signal to background

The power of pi at Fermilab; DESY turns on its new free-electron laser; selling old equipment on eBay; studying the properties of spiders' webs with synchrotrons; review of *Deep Down Things*; letters.

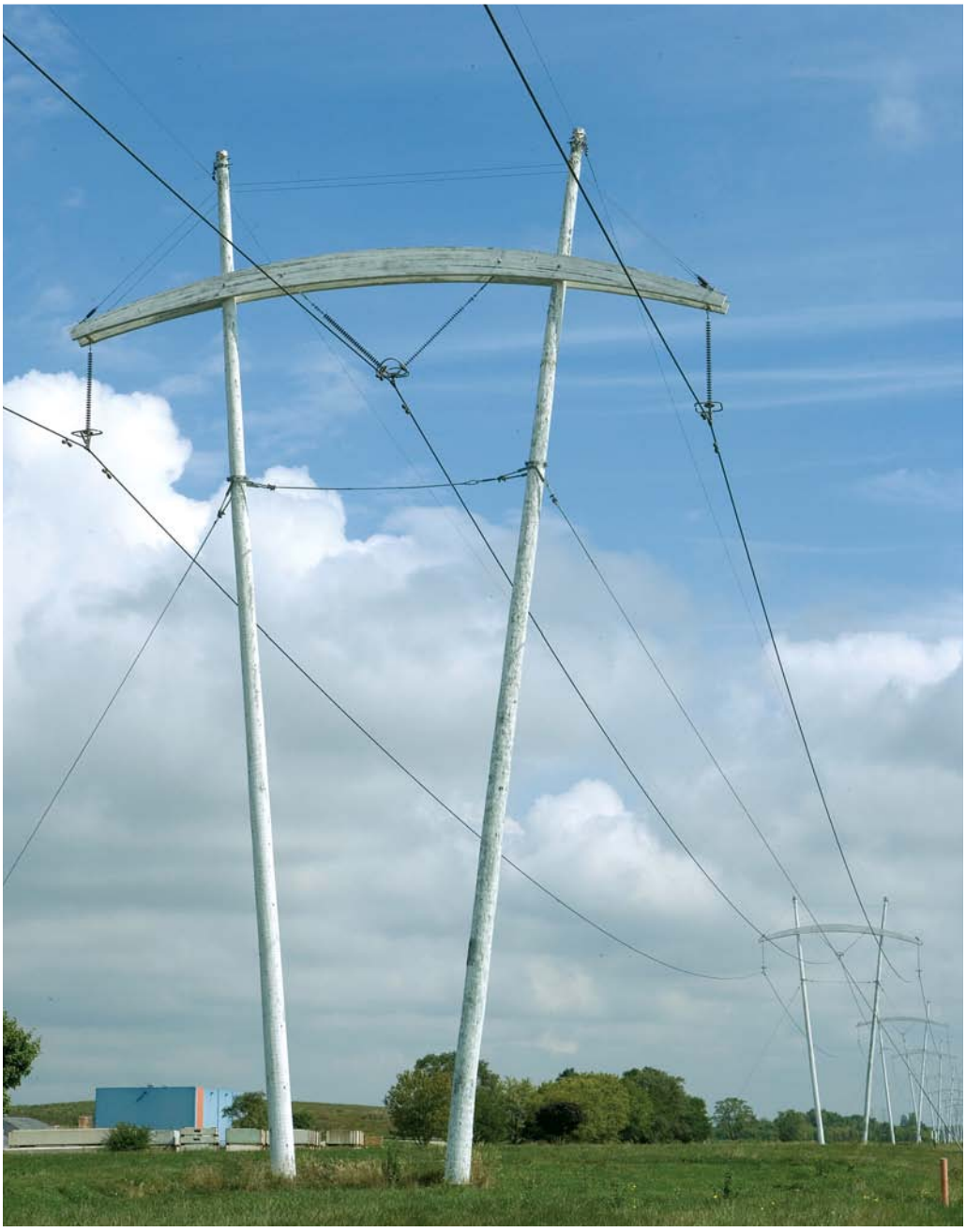


Photo: Deborah Guzman Meyer, Fermilab

The power of pi

Believe it or not, most of Fermilab's power comes from pi. Electrical power, that is, as the shape of the lab's power poles is modeled after π, the symbol for the famous number. The π-poles were designed by founding director Robert Wilson during the construction of the lab. Amazingly, the original wooden poles are still standing, over 30 years later—but not without encountering some obstacles along the way.

Because the π-poles are wooden, they are subject to infestation from insects and woodpeckers. That's why engineer Joe Pathiyil is not only in charge of power distribution for the site, but he is also on continual woodpecker duty. In

order to minimize the damage to any poles from woodpecker holes, "we fill the woodpecker holes with epoxy and put steel mesh around the area," explains Pathiyil.

While reliability and safety are important reasons to maintain these unique structures, they are not the only ones. "A lot of who we are at Fermilab is captured in our unique art and architecture," says Randy Ortgiesen, deputy head of Fermilab's Facilities Engineering Services Section. Engineering Group manager Ed Crumpley agrees, adding, "Wilson thought as a sculptor, not as an architect," when he designed Fermilab structures such as the Feynman Computing Center, the high rise that now bears his name, and, of course, the π-poles.

The π-poles are a symbol of the intellectual endeavors that take place at Fermilab, and—with protection, care, maintenance, and replacement as needed—they will continue to supply Fermilab with power for years to come.

Elizabeth Wade

VIP at DESY

He boldly pressed the red button and said, "They promised to explain to me afterwards what I am doing here exactly."

And the director kept that promise: "With this push of a button you have opened, like in a camera, the shutter to take pictures with this pioneering facility for free-electron lasers. Flashes of laser-like X-ray light are now available for science," he said.

The scene of the action: an experimental hall at DESY in Hamburg, Germany, on August 3, 2005. The actors: German Chancellor Gerhard Schröder and DESY's director-general Albrecht Wagner, facing some 50 representatives from the media. The occasion: the dedication of the world's first vacuum ultraviolet free-electron laser (VUV-FEL), a machine that sets new standards: ten million times the peak brilliance of the best synchrotron radiation sources today; coherent radiation; light pulses of only 10 to 50 femtoseconds duration; tiny wavelength, tunable from 6 to 30 nanometers.

Photo: DESY

At the dedication, Wagner, Schröder and DESY's Jochen Schneider (photo, left to right) took a walk through the VUV-FEL tunnel. During its first phase of operations, a total of 29 VUV-FEL research projects will be carried out by 200 scientists from 60 institutes in 11 countries. The experiments focus on fields such as cluster physics, solid state physics, surface physics, plasma research, and molecular biology. Demand for beam time is high, and researchers interested in many more projects are already knocking at the door.

The startup of the VUV-FEL is of great interest to the accelerator community. A main component of the 260-meter-long facility is a linear accelerator that uses superconducting radio-frequency technology, developed at DESY by the TESLA Collaboration from 1992 to 2004. The same technology is also at the heart of two even larger projects. By 2012, DESY and its international partners will build a 3.4-kilometer "FEL big brother," the European X-ray laser (XFEL). And the design of the approximately 40-kilometer-long International Linear Collider, a global project, features superconducting technology, too.

Petra Folkerts, DESY

Fermilab goes eBay

In need of a computer monitor? How about a forklift? Or maybe a sousaphone? If you are working for the US federal government or an approved agency, all this and more is available to your organization—for merely the cost of shipping a few boxes or a crate. The Web site GSAXcess.gov provides extensive listings of surplus items from various government facilities around the country, including Fermilab and other Department of Energy laboratories. "The program is like a flea market for the federal government," says Eric Mieland, of Fermilab's Environment, Safety & Health Section.

Photo: Elizabeth Clements, Fermilab

But if you need that sousaphone for your home, there is still hope. If there is no interest in the items at GSAXcess.gov, they become available for the general public to bid on, for example at gsaauctions.gov or at commercial Web sites. "If no one picks up items when they are listed on federal sites, we sell them on Bid4Assets (www.bid4assets.com) or eBay (www.ebay.com)," explains Jack Kelly, the manager of Fermilab's Property and Inventory Control Department. "We try to sell equipment before we recycle it, because it generates revenue for the lab."

Fermilab not only sells items on the Web, it also goes bargain hunting, sometimes procuring top-of-the-line equipment for little cost. Greg Sellberg of the Silicon Detector Facility's (SiDet) Micro Detector Assembly group is especially skilled at taking advantage of government surplus programs, acquiring about 90% of his equipment from them—and saving Fermilab countless dollars in the process. For example, Sellberg routinely pieces together test stations worth $100,000 with equipment he acquired for $35 in shipping costs. "I try to use government resources, especially taxpayer money, in the best possible way," Sellberg says, "and government surplus is a phenomenally good system for doing that."
Elizabeth Wade

Photo: Hwo-Shuenn Sheu, NSRRC

It's not just *Charlotte's Web*

The amazing properties of spider webs have fascinated scientists for years. Some of the mysteries of the spider's thread (such as the radii and spirals of threads produced by the *Nephila pilips* spider shown above) are unraveling through the use of synchrotron light sources. We now know that the remarkable thermal stability and the equatorial reflections of the spider's weavings are due to the crystals in the orb-web. These properties remain undiminished even over 100 degrees Celsius.

Perhaps an old Buddhist story from hundreds of years ago complements and enhances the scientific papers on this topic.

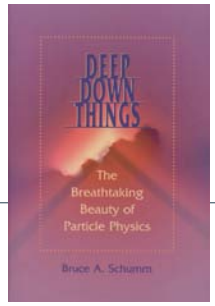
A long long time ago, a somewhat cruel thief called Gadado went straight to the place of eternal punishment after he died. The torment was unbearable and remorse arose in Gadado. One day, Buddha passed by and heard a weary sigh. Deciding to give Gadado a second chance, Buddha said, "If you manage to recall even a small favor you have done for someone, forgiveness will be granted to you." Pitifully, Gadado could recall none. As Buddha was about to leave, a tiny spider wandered toward Gadado, speaking of his kindness for once not stepping on the spider while on his way to rob some travelers. "Let your savior be saved by you." Buddha smiled at the heroic little creature. The spider climbed up the cliff and sent a very thin spider thread down. The grateful and almost jubilant Gadado held on to the thread and started moving up. Halfway up, he looked down and realized that a handful of people had clung to the fine thread below him. Worrying the thin filament might break, Gadado, who had so soon forgotten the reason for his forgiveness, kicked them down hard. "Go to hell," he said. And, to hell he also went again.

Had Gadado been a synchrotron user he might have known that a bunch of spider threads can easily pull an 11-passenger Learjet.
Diana Lin,
National Synchrotron Radiation Research Center, Taiwan

Reviewed by Mike Perricone

Deep Down Things: The Breathtaking Beauty of Particle Physics

Bruce A. Schumm
Johns Hopkins University Press, Baltimore, 2004



How deep down does Bruce Schumm want to take us? "Deep down within the atomic nucleus," he writes, "deeply within the paradoxical richness of empty space, deep inside the synapses of the great scientific thinkers of the twentieth century." An experimental particle physicist from the University of California, Santa Cruz, Schumm is a collaborator on the BaBar experiment, and previously the SLD experiment, both at Stanford Linear Accelerator Center, and is also working on International Linear Collider detector studies. Schumm writes: "Einstein held that any physical theory worthy of respect must be explicable to any clear-thinking person."

Schumm states that he intends the book for the "deeply interested public." Is his approach on target? Moving from particles to waves, on to the importance of phase, then to the irrelevance of phase in quantum mechanics, he writes, "It's not that the phase of quantum mechanical systems becomes irrelevant, but that the irrelevance of phase is understood to be, in and of itself, tremendously relevant. The rigorous formulation of this notion, known as gauge theory, is a theory of the relevance of irrelevance; within this oxymoronic inspiration lies one of the most profound intellectual leaps in the storied history of particle physics." Perhaps the best matches are well-read physics amateurs, or readers with a scientific background, not necessarily in physics.

Still, after following the complex trail of the mass-giving Higgs boson–from the concept of screening in solid state physics, through the noted 1964 paper by Peter Higgs linking screening to relativistic quantum field theory, and on to what he terms "the developing notion" of hidden gauge symmetry–Schumm knows how to get himself back in phase: crack a cold one ("Not a 'Lite' one, mind you, but a robust draft fit for the occasion") and raise a toast to Peter Higgs.

Letters

Careers in particle physics

I am a high school student in Illinois, close to Fermilab. I am very interested in a career in particle physics. I admire the efforts of the many laboratories to introduce topics of particle physics to various age groups, including mine. One problem I find myself having lately, however, is figuring out how to turn my particle physics dream into reality. With a myriad of universities, majors, and positions in laboratories, it is almost impossible to figure out where to go, what to major in, and what job to look for that pertains to my specific responsibility desires. I am sure that there are many others, like myself, who experience this problem. So, I would like to suggest an article or issue topic that is focused on teens like me, looking to enter the industry but not sure what to do. It could outline which universities to attend or majors to study in order to enter specific fields in physics. It could also describe the responsibilities of various positions in a laboratory environment. From the articles in your magazine, I can see that the particle physics field is very focused on the future. I think it would be very beneficial to give guidance now to the people who are the future of particle physics.
Tomo Lazovich, Lyons, Illinois

Editor's note: *symmetry* plans to cover this topic in the future but, for now, check out the archive of the first *Quantum Diaries* Career Week at http://blogs.quantumdiaries.org/37/ for a list of questions and answers. A second career week will be held in October.

Letters can be submitted via letters@symmetrymagazine.org

Correction: *The article "Super-fast Super-sensitive Detectors" in the September issue of* symmetry *should have read "Particle detectors have evolved from simple foil-covered plates, used by Ernest Rutherford to discover the atomic nucleus in 1911,…" rather than the mention of the discovery of the electron.*