



Argonne Lab's Ian Foster

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Research Highlights . . .



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INL nuclear research contributes to advanced cancer treatments

Even with the best of modern medical treatment, Glioblastoma Multiforme kills roughly 90 percent of all patients who contract it within two years. Boron Neutron Capture Therapy (BNCT) is emerging as a promising treatment for this malignant cancer. Boron-10 has a high tendency to absorb neutrons. By attaching isotopically separated boron-10 to a biochemical agent that has an affinity for cancerous tissue, it can be ideally delivered through the blood straight to cancerous cells. When that area is exposed to a beam of neutrons, the boron-carrying cancer cells are exposed to high radiation doses and are killed. Healthy tissue ideally receives a significantly lower radiation dose.

[Teri Ehresman, 208/526-7785, teri.ehresman@inl.gov]

DZero finds evidence of rare top quark signature

A Scientists of the [DZero collaboration](#) at the Department of Energy's [Fermi National Accelerator Laboratory](#) found the first evidence of top quarks produced in a rare subatomic process involving the weak nuclear force. The [result](#) is an important test of predictions made by particle theory, such as the number of quarks that exist in nature. Up to now, scientists had observed the top quark only in processes involving the strong nuclear force. Those observations led to the [discovery](#) of the top quark at Fermilab in 1995. In the longer term, the techniques employed in this DZero analysis will allow scientists to search for the elusive Higgs boson.

[Kurt Riesselmann, 630/840-5681, kurtr@fnal.gov]

Quantum keys and unbreakable codes

Scientists at DOE's [Los Alamos National Laboratory](#) and the National Institute of Standards and Technology in Boulder have demonstrated a method for unconditionally secure quantum key distribution (QKD) over a record-setting 107 kilometers of optical fiber. The method uses a decoy-state protocol that enables the creation of cryptographic keys that are immune to even the strongest decryption attacks. QKD has emerged in recent years as a promising method of encrypting information for electronic data exchange. The researchers believe the new technology might be the basis for extending the range of unconditionally secure QKD past the current range to 250 kilometers or more.

[Todd A. Hanson, 505/665-2085, tahanson@lanl.gov]

A worm holds clues to the evolution of sex

Sex is a boon to evolution; it combines genetic material from parents to produce a unique new genome. But how did sex itself evolve? Abby Dernburg of [Lawrence Berkeley National Laboratory](#)'s Life Sciences Division and graduate student Carolyn Phillips have found a family of genes and zinc-finger proteins that help bring together chromosomes in the nematode *Caenorhabditis elegans* during meiosis, the specialized cell division that produces sperm and eggs. The genes, *him-8* for the X chromosome and *zim-1*, *zim-2*, and *zim-3* for the nonsex chromosomes, appear to have evolved rapidly from a common forerunner, offering a peek at how the [molecular mechanics of sex](#) may have developed in other organisms as well.

[Paul Preuss, 510/486-6249, paul_preuss@lbl.gov]

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Free-Electron Laser outshines competition in infrared

On October 30, the Free-Electron Laser (FEL) at DOE's [Jefferson Lab](#) set a new world record by delivering 14.2 kilowatts of high-average power infrared laser light at a wavelength of 1.6 micrometers.



This picture of the FEL team was snapped just after they achieved the first 10 kW milestone.

"This wavelength is of interest for material science applications and for naval interest in transmission of light through the maritime atmosphere," says Fred Dylla, Associate Director of the FEL Division and JLab Chief Technology Officer. In addition, the wavelength is of interest for exploring a wide range of applications, including defense and manufacturing technologies and scientific studies in chemistry, physics, biology and medicine.

The Free-Electron Laser (FEL) provides intense beams of laser light that can be tuned to a precise wavelength. "In the one kilowatt range, the FEL has broad tunability. We can tune it to produce infrared light between .7 and 4.5 micrometers," Dylla says. "Sometime in the near future, we're going to explore how far we can tune the wavelength."

The FEL team originally attained its 10 kW milestone in July 2004 at an infrared wavelength of 6 micrometers (microns, for short). The FEL group then partially dismantled the machine to upgrade it with a new highly efficient wiggler optimized for the 1.6 micron infrared wavelength and a groundbreaking set of new mirrors that can withstand the intense laser light.

The 1.6 micron wavelength of light is the least dangerous to eyes in this part of the light spectrum in case of inadvertent exposure, while also theoretically capable of effectively piercing humid atmospheres, a necessity for the Navy's goal of building a ship-based laser capable of protecting its ships from incoming missiles.

The Free-Electron Laser program is part of the Free-Electron Laser/Chief Technology Officer Division. It is supported by the [Department of Defense's Office of Naval Research](#), the [Naval Sea Systems Command](#), the [Air Force Research Laboratory](#) and the Joint Technology Office; and by the Commonwealth of Virginia.

Submitted by DOE's [Jefferson Lab](#)

FOSTER: GODFATHER OF GRID COMPUTING

Ian Foster of DOE's [Argonne National Lab](#) has been called a godfather – but not one of those Mafia types. Foster is godfather of grid computing, a software program that lets people share computing power, databases, and other tools securely online across corporate, institutional, and geographic boundaries without sacrificing local autonomy.



Ian Foster

Foster is associate division director for Argonne's [Mathematics and Computer Science Division](#) and is also Arthur Holly Compton Distinguished Service Professor of Computer Science at The University of Chicago. Foster's honors include the Lovelace Medal of the British Computer Society and the Gordon Bell Prize for high-performance supercomputing. He was also the winner earlier this year of the first GridWorld "Industry Leadership Award."

In March 2006, Foster was appointed director of the [Computation Institute](#), a joint project between The University of Chicago and Argonne that addresses the most challenging computational and communications problems arising from a broad range of intellectual pursuits. Research at the Computation Institute potentially affects every major scientific discipline that requires intensive computing capabilities, including disease diagnosis, weather forecasting and aircraft design simulation.

He is also Chief Open Source Strategist for [Univa Corp.](#), a spin-off company formed to commercialize Argonne research in open source Globus software, which enables grid computing. Globus technologies are used worldwide in business and science, forming the basis of several dozen national and international collaborative computing projects.

In 2003, Foster was named Innovator of the Year by R&D Magazine, and also won the Illinois Innovation Award. Silicon.com named him one of the Top 50 Agenda Setters, and MIT Technology Review named grid computing one of "Ten Technologies that Will Change the World."

His research is funded by the Department of Energy and the [National Science Foundation](#) to advance the national, economic and energy security of the United States and to promote the progress of science and technological innovation.

Submitted by DOE's [Argonne National Laboratory](#)