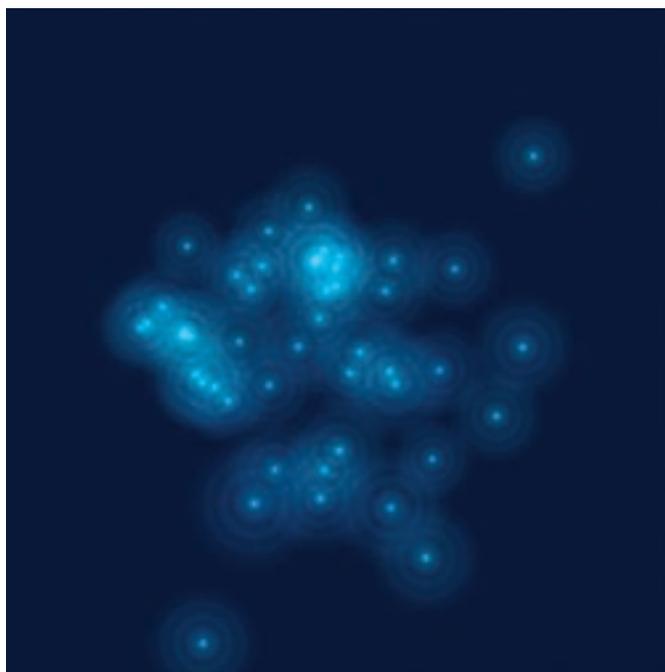
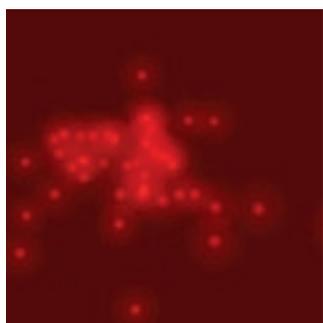
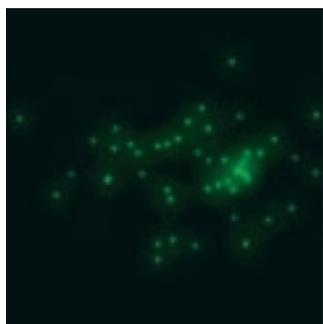


## signal to background

Not just about aliens anymore; life among physics tribes; Spartan software; connecting with Africa; the LHC by mail; penguins and particles; two new directors.



As a volunteer's computer cranks out calculations for LHC@home, it displays a screensaver with an artist's impression of the evolving particle beam. *Images courtesy of LHC@home*

### Computers take on more than aliens

They started out scanning the cosmos for signs of extraterrestrial intelligence with SETI@home. They've plotted chess moves, battled malaria, and folded proteins, all from their home computers. Now, volunteers are tackling particle physics with LHC@home.

It's one of a number of distributed computing projects that allow you to download scientific data for your computer to analyze when it would otherwise be sleeping. The Search for Extraterrestrial Intelligence launched the first @home project in 1999 with screensaver software that searched for signs of life amid radio signals from space. Today, users can choose from more than 20 @home options.

The LHC@home software simulates particles cruising along the Large Hadron Collider ring, currently under construction

at CERN, the European particle physics lab in Switzerland. In this case, all that number crunching helps scientists determine how to position the magnets that control the proton beam.

Since 2004, when LHC@home hit the Internet, 40,000 users have registered, logging in from more than 100 countries. Combined, they have put in 3000 years' worth of computer time. But they're still hungry for more data.

"We have very eager users who want to be running their computers red-hot 24/7," says Alex Owen, manager of the project, which recently moved from CERN to Queen Mary, University of London.

To feed the volunteers' voracious appetites, Owen and co-manager Neasan O'Neill plan two new projects for LHC@home in early 2008. The Garfield program will test drift chambers, and Rivet will compare online

data warehouses with newer data sets.

Users can also organize into teams and compete for top ranking. SwissTeam.net holds the lead with nearly 5.5 million "credits"—a measure of CPU power donated to LHC@home.

Team founder Dominique Bugmann, an IT specialist in Baden, Switzerland, manages more than 100 computers running LHC@home and other distributed computing projects.

"One of the great things about LHC@home is that what we do directly helps the scientists," Bugmann says. "I can help the world just by running software on some PCs."

### Amber Dance

### Life among the physics tribes

Meeting in CERN's Restaurant 1, anthropologist Arpita Roy of the University of California, Berkeley is quick to declare that she will not be having any

Photos courtesy of Arpita Roy



more coffee today. She has begun drinking multiple cups per day as she meets with CERN physicists to learn about their work. "Going native" over the last two months, she has not yet acclimated to her increased caffeine intake. Nevertheless, she intends to stick it out until she has observed experimenters taking data, even if it takes another year.

"I'm interested in how social convention or custom enter the objective world of physics," Roy says. For example, the use of "right-handed" and "left-handed" to describe the parity of particles can be seen as a link from concrete, observed reality to the abstract workings of the mind. To study this topic more closely, she plans to work with physicists from the LHCb experiment, since parity is one of the key topics they will investigate.

Roy also examines the assumptions made by particle physicists and the effects of those assumptions on their results. She is interested, for instance, in the criteria that the ATLAS Trigger Data Acquisition group use for deciding which particle collisions are interesting enough to record, and which to throw out. The choice requires

physicists to predict the signatures of collisions that might produce new particles. If they chose different signatures, they would record a completely different set of events.

In an experience common to anthropologists around the world, Roy struggles to find members of the tribe who take an interest in her work and are willing to help, and is grateful to physicists who spare an hour or two to talk with her. Her research, like the Large Hadron Collider project itself, offers little in the way of immediate gain to those who have invested in it. Rather, it serves primarily to enrich our understanding of how scientists measure and describe the world.

**Katie McAlpine, CERN**

**Spartan software**

Every time Fermilab scientist Tom Schwarz starts up SpartyJet, he inwardly grimaces.

The computer program works well. It does a fine job of finding and recording jets—sprays of subatomic particles that emerge from collisions involving protons.

But as a graduate of the University of Michigan, Schwarz finds one thing irritating: The software was named for Sparty, a Spartan warrior and the mascot of rival Michigan State University. The two universities battle for student enrollment, academic prowess, and success on the football field.

The software was created last fall by a group led by Michigan State professor Joey Huston, who collaborates with

Schwarz on Fermilab's CDF experiment. "Joey chose that name just to goad me," Schwarz says jokingly.

Part of the credit for developing SpartyJet goes to yet another Spartan—Michigan State undergraduate student Kurtis Geerlings.

"It is unusual for an undergraduate to be able to create cutting-edge software like this, and it bodes well for him," says Huston, who invited Geerlings to join the team, along with post-doctoral researcher Pierre-Antoine Delsart from the French laboratory LAPP.

Last year, he says, Geerlings presented his work at a CDF meeting, and "everyone was sending me e-mail asking if Kurtis had committed to a graduate school yet, and could they interest him in theirs."

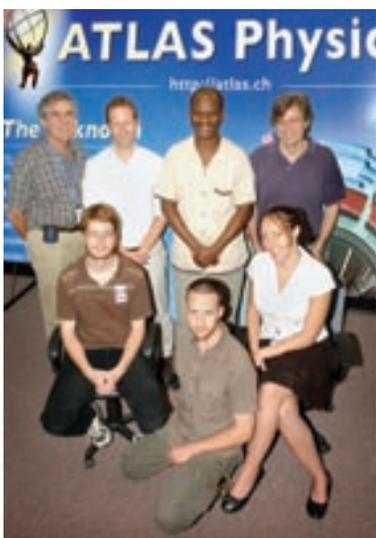
Geerlings says that as an undergraduate not burdened with PhD research, he actually had more freedom to pursue his interest in SpartyJet.

As for the name, he says it's a good thing: "I got sick of referring to it as 'the anonymous program' or 'the program which must not be named!'"

**Haley Bridger**



Photo: Brookhaven National Laboratory



University of Witwatersrand graduate students (bottom, from left) Martin Cook, Norman Ives, and Claire Lee, with (top, from left) US ATLAS Deputy Research Program Manager Howard Gordon, Columbia University physicist Jeremy Dodd, Brookhaven physicist Ketevi Assamagan, and US ATLAS Research Program Manager Michael Tuts.

## Connecting with Africa

ATLAS, a particle physics experiment at CERN's Large Hadron Collider, boasts 2000-plus members from 35 countries. But on a map showing where those members come from, one continent is almost mark-free: Africa.

Leaders of ATLAS are trying to change that.

This summer, three graduate students from the University of Witwatersrand in South Africa came to the United States for a 10-day tour and a workshop on the Open Science Grid, which will help US scientists analyze the huge amount of data collected by the ATLAS experiment.

At Brookhaven National Laboratory on Long Island, New York, Claire Lee, Norman Ives, and Martin Cook met with physicist Ketevi Assamagan and his colleagues (photo). Brookhaven is the central hub for distributing ATLAS data among US physicists.

"Prior to this trip, all we really knew about the Grid is that it's a bunch of computers put together," says Cook. At the Grid workshop in Nebraska, he and his fellow students learned how to install software back at their home university and how to use various data analysis techniques.

They also talked with scientists about how their university might fit into the ATLAS collaboration. So far it includes just one African country—Morocco.

"We don't want them to just disappear in this massive collaboration," says Assamagan. "We

want them to find some specialty that will make them visible."

**Kendra Snyder, Brookhaven National Laboratory**

## The LHC by mail

Each year the European laboratory CERN welcomes tens of thousands of visitors. Now the lab can visit them back.

Last summer, the French postal service of the Pays de Gex issued a set of pre-paid envelopes featuring the laboratory, which straddles the French-Swiss border. A second set of 10 envelopes, produced in collaboration with the laboratory and this time highlighting its Large Hadron Collider, went on sale at five post offices on November 12.

Each envelope in the new series focuses on a technical aspect or spin-off of the LHC. Some sets even contain a small sample of the superconducting cable used in the LHC magnets.

If you are not lucky enough to receive one of the envelopes in your mailbox, don't despair. You can learn more about the LHC at the Web address printed on the envelopes, [www.cern.ch](http://www.cern.ch).

**Kurt Riesselmann**

Image: CERN



## Penguins and particles

'Tis the season for science at the bottom of the Earth. Researchers are flying to the South Pole from all over the globe to take advantage of the "warm" summer months, when temperatures average minus 35 degrees Fahrenheit.

This year, San Francisco's Exploratorium brings their tales of science to the Internet with Ice Stories, a series of Webcasts highlighting Antarctic research. Among the tuxedoed birds and climatologists, particle physicists are building a neutrino detector called IceCube.

"Neutrino telescopes are weird; they're not what most people think of as telescopes," says Mary Miller, Ice Stories project director. "It's almost mysterious and magical."

Viewers can join the dozens of workers using hot water to drill through 2.45 kilometers of ice to place sensors in an array that will fill one cubic kilometer. The sensors detect the blue flashes generated when neutrinos collide with ice molecules. The South Pole is the prime location for the instrument because of the vast depths of pure ice.

Neutrinos may fly in from sources such as supernova explosions and black holes, and scientists plan to match neutrinos with their origins to better understand extra-galactic events. But project leader Francis Halzen, a physics professor at the University of Wisconsin, Madison, says other applications are possible and it's too early to know exactly how IceCube will contribute to science.

"We will build it; we will see what will come," he says. "Hopefully it's exciting."

Tune in to [www.exploratorium.edu/icestories](http://www.exploratorium.edu/icestories) for archived Webcasts about IceCube and the rest of the science at the coldest place on Earth.

**Amber Dance**

## New directions, new directors

Two labs on the brink of launching major projects have one more thing in common: new directors named in December.

Persis S. Drell (top photo) was named director of the Stanford Linear Accelerator Center in California—only the fourth director in the lab's 45-year history.

And the CERN council elected its next director general, Rolf-Dieter Heuer (bottom photo). He will begin his five-year term at the European particle physics lab near Geneva on January 1, 2009.

Drell joined SLAC in 2002 after 14 years as a professor of physics at Cornell University in New York, and served in a number of senior positions there. But her roots at SLAC are much deeper: Her father, Sidney Drell, was a deputy director of the lab.

She's already launched a major reorganization and established her vision of SLAC as "one lab," in which all research programs are united under one management system and benefit from multidisciplinary collaboration. Drell will also guide the lab through a major transition in which the two-mile-long linear accelerator, after more than 40 years of providing beams for particle physics, will in 2009 become the injector for the Linac Coherent Light Source, the world's first hard X-ray free electron laser.

"The science delivered by the LCLS, along with programs in particle physics, photon science, and particle astrophysics and cosmology, will ensure frontier science from the laboratory for decades to come," Drell said.

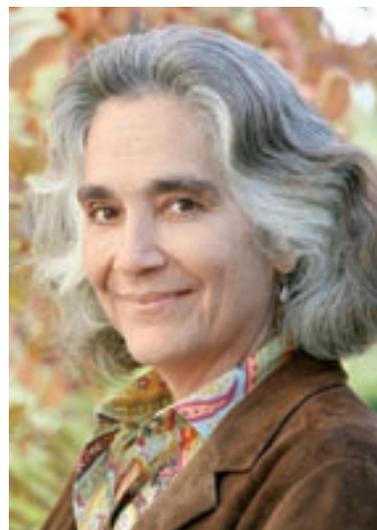
Heuer will take his new post at CERN just months after the start-up of the Large Hadron Collider, by far the world's most powerful particle accelerator. Currently research director for particle physics at DESY laboratory in Hamburg, Germany,

Heuer spent 14 years at CERN. For four of those years he was spokesperson for OPAL, one of the major experiments on the Large Electron Positron collider.

While the LHC should be running by the time Heuer is handed the baton by current Director General Robert Aymar, his main concerns will be getting the machine to operate smoothly and seeing that data analysis is handled efficiently.

"This is a very exciting time for particle physics," Heuer said. "To become CERN's director general for the early years of LHC operation is a great honor, a great challenge, and probably the best job in physics research today."

**Glennnda Chui, SLAC, and Katie McAlpine, CERN**



Photos: SLAC and CERN

## What's in a name? Parsing the 'God particle,' the ultimate metaphor

By Dennis Overbye

We need to talk about the "God particle."

Recently in *The New York Times*, I reported on the attempts by various small armies of physicists to discover an elementary particle central to the modern conception of nature. Technically it's called the Higgs boson, after Peter Higgs, an English physicist who conceived of it in 1964. It is said to be responsible for endowing the other elementary particles in the universe with mass.

In a stroke of either public relations genius or disaster, Leon M. Lederman, the former director of the Fermi National Accelerator Laboratory, or Fermilab, referred to the Higgs as "the God particle" in the book of the same name he published with the science writer Dick Teresi in 1993. To Dr. Lederman, it made metaphorical sense, he explained in the book, because

the Higgs mechanism made it possible to simplify the universe, resolving many different seeming forces into one, like tearing down the Tower of Babel. Besides, his publisher complained, nobody had ever heard of the Higgs particle.

In some superficial ways, the Higgs has lived up to its name. Several Nobel Prizes have been awarded for work on the so-called Standard Model, of which the Higgs is the central cog. Billions of dollars are being spent on particle accelerators and experiments to find it, inspect it, and figure out how it really works.

But physicists groan when they hear it referred to as the "God particle" in newspapers and elsewhere (and the temptation to repeat it, given science reporters' desperate need for colorful phrases in an abstract and daunting field, is irresistible). Even when these physicists approve of what you have written about their craft, they grumble that the media are engaging in sensationalism, or worse.

Last week a reader accused me of trying to attract religiously inclined readers by throwing out "God meat" for them.

It was not the first time that I had been accused of using religion to sell science. Or was it using science to sell religion?

Last year, I described the onset five billion years ago of dark energy, the mysterious force that seems to be accelerating the expansion of the cosmos, with the words "as if God had turned on an antigravity machine."

More people than I had expected wrote in wanting to know why I had ruined a perfectly good article by dragging mythical deities into it.

My guide in all of this, of course, the biggest name-dropper in science, is Albert Einstein, who mentioned God often enough that one could imagine he and the "Old One" had a standing date for coffee or tennis. To wit: "The Lord is subtle, but malicious he is not."

Or this quote regarding the pesky randomness of quantum mechanics: "The theory yields much, but it hardly brings us closer to the Old One's secrets. I, in any case, am convinced that He does not play dice."

With Einstein, we always knew where he stood in relation to "God"—it was shorthand for the mystery and rationality of nature, the touchstones of the scientific experience. Cosmic mystery, Einstein said, is the most beautiful experience we can have, "the fundamental emotion that stands at the cradle of true art and true science."

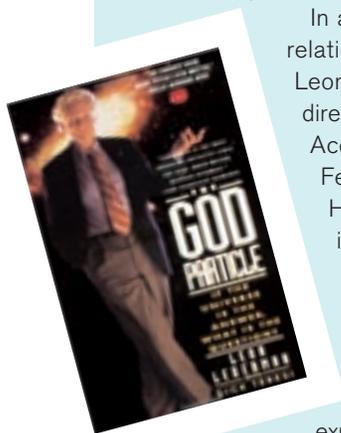
"He who does not know it and can no longer wonder, no longer feel amazement," he continued, "is as good as a snuffed-out candle."

If we didn't already have a name for the object of Einstein's "cosmic religion," we would have to invent one. It's just too bad that the name has been tainted and trivialized by association with the image of a white-bearded Caucasian-looking creature who sits in the clouds attended by harp-strumming angels.

If Einstein were around today, he would likely be scolded every other time he opened his metaphor-laden mouth for giving aid and comfort to the creationists. Indeed, the architects of intelligent design have not been shy about interpreting his aversion to divine dice playing, and a remark wondering if God had any choice in creating the world, as support for an intelligent designer. Einstein didn't mean it that way, of course. He was only using a metaphor to wonder if it was possible to build more than one logically consistent universe. That's a question that still provokes hot debate.

As it happened, Dr. Lederman's book came out about the time that creationism was on the rise in this country, and "my colleagues gave me hell," as he put it in a recent e-mail message.

Neither time nor criticism seems to have dimmed Dr. Lederman's taste for metaphor or sense of humor. Only two weeks ago, he titled an article about particle physics "The God Particle, Et Al." Well, OK, he had a book to sell.



It's not easy to stand up for a moniker as over the top as the one that Dr. Lederman used—one we are likely to hear again and again in the next couple of years as the generation-long hunt for the Higgs particle reaches a climax. But I have to applaud Dr. Lederman's spirit. Historians have suggested that it was a mistake for the antiwar movement of the 1960s to yield the flag—a powerful symbol of patriotism—to the war's supporters, and likewise I think it would be a mistake for scientists to yield such a powerful metaphor to creationists and religious fundamentalists.

The Higgs particle is not God, but as theorized it is a piece of the sublime beauty of nature that had Einstein figuratively on his knees. I can't prove it, but I can't help wondering if Einstein, a man with what the geneticist Barbara McClintock called "a feeling for the organism"—in this case the universe—was aided in his intuition by being able to personify nature in such a familiar and irreverent way.

Is there a God who worries about the flight of every sparrow? Einstein said that was a naïve and even abhorrent idea.

Do I believe the universe is a mystery? Absolutely. Is that mystery ultimately explicable? Intellectual empires from Plato to Einstein have been founded on that presumption, bold and optimistic as it is, and I wouldn't advise betting against it.

In the meantime, I wouldn't dream of depriving any future Einstein of his or her rhetorical or metaphorical tools.

Not to mention myself.

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*Dennis Overbye is a correspondent for The New York Times, which published this essay on August 7, 2007. Copyright 2007, The New York Times. All rights reserved. Reprinted with permission.*

