signal to background

Physicist turns bicycle pro; the fastest way to stuff an airplane; trashy hot rod steals the show; making dark matter sing; Faraday Cup cartoons; trumpets blast for GLAST; letters; where your *symmetry* magazines have been

Photo courtesy of Circuit Global Sports Management

Call of the bike

As Reid Mumford pedals, sometimes he thinks about how to break away from the pack. Other times he thinks about how the smallest bits of the universe break apart in high-energy collisions.

Mumford, who studies rare subatomic particles at Fermilab, is a rarity himself: a particle physicist who is also a professional bicycle racer. Riding gives him a physical workout; analyzing data from the world's highest-energy particle accelerator, the Tevatron, exercises his mind.

"Cycling is a tough sport. You don't win much, but the one day that everything works is a beautiful thing," he says. "Just like high-energy physics research."

The 32-year-old finds a grueling physical trainer in the prairie-powered winds that sometimes threaten to topple strollers at the laboratory. On the most blustery days, wind speeds average 26 mph and gusts blow nearly 80 mph.

"The wind makes training here hard, which is a good thing," Mumford says. "Most of the people I race against live in high altitudes. If I didn't have the wind, it would be hard to get faster."

He practices 17 hours a week, even in the snow, using the time to recharge and work out complex theories in his head.

Mumford started racing as a graduate student at Johns Hopkins University. In 2007 he joined Kelly Benefit Stategies/Medifast, a Minneapolis-based professional team. In a sport that requires half the team fall under age 27, Mumford had to work extra hard to secure a spot. After breaking his leg in a collision with a van during practice, he had to work even harder to recover and reclaim his position.

His Johns Hopkins professors and co-workers from the lab's CDF experiment support his bid for bicycling fame, helping him fit training—and weekend races all over the country—into grueling grad-student hours of data analysis.

Mumford is wrapping up his PhD thesis and plans to take a break from physics in the fall to focus full-time on racing. But once that challenge runs its course, he hopes to return and tackle the new energy frontier at CERN's Large Hadron Collider.

You can find Mumford's team bio at www.symmetrymag.org/bikeracer/.

Tona Kunz

All aboard

Jason Steffen waited to board a plane in the Seattle airport. He waited to get his boarding pass scanned. Then he walked a few steps down the jet way, and waited some more. His frustration grew.

"I thought, I've got to be able to do something about this," Steffen says.

After brooding for 18 months, Steffen, a physicist in the Particle Astrophysics Center at Fermilab, came up with a mathematical solution. It would allow passengers to board four to 10 times faster, depending on the size of the airplane.

The secret: load passengers in groups, spaced two to three rows apart, so they can simultaneously stow their luggage.

Steffen posted his method in the Physics and Society section of arXiv.org, a Web site where physicists share results.

In the 3 1/2 months since, he's been contacted by dozens of media outlets all over the globe. But guess who hasn't called? The airlines. Steffen says he heard from a friend of a friend of a friend who works at Boeing that the airline manufacturer has taken note of the study, but his phone has yet to ring.

Since posting his results, Steffen has learned that four or five other groups, including one in Arizona and one in Belgium, had also done airplane boarding studies. Only one was contacted by an airline, and the interest died when the airline was bought out shortly after the initial contact, he says.

Steffen says he never really expected airline interest, and did the study just for his own satisfaction.

"I knew that there had to be a reason for this, and it is nice to know there is a better way to board," he says. "But that hasn't make the time waiting in airport lines go any faster."

What's next? Steffen says he is thinking of examining how the layouts of construction barriers affect the flow of cars per second—a topic of special interest in Illinois, a land of nearly perpetual road construction.

"I would look at how they minimize the number of cars through per second," he says. "That seems to be the goal—not to maximize the flow."

To read Steffen's paper, visit www.symmetrymag.org/boardingstudy/.

Rhianna Wisniewski and Tona Kunz

Rat rod

Parked between a shiny green Camaro and a remodeled '63 Mustang, a 1929 Ford Model A pickup-turned-hot rod is a mosaic of rust and rot. A rag plugs the radiator, and ancient wooden slats border the truck bed. The car looks fresh from the junkyard, and hardly at home with such classy competitors at the Stanford Linear Accelerator Center's Hot Rides Car Show.

But the car's owner, Jeff Jones, stands self-assured next to what is known around SLAC as the Rat Rod. To him, the car is exactly what he wants it to be. He proudly declares, "It's a work of art."

Jones is the precision sheet metal engineer at SLAC. Two years ago he pulled the truck body out of a friend's yard, planning to turn it into a hot rod. The Rat Rod has certainly met that expectation: It can go 120 mph before the front wheel starts to wobble, and it's been known to out-race a Harley Davidson. But along the way the car became more than a test of engineering—it turned into Jones' personal canvas "That car is me," he says. "It's a little different; I've always been a little different. I made myself my car."

Looking closely, one can see symmetric designs drilled into the rusting doors and hood—Jones' own handiwork. Antique Coca Cola serving trays function as floor boards, an oversized bullet plugs the overflow tank, and safety pins keep the spark-plug wires together. The cable bracket is a silver spoon. "I had the stock bracket," he says with a shrug. "It was just too normal." The words "Straight 2 Hell," borrowed from the title of a Hank Williams III album, are fading from the doors, but are still bold enough to proclaim the car's attitude.

The Rat Rod has won three car-show awards, most notably the Chrome and Suede Award at a Good Guys show, where it was the only car in the winners' circle without a paint job.

To Jones, the car is complete. "People still ask me what color I'm going to paint it," he laughs, "but it's done." Then he pauses and adds, "Except for front brakes. And seat belts. It should have seat belts."

Calla Cofield

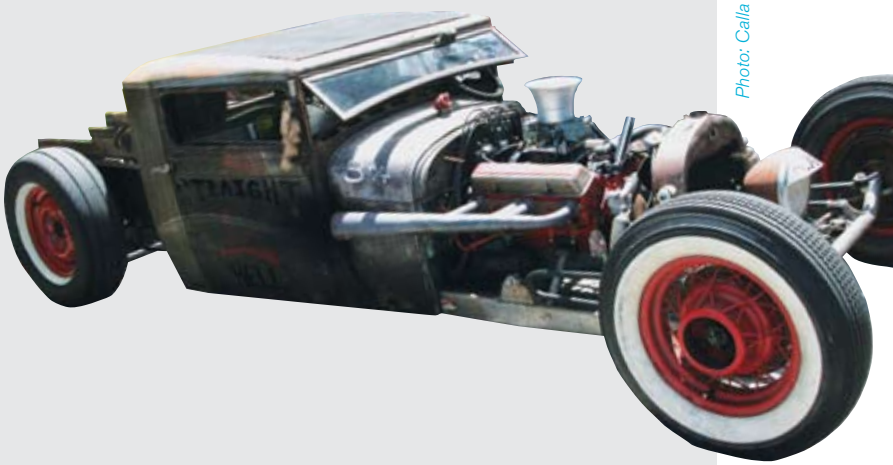

Photo: Calla Cofield

Photos: Reidar Hahn, Fermilab

Dark matter music

The search for dark matter strikes a new note with a multimedia art work that turns data from an underground experiment into colored light and musical tones.

Karl Ramberg's creations often blend sound and visuals; one of his most recent works, for example, combined art made from musical scores with the music they contained. But a trip with his brother, Fermilab physicist Erik Ramberg, took his work in a more scientific direction.

Their destination was a mine in Soudan, Minnesota, where Erik was scheduled to work in the control room of the Cryogenic Dark Matter Search experiment.

"The whole notion of being at the bottom of an abandoned iron mine—there is something kind of romantic or mysterious about it," Karl says.

The Cryogenic Dark Matter Search detects particles such as neutrons, electrons, and cosmic rays that rain in from space. It hasn't recorded any dark matter particles yet, but scientists are hopeful.

After spending the better part of a week in the mine, Karl built a full-scale plastic model of the detector with the help of his brother and CDMS collaborator Prisca Cushman, a physics professor at the University of Minnesota, who translated the data into light and sound.

"I spent a lot of time programming it," Cushman says. "I had to get CDMS files in the proper format and figure out what sounds good." Her neighbor's 10-year-old nephew helped film the musical model and post it on YouTube.

Cushman translated the energy of each incoming particle into a musical note, and the point where it struck the detector into color. In addition, each type of particle got a unique instrumental voice. Midway through the performance, Cushman had the model play the familiar six-note melody from *Close Encounters of the Third Kind* and a snippet of "When You Wish Upon a Star." ("That is a little joke," she confesses in the comments following the video clip. "I couldn't help myself.")

The end result, Karl says, is that "you get an experience, aurally and visually, of subatomic effects. You get a better understanding of what the data is saying."

Cushman says she and the Rambergs would eventually like to display the model, or one just like it, at a science or university museum.

"This could be a great outreach tool," Cushman says. "It has a lot of potential to spark people's interest."

Rhianna Wisniewski

Pécub's Cup

A Faraday Cup is (pick one) 1) a gadget named after the great experimentalist Michael Faraday, used to measure the current of a charged-particle beam, or 2) an award that recognizes the inventors of innovative instruments for particle accelerators.

Trick question. It's both. This year the Faraday Cup, awarded biannually since 1992, was presented on the opening day of the 2008 Beam Instrumentation Workshop, sponsored by Lawrence Berkeley National Laboratory and held at Lake Tahoe in early May. In keeping with the workshop's theme—the challenges of beam diagnostics—Suren Arutunian, head of the Low Temperature Physics Laboratory at Armenia's Yerevan Physics Institute, won the award for inventing a beam-diagnostic "vibrating wire scanner" for the Yerevan Synchrotron.

Second trick: the Faraday Cup Award isn't a cup at all. It's a work of art. In 1981 the Italian Swiss artist Pierpaolo Pugnali, better known as Pécub ("P cubed"), illustrated some ads in the CERN Courier for a new company, Bergoz Instrumentation. Pécub and the company's founder, Julien Bergoz, became friends, and in 1992 Bergoz asked him to design the certificate for a new

Image courtesy of Pierpaolo Pugnali

award his company was sponsoring. Voilá.

"You can't tell Pécub what he should draw," says Bergoz. "You tell him what you want to communicate; he listens intently, then draws four or five sketches on a large sheet of paper—less than two minutes per sketch." Once a sketch is chosen, "he gets his set of seven or eight small pots of colored ink, dips his fingers in a few... Another four minutes and it's done."

Bergoz thinks of Pécub as both an artist and a philosopher of science: "I am always amazed how he can imagine things I have not told him." It was Bergoz who introduced Pécub, who has a scientific background in pharmaceutical research, to high-energy physics.

Says Pécub, "The invisible in biology and the invisible of basic matter are closely connected. Bridges to put imagination into the big bang... Your atomic world is so infinite in questions."

Although there's no poster this year, Pécub has drawn a handsome certificate for the winner.

Paul Preuss, Berkeley Lab

Gamma-rays inspire brass quintet

When you hear the descending flurry of 16th notes in the trumpets, you know the gamma rays are coming. They speed toward the detector in the Gamma-ray Large Area Space Telescope in chromatically harmonized notes. The rays split with a sharp accent, and an electron and positron speed away from each other in the GLAST detector, their movement conveyed by short bursts of notes sliding in opposite directions along the scale.

That's how Nolan Gasser interprets the science of GLAST in his original composition GLAST Prelude for Brass Quintet, op. 12, which made its debut at the June 9 pre-launch party in Cocoa Beach, Florida. The piece can be rhythmically complex when evoking the wavelengths of the electromagnetic spectrum, or simple and beautiful when depicting GLAST's elegant orbit. A video created by the NASA Goddard Television and Multimedia Group accompanies the music. "The visuals," Gasser explains, "allow for that rare mix of an aesthetic experience with scientific appreciation and education."

The gamma-ray telescope, designed and constructed in part at Stanford Linear Accelerator Center, will be the first to survey the entire sky every day searching for the most energetic form of radiation in the universe. Until about a year ago, Gasser knew almost nothing about the science related to GLAST. He is a classically trained composer and artistic director of the Classical Archives, an online classical music site. Then his friend and Classical Archives CEO Pierre Schwob, a science enthusiast who is one of the major donors to the Kavli Institute for Particle Astrophysics and Cosmology, commissioned him to compose a piece for the GLAST launch and mission.

Gasser spent months immersing himself in scientific literature. He traveled to the NASA Goddard Flight Center to meet with the mission's project scientist, Steve Ritz, and deputy scientist, Neil Gehrels, and learn about the history, mission, and expectations of GLAST.

The art, Gasser says, is an invitation to the science, a doorway through which the public, and hopefully the press and the government, will enter the world he has become so passionate about.

Calla Cofield

Photo courtesy of NASA

Letters

The Big Bang Theory

Jennifer Ouellette missed one major unfortunate connection to reality provided by the TV show *The Big Bang Theory*: the main female character Penny not only is treated primarily as an object of sexual fantasy by the physicists, but is also the main representation of all womankind in the show. When Penny's intelligence is questioned, so is that of all women. When Penny, the non-physicist, is excluded from the conversation, so are all women. The identification is nearly set in concrete (modulo a few glimpses of Leslie): woman equals non-physicist equals dumb sex object. The physics community (maybe especially high-energy theory) has plenty of clones of Leonard, Sheldon, Howard, and Rajesh.

Having struggled for acceptance in this community all my career life, I must admit this represents the reality I experienced. Yeah, I get the physics humor, but—as so often happens in real life—as a woman, I'm also the butt of the rest of the jokes.

Name withheld on request

CBS projects a second season for *The Big Bang Theory*—a "very smart, savvy series" with evolving characters and humor, says essayist Jennifer Ouellette (January/February 08). Could a sitcom that began by shallowly caricaturing physicists end up branding physics? Given that comedy at its best instructs as well as delights, could physicists somehow suggest story ideas leading not only to laughing but to learning?

What about Sheldon in conflict with a global-warming denier? Sheldon would condescend sarcastically, lecturing accurately but highly technically. Sensible non-scientist Penny might turn his jargon into plain English—making fools of Sheldon for snide pomposity and of the denier for denial.

Or what if Leonard, seeking to continue dating a young woman, had to calibrate how much scientific truth to tell her dad—a bit of a nut who loves to talk science, especially concerning his lawsuit alleging that a new collider's startup could destroy the planet?

Last fall this sitcom seemed a science-outreach disaster, with only slapstick resemblances to the physics world that it might nevertheless have begun branding. But Ouellette is right: it's evolving now. Maybe physicists should speak up.

Steven T. Corneliussen, Jefferson Lab, Newport News, Virginia

The Iron Lady and the boson

I enjoyed seeing the confidential letter from CERN Director General Herwig Schopper to UK Prime Minister Margaret Thatcher in the Jan/Feb 08 issue of symmetry. It reminded me of a related letter.

I was one of the people who showed Mrs. Thatcher round the UA1 experiment when she visited CERN in August 1982. It was a private visit, and we were not told who was coming, merely that it was a senior UK person and "she was very important," so we should take the visit seriously. Indeed we did, and before the visit I spent some time crawling through the apparatus checking that no bomb had been hidden there.

Alan Astbury, the leader of the Rutherford Lab group and co-spokesperson of UA1, gave a short presentation of our experiment. He ended on a cautiously optimistic note: "If we are lucky, and there is a Father Christmas, we will see the *W* by the end of this year." "Right," said the Iron Lady, pointing her finger at Alan. "I will phone you in January to see whether you have found it." She did not say what would happen to our funding if we did not discover the *W*.

The discovery of the *W* was announced at a CERN press conference on 25 January 1983. I remember the date well: It was my 50th birthday, and I gave a talk about the discovery to a packed audience in London. After publication of the results, I received a letter of congratulation from Mrs. Thatcher. Coming from our Prime Minister it was perhaps understandable that it was a bit nationalistic in its tone, emphasizing the British participation. The UA1 and UA2 experiments were of course international, and I did not have the heart to tell Mrs. Thatcher that even in the Queen Mary College group from London, the eight participants included two American physicists, one Canadian physicist, one Italian graduate student and another with a Greek mother, and that I was born in Czechoslovakia.

Peter Kalmus was the leader of the Queen Mary College group in UA1

Letters can be submitted via letters@symmetrymagazine.org

Contest results…

Oh, the places your *symmetry* went! In August 2007, we asked readers to send photos of places their copies of *symmetry* have been. Here are three letters with photographic evidence of the magazine's travels.

I am so fascinated by the latest particle physics news (and quips and quotes from the crews), *symmetry* keeps me stimulated even on otherwise restful vacation days! The Abacos archipelago in northeastern Bahamas is a destination of turquoise water, developed and deserted cays, pastel houses, bougainvillea, sandy beaches, snorkeling reefs, and starfish the size of a human torso. What better means to explore nature and exercise the mind (thereby avoiding the hazard of falling into lethargy from the intense sun and steamy climate) than a boat, a mask and fins, a cool one, and thou? Two friends joined me in January for an excellent excursion on a chartered 31-foot sailboat based in Hope Town, Elbow Cay. Even running aground on sandbars didn't faze us—raid the cooler, put Jimmy Buffett on the stereo, and wait for the tide to rise. Between black holes, sea turtles, and rum punches, our Abacos vacation "sailed" by!
Amber Jones

A beautiful day at McMurdo Station, Antarctica, found me reading my *symmetry* magazine while taking a break from packing up the CREAM instrument after its recovery from the Ross Ice Shelf, where it came down after a 28-day flight circling high above the Antarctic continent in its quest for answers to questions about the supernova acceleration mechanism of cosmic rays (see http://cosmicray.umd.edu/cream). CREAM was launched on December 19th from the ice shelf near McMurdo Station, and my job since early January was to wait for it to come back down to earth and then go out to pick up the pieces, so to speak. Balloon cosmic-ray experiments are really high-energy experiments, but done in a smaller space and on a smaller budget.

I get *symmetry* to stay in touch with my earth-bound brethren, and have caught up on several back issues during my wait. The view here is unbeatable. In the photos, you can see the sea crates I have been putting the support equipment and recovered instruments into, and in the background the glacier-covered Ross Island, upon which McMurdo Station is built. I am out on the permanent ice of the shelf itself, in the area where the balloon instruments are prepared and launched. You can see Mount Erebus, the southernmost active volcano in the world, in the background of the more distant photo, although it was a bit cloud-covered that day. The weather has been pretty poor this year, and I had to wait for two weeks after the instrument came down before a plane was available to go get it.

You can see more of what I have been doing here and going through via my blog at http://antarctic-scott.blogspot.com.
Scott Nutter

I have been doing science on the *Late Show with David Letterman* for 18-plus years. The first eight were me alone, but for the last 10 I had kids from the Naperville, Illinois, area doing the science. The Kid Scientists appeared on February 27. I had a picture taken with *symmetry* and the kids at Dave's desk. I get *symmetry* magazine because I "worked" with Fermilab education programs for 20 years with Friends of Fermilab and Marge Bardeen.
Lee Marek

Editor's note: A video clip of part of the February 27 Kid Scientist segment, titled "Magic Carpet Ride," is at www.symmetrymag.org/lateshowclip/.