Say it in Russian; a quick how-to; a zappy show; sporty design; radioactive people; farm-family reunion; tracking dark energy; name that particle; letters

Photo: Reidar Hahn, Fermilab

Peel and stick

Chip Edstrom routinely tidies the Fermilab Main Control Room to stay awake while working as an accelerator operator on the owl shift. One night, while cleaning equipment and peeling off decades-old labels, Edstrom decided to replace the old ones with fresh ones. In Russian.

"Considering the number of Russians in the Tevatron department at the time, it seemed like a fun idea," says Edstrom, who studied some Russian in college. "I should also mention that it was the midnight shift, which made the fun seem even better."

The labels, which mark two crucial monitors displaying the bend of the Tevatron's beamline as it moves through the tunnel, proved amusing—especially to the Russians.

Vsevolod "Seva" Kamerdzhiev is one of the many who have enjoyed Edstrom's creative grammar. On the labels Edstrom had written "this is horizontal" and "this is vertical," instead of simply "horizontal" and "vertical." "The words do exist—they just wouldn't be used in a case like this," Kamerdzhiev says. The grammatical errors were easy ones to make as only the endings of the words were incorrect, thus changing their meanings.

Still, Kamerdzhiev appreciates the gesture. "The Russian labels give a nice feeling of being welcome," he says.
Kate Raiford

Wait just a minute

Berkeley Lab physicist Hitoshi Murayama and SLAC physicist Herman Winick have provided audio segments for One-Minute How-To, a Web site that provides 60-second explanations ranging from "How to write a flawless email," to "How to organize a river clean-up," to "How to stop smoking."

Murayama tells "How to Understand the Standard Model" (program #117), which he says is "probably the best theory physicists have come up with describing everything around us and everything in the universe. I would say it's one of the biggest achievements in 20th-century science, because it really describes everything we know about what things are made of, how they are put together, and how they interact with each other."

In "How to Understand X-ray Lasers" (program #113), Winick says: "We have achieved what amounts to a revolution in science because the intensity of X-ray lasers and other X-ray sources are so much greater than the normal X-ray machines that we are familiar with in hospitals and dental offices. And X-rays are a ubiquitous tool in

Photo: Reidar Hahn, Fermilab

so many branches of research; so the increase in intensity has opened up entirely new scientific areas."

The programs can be downloaded from: www.oneminutehowto.com.

Mike Perricone

Tesla in paradise

Even in the company of a two-story nose-picking machine, human cupcakes, battling robots, and power-tool drag races, the giant Tesla coil stands out.

Maybe it's the loud buzz and crackle of artificial lightning bolts, writhing like fiery serpents from the top of the thing.

Maybe it's the hint of danger: More than one million volts! Stay back behind the ropes, and turn off your cell phone!

Paulina Shearer and her brother, Andrew, watched wide-eyed, hands over their ears, as a volunteer, safely enclosed in a clunky metal suit, came forward to do battle with the flashing electrical arcs (Look folks, he's safe! Give him a hand!).

"It was cool," six-year-old Paulina said, "but kind of freaky."

The scene was the second annual Maker Faire in San Mateo, California, put on in late May by the publishers of *Make*, a magazine devoted to do-it-yourself technology projects.

Terry Schalk and Hartmut Sadrozinski, adjunct professors of physics at the Santa Cruz Institute of Particle Physics, haul the Tesla coil to schools about 10 times a year, using it to lure kids into the world of science. Their demonstrations span everything from atoms and galaxies to how particle accelerators work.

"This is just enough entertainment to catch the attention of students. It's enough real physics to actually present some meat," says Schalk, who works on experiments at the Stanford Linear Accelerator Center (SLAC). "We use it to tell them about opportunities, and also to let them see we're having fun, that there are jobs in the world where you get paid to do what you find interesting."

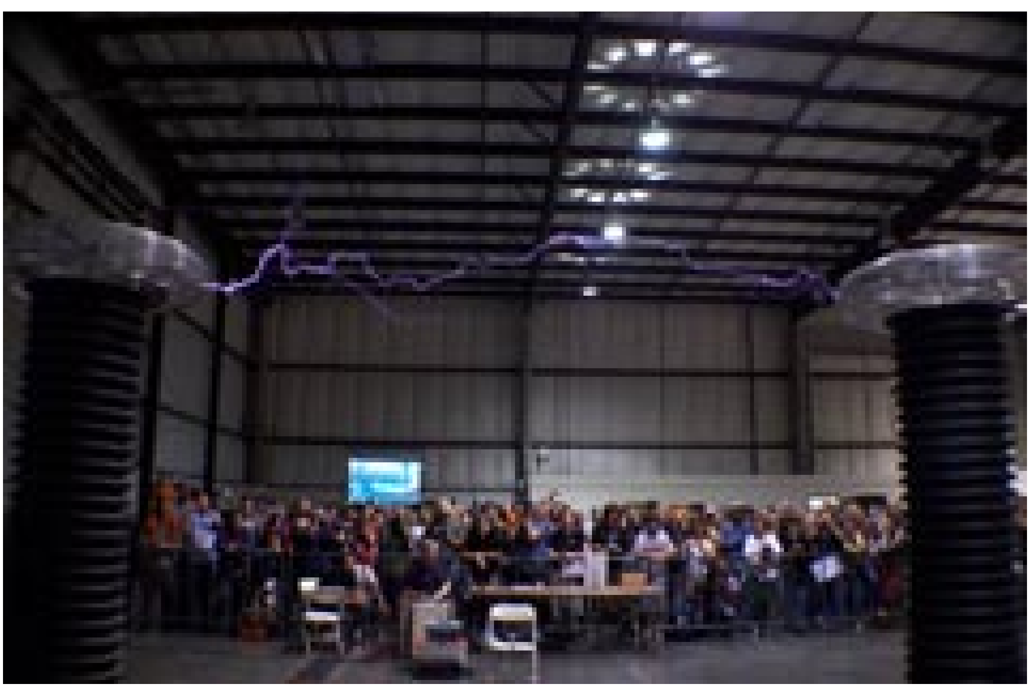
Despite the theatrics, he adds, the coil itself is not that dangerous: "I'd just as soon not get hit by it, but I wouldn't be afraid to get hit by it."

From Schalk's standpoint, the two-day stint at the Maker Faire was a big success. A lot of people came up after the demonstrations to sign up for SLAC tours, find out how to bring the Tesla coil to their school or ask about summer programs for their kids.

The Faire itself was icing on the cake—the perfect venue for a guy who, as an undergraduate, helped three friends build a working 1.5 MeV cyclotron from scratch.

"This whole show was a geek's paradise," Schalk says. "It was eye candy everywhere. I was drooling all over the LEGO train apparatus, and all over the 3D printers that make things out of sugar."

Glennda Chui



Photos courtesy of Jason Chen, Gizmodo.com

Sports car treatment for cavities

Hydroforming is used in the auto industry to mold sheets of metal—mostly aluminum alloys—into complicated shapes for high-end sports cars. Now a small team from DESY, the German national laboratory in Hamburg, has used it to create a nine-cell cavity from niobium. They hope the process will come in handy for building 16,000 cavities needed for the International Linear Collider.

Radiofrequency cavities create the electromagnetic fields that accelerate particles in a collider. The performance of the cavities, measured by the way electrons pass through them, is determined by their shape and the way they're put together.

Hydroforming starts with a niobium tube 150 millimeters in diameter. First the tube is grooved to produce the narrow parts between the cavity's bulging cells. Then it's filled to the brim with water. A hydraulic system increases the water pressure inside the tube, forcing the metal into a mold in the shape of the cavity. The finished product has walls of uniform thickness and only two seams, reducing the risk of welding flaws that can hinder cavity performance.

"We have tried many different procedures, used all sorts of tubes, simulated every eventuality until we found the perfect way," says Waldemar Singer, a material scientist at DESY. The team had a lot of support and help from the Russian Institute for Nuclear Research. Other labs are also getting in on the act; Japan's KEK is building a hydroforming machine and Fermilab is planning a similar facility.

Barbara Warmbein, ILC Global Design Effort

Those pesky humans

Lead bricks and radiation gloves normally indicate a need to protect lab workers from radioactivity. For a laboratory at the University of Alabama in Tuscaloosa, however, the opposite is true. There, a sensitive set of measurements needs to be shielded from the radiation naturally emitted by people.

The measurements are part of an experiment called EXO (the Enriched Xenon Observatory), destined for installation half a mile below ground in a New Mexico salt mine. There it will search for signs of a nuclear decay known as the neutrinoless double beta decay that researchers hope will help them pin down the mass of the neutrino.

While the experiment's deep location protects it from cosmic rays, it still has to contend with the constant chatter of natural radiation from surrounding rock and from pieces of the detector itself.

To measure this background radiation, Andreas Piepke and his team have been carefully cataloging the radiation signatures of EXO's plastic knobs, gaskets, and other components. How sensitive is the measurement equipment? The researchers had to shield the apparatus from radiation given off by their own bodies. For a typical adult, that's about 7000 becquerels—a unit that has replaced the curie as a measure of radioactivity. In comparison, a household smoke detector contains about 30,000 becquerels, and typical low-level radioactive waste about a million becquerels per kilogram. The team also had to account for the faint radiation signatures of lead bricks used to shield the components during testing.

Once all the sources of background radiation have been identified it will be easier to separate the valid signals from the noise.

Mike Wofsey, University of Alabama

Farmers' picnic

Just inside the site boundary, secluded from most of Fermilab, sits Leonard Baumann's rickety red barn. Baumann, like 55 other farmers, relocated 40 years ago to make way for the construction of Fermilab. Today, grasses have overtaken the fields and barns have been torn down, but the farming community survives.

In May, the 10th annual Fermilab Farmers' Picnic attracted nearly 100 people to celebrate their decades-old farming community. "I come back every year to see old friends," Baumann says. "We are all farmers. We're older

Illustration: Sandbox Studio

Photo: Reidar Hahn, Fermilab

than rocks." Baumann will be 85 in two weeks.

Inside Fermilab's Kuhn Barn, one of several barns still in use, visitors were treated to a spread of treats, including a farm-scene cake complete with a barn and rows of crops. Fermilab's Bob Lootens, who used to live on one of the farms, drove a group of about 10 partygoers around the lab. "I'm going to take you down memory lane," he said as the bus turned onto Holter Road inside the Tevatron's main ring.

Prairie burns have thinned out the forest, making it look as it did in the past; even the same gravel roads are there. "It's like a time capsule," Lootens says.

For the farming community, the Farmers' Picnic is a chance to reconnect with those who used to live here. Baumann looks up his friends every once in a while, and depended on them when he had open heart surgery. "They were there to support me," he said.

Flanked by relatives, Baumann pointed out people he knew from the pre-Fermilab days, including a 96-year-old woman for whom he had baled hay when he was younger. A former babysitter, Janet L. Mish, also remembered life in the rural community. "I babysat for a lot of the people who lived on these farms. I miss these people," she said.

Some from the farming community can recognize patches of grass where their barns once sat. Baumann's barn is still standing, although it is showing signs of its nearly 100 years and may have to be torn down for reasons of safety.

Kate Raiford

A tale of dark energy

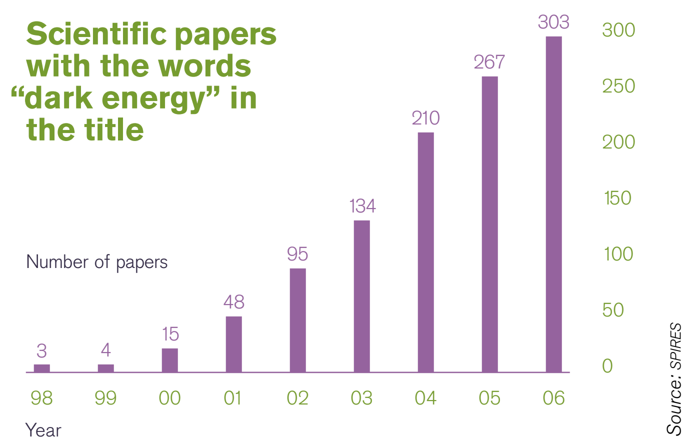
In the 1990s, astronomical observations revealed that the expansion of the universe is accelerating. Not knowing what causes this acceleration, scientists began to attribute the phenomenon to some unknown source of energy, coined "dark energy" by astrophysicist Michael Turner.

According to the SPIRES database, the first three papers to contain the words "dark energy" in the title were published in 1998: a *Physical Review D* article by Turner and Dragan Huterer; an article by Turner summarizing his talk at the Stromlo Symposium; and a Lawrence Krauss article in the proceedings of the 1998 conference on Weak and Electromagnetic Interactions in Nuclei (WEIN 98). Since then, the number of papers has increased dramatically, often doubling or even tripling from year to year. In 2006, the number of papers with "dark energy" in the title exceeded 300 (see graphic), about 20 percent more than those published in 2005.

Dark energy has captured the imaginations of physicists working in a variety of subfields represented in the SPIRES database. While the majority of dark-energy-titled papers, about three quarters, are submitted to the SPIRES astrophysics phenomenology (astro-ph) e-print archive, 1 in 10 can be found in gravity-quantum cosmology (gr-qc), another 10 percent in high-energy physics theory (hep-th) and 6 percent in high-energy physics phenomenology (hep-ph). Even the condensed matter physics (cond-mat) archive contains a paper with "dark energy" in its title.

Today, there are more than 1000 of these papers on dark energy. A look at the references these papers make to other scientific studies reveals what might be the most influential paper in dark energy research: about one-third of all papers cite "Cosmological Consequences of a Rolling Homogeneous Scalar Field," published by Bharat Ratra and P.J.E. Peebles of Princeton University (*Phys. Rev. D* 37:3406, 1988).

Heath O'Connell, Fermilab



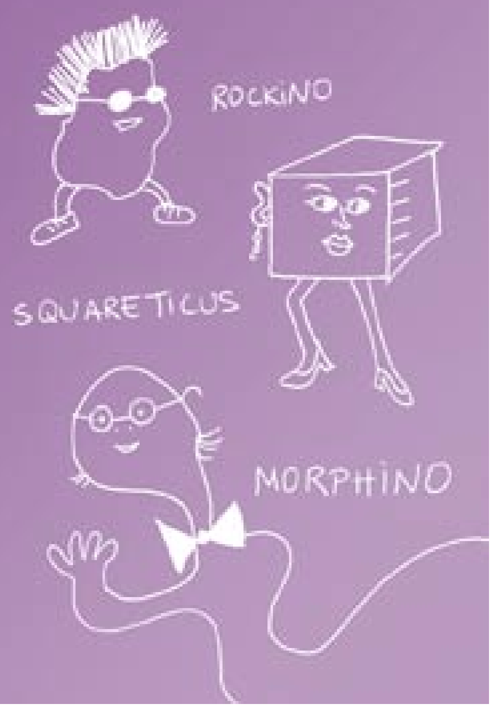
CALL TO ACTION!

The *symmetry* challenge: Name that particle

Flerbs? Marteenies?? Tom, Dick, and Harry???

Cartoonist Roz Chast has busted the field of particle physics wide open with her pioneering cover for this issue of *symmetry*. We say it's about time: Why limit ourselves to the same old list of particles that have actually been discovered, or at least properly theorized?

So here's the challenge: Invent an elementary particle and tell us what it does in 30 words or less. A drawing would be nice, but not mandatory. Send your entry to letters@symmetrymagazine.org with subject line "Contest" or mail it to the address on page 2. The winner will receive an autographed copy of Roz Chast's cover and a place of honor for their entry in an upcoming issue.



Letters

Nice ice

A recent article by scientists in Leeds and Oslo featured in CERN's "Picked Up for You" might have an answer to Terry Anderson's ice-related question in March's *symmetry*. Terry's frost picture bears a striking resemblance to the patterns formed in draining thin-film suspensions. I invite readers to take a look at the article at:
http://dx.doi.org/10.1021/la063282a
Heath O'Connell, Fermilab

Left: The roof of the car pictured in the March 07 issue of *symmetry*, courtesy of Terry Anderson, SLAC.

The little article about frost on the roof of a Honda reminded me of the photo I took of frost on my step-daughter's 1994 Honda Accord roof. I don't recall the details, except that I thought it was beautiful. Here's the photo. Thanks for a great magazine.
David Frye, Denton, NE

Aspirins in times of war

I know of the use of aspirins as water detectors (Apr 07) from my year and a half (June 70–Jan 72) in the US Army in the Republic of South Vietnam on the receiving end. I heard from people who had been there in the late 1960s that it had been used then as well. Perhaps the engineers and technicians using aspirins to detect water seeping into accelerators had been or knew someone who had been in Vietnam.

Because American counter-battery artillery fire was so effective, the North Vietnam army did not want to be around when the rocket launched. Therefore, they would bring rockets down from North Vietnam and gather launching supplies locally: bamboo to make launch platforms; old batteries, wire, and aspirins to launch the rockets. Crossed wires separated by an aspirin were used as a switch. It rains often in South Vietnam in the monsoon season and even in the dry season there is enough humidity close to the ground to break down an aspirin in a few days.
Randolph Herber, Fermilab

Black holes for beginners

I read the nice article by Jennifer Ouellette "Beginner's mind" in the March 2007 edition with great interest.

Based on current information I do not understand why the production of a mini black hole produced at the Tevatron or LHC, which is mentioned as a very well chosen example by Ouellette, does not pose any safety risk. Can the possibility be ignored in the safety planning of these labs?

I hold a PhD in particle astrophysics and read all original technical literature pertaining to this risk that I could find (including the safety reports on this subject prepared at BNL and CERN in 2000 and 2003). To some of my friends without a physics background the whole issue must appear even more threatening. A recent made-for-television movie (The Black Hole, USA, 2006) about a collider catastrophe might contribute to public concerns.

May I respectfully ask whether the particle physics community plans to rise to Ouellette's challenge and commission some of its members to explain the reasons for the absence of the potential risk mentioned by Ouellette to an audience with a "Beginner's mind"?

Rainer Plaga, Bonn, Germany

The editors respond: CERN has a document addressing this topic, available on its public Web site at: http://public.web.cern.ch/Public/Content/Chapters/AboutCERN/CERNFuture/LHCSafe/LHCSafe-en.html or http://tinyurl.com/2ya8pk

More famous undercited physicists

The numbers on citations and all listed by Heath O'Connell (Mar 07) are exceedingly interesting! The general phenomenon has been known to people working in scientometrics for many decades, and is called "incorporation." I also rediscovered it, about 20 years ago, in connection with astronomical entities like the Schwarzschild solution, Weber bars, and von Zeipel's theorem. Not then knowing that it was a well-established concept, I coined the name "second order Mossbauer effect" (meaning that many folks used and use Mossbauer spectroscopy, but rather few cite him).

Virginia Trimble, Past Chair,
APS Forum on History of Physics

Cooking up Improvisation

The article (Apr 07) on improvisation in experimental physics was a fascinating one. Along the same lines, I heard that at Cornell (I think), and probably at least one other accelerator, Revereware—copper-bottomed steel cookware—was used to avoid having to make copper to steel welds. Instead a hole was cut in the copper bottom of the cookware, and that was welded to copper pipe. Then the steel top was welded to steel.

Lance Dixon, SLAC

Past and future

I've observed an important relationship between David Harris' intro "Appreciating Successes" and Ray Orbach's "Focus on the Future" in the March issue of *symmetry*.

Both theorists and experimental physicists need to retrace the past of their fields so as to ensure a promising future. Physicists, especially theorists, have advanced their respective fields by using different approaches, but one thing is common to them all, appreciating successes and focusing on the future; the prediction of existence of neutrino (future) by reflecting on the fact that established theories (past) conflicted with some experimental results. The impressive success of general relativity could not have been possible without appreciating the success of Newtonian mechanics.

Grand Unified Theories can also record impressive successes if physicists cultivate the culture of reflecting deeply on past successes and fervently focusing on future possibilities.

Ayodele Adebayo, Obafemi Awolowo University, Nigeria

Letters can be submitted via letters@symmetrymagazine.org