.

"When I was a youngster, I got a transistor radio as a gift and it was the greatest thing I could imagine—music coming from a box I could hold in my hand!" Zettl said. "When we first played our nanoradio, I was just as excited as I was when I first turned on that transistor radio as a kid."

Submitted by DOE's Lawrence Berkeley National Laboratory