Speedy dragons; pesky invaders; Russian quiz show; wireless power transmission; synchronized helmets; a pneumatic tube for drugs; letters; sudoku challenge.

Speed: It's not just for particles

In pursuit of high velocities, a group of Fermilab physicists has found an unusual outlet: They race a dragon boat.

The team, known as the Draggin' Runners, met at Pottawatomie Park in St. Charles, Ill., one Sunday in June to put their acceleration skills to work, skimming the waters in a 40-foot-long boat that resembles a Chinese dragon.

This form of racing began about 2300 years ago as a religious rite in Southern China. Pairs of teams race head-to-head, striving to be the first to grab a flag at the end. Each crew consists of 18 paddlers, a flag catcher, and a drummer. For this year's annual "Pride of the Fox River-Fest" competition, Fermilab's boat carried postdocs, graduate students, and scientists from various parts of the lab.

All but five of the Draggin' Runners were rookies, Barbara Alvarez among them. A graduate student with the lab's CDF experiment who watched the race last year, she said that while the activity was physically demanding, it was also "great fun."

The Runners were founded in 2001 by J.J. Schmidt of CDF, who proposed the idea to his friends as a "fun large-group activity," and the team's attitude reflected this cheerfully competitive spirit. Despite their lack of experience, the Runners won their qualifying match and barely lost in the finals. Following the race, Schmidt said the team had been "in sync," and confidently stated, "We'll be back."

J. Bryan Lowder

Pesky invaders

An overgrown zebra mussel population at Fermilab received a rude awaking when operations engineers treated the lab's water cooling system in early June to remove nearly 4000 pounds of mussels.

Foreign to the Midwest and without any natural predators in the region, zebra mussels at Fermilab can become problematic when they coat the inside of the water cooling system pipes. One zebra mussel can produce more than a million offspring each year, says Fermilab's Randy Ortgiesen, head of the Facilities Engineering Services Section (FESS). "If left untreated, they will eventually clog up the pipes, creating a huge problem," he says.

To remove the zebra mussels, engineers injected a chemical called EVAC into an intake pipe and opened hydrants along the system to draw the chemical through the pipes. EVAC works by coating the gills of the mussels, effectively eradicating them. EVAC is not toxic when used in low quantities and does not harm fish and birds.

FESS engineers first treated the mussels in May of 2006 when they removed and flushed more than 15,000 pounds of them from the system. This spring's treatment, which took a little more than 24 hours, was a follow-up measure to eliminate any zebra mussel offspring, called veligers, that made it into the system from the ponds.

Fermilab engineer Anne Lucietto says the treatment program has been successful so far. "It's something we're going to have to keep up with," she says. "It's been a challenge, but I think we've won this round."

Amelia Williamson

Photo: Jack Furlong, Fermilab

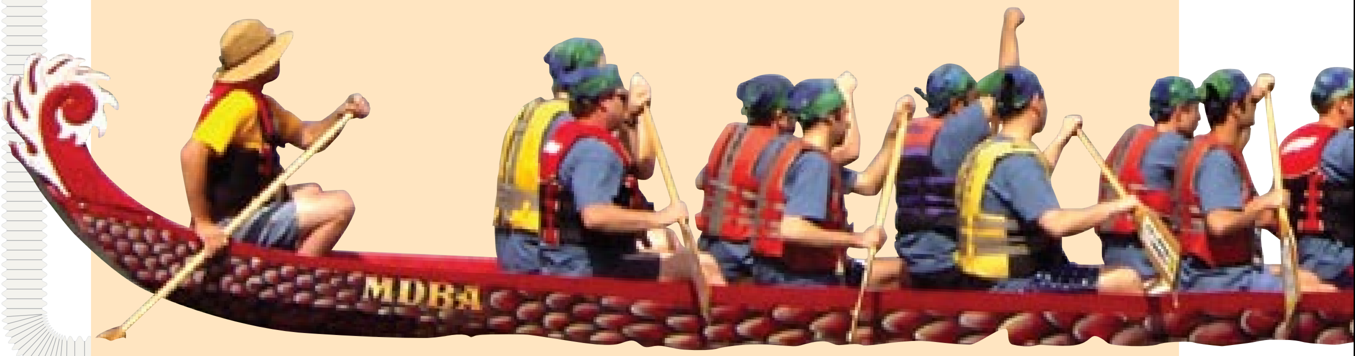


Photo courtesy of Alexandre Telnov

Russian quiz champ

What? An intellectual game show. Where? Based in Russia and played all around the world. When? Since 1986.

The show, *What? Where? When?* challenges a team of six to solve riddles and puzzles, using common knowledge and logic, in 60-second brainstorming sessions. The questions are submitted by members of a TV audience that numbers in the tens of millions. In addition, a competitive version is played by more than 5000 ranked teams throughout the world.

For the past two years, Princeton University particle physicist Alexandre Telnov has been one of six players handpicked for the US national team that competes in the world championship, known as the Nations Cup.

"One reason the show is so popular is because of the spirit of freedom that permeates the game," says Telnov. It was the first live television program aired in the Soviet Union—no small feat in a country that, at the time, had government-controlled broadcasts and only two national TV channels.

Telnov recalls that when he was about 11, the show estimated the size of its Moscow audience by asking people to briefly turn off their TV sets. This decreased the load on the electrical system and sped up the turbines in the power plants; based on the resulting change in the frequency of the current, it was determined that 42.7 percent of households were tuned in.

"The questions really cover the entire spectrum of human knowledge, except they do not require anything that only a specialist would know," Telnov says. For that reason, it's important to have people with diverse backgrounds and expertise on a team. His includes an accelerator physicist with a background in electrical engineering; a woman with an MBA from the University of Chicago; two computer scientists; and a retired Russian language professor.

The Nations Cup is a weeklong extravaganza that attracts more television cameras than teams; competitors become local celebrities. Telnov declined an invitation to join this year's US team, which will compete in Azerbaijan; however, his Silicon Valley-based team, the reigning US champion, will compete in a separate international championship in Russia.

"It's not, by any means, a major part of my life—not my reason for living," says Telnov. More important, he says, are his soon-to-be-published work on charge-parity violation and his participation on the executive committee of the Stanford Linear Accelerator Center Users' Organization, for which he lobbies in Washington, DC.

Telnov says he does appreciate the time he has spent playing *What? Where? When?*, both for the fun of it and for the way it has sharpened his problem-solving skills. "Gaining experience working in a team of six, brainstorming solutions in less than 60 seconds, has great real-world applications," he says.

More information is at http://en.wikipedia.org/wiki/What_Where_When.

Ken Kingery

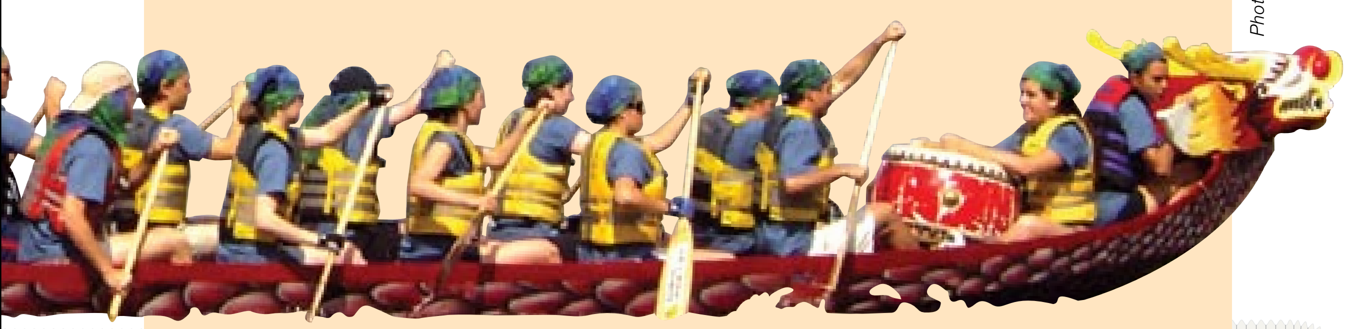


Photo: J. Bryan Lowder, Fermilab

Photos: Aristeidis Karalis

Cordless juice

Peter Fisher was in the audience when Marin Soljacic, a fellow physicist at the Massachusetts Institute of Technology, gave a lunchtime talk about a technology that could transform consumer electronics.

"It was just a theory talk," Fisher says, "and I wasn't really paying attention. But at the end he started talking about what it might look like. I thought, 'We could build that, easily.'"

That's how Fisher, a particle physicist whose normal preoccupations run to dark matter, neutrino oscillations, and cosmic rays, became part of a team that demonstrated how to transmit electrical power without wires.

Their paper, published June 7 in *Science Express*, made quite a splash. The initial experiments successfully lit up a 60-watt bulb from a power source more than two meters away (see photos). But the potential applications are much broader: Smaller, lighter laptops that never run out of juice. Cell phones that start charging the moment you walk into a room. Cordless table lamps: Plop them anywhere!

"The idea is to get rid of cables and batteries," Fisher says. "We found this undergraduate named Robert Moffatt who did most of the work" with the aid of graduate students Aristeidis Karalis and Andre Kurs, he says. "Once we got going it took maybe three months to build the thing. It's not at all sophisticated; it's something almost anyone who had an interest in experimental physics could think up and execute."

In fact, the idea dates back to the late 1800s, when Nikola Tesla experimented with the wireless transmission of electrical power.

Here's how the team's method—called WiTricity—would work:

Put a loop of coiled wire up near the ceiling and run an oscillating current through it to create a magnetic field. This is your power source for everything in the room.

The magnetic field must oscillate at exactly the right frequency to resonate with similar coils in your computer and other gadgets. It pushes the electrons within the coiled wire back and forth, as if pushing a kid on a swing, creating a current that can be used to do work.

Fisher says it's not the first time he has ventured out of basic research to tackle something practical. "About 10 years ago we had a scheme for tracking nuclear submarines that we talked to the Navy about. That didn't go anywhere," he says. "There was a guy who wanted to inflate tires with vinegar and baking soda. He paid me about $5000 to convince him it wasn't possible."

But now, he says, it looks like he's found a project that could fly.

"We don't have a business model yet," Fisher says. "But just look at WiFi. If you can build something where the transmitter is $200, and the receivers can fit into existing equipment and cost $30, people would buy them."

Glennda Chui

Rig, and rig alike

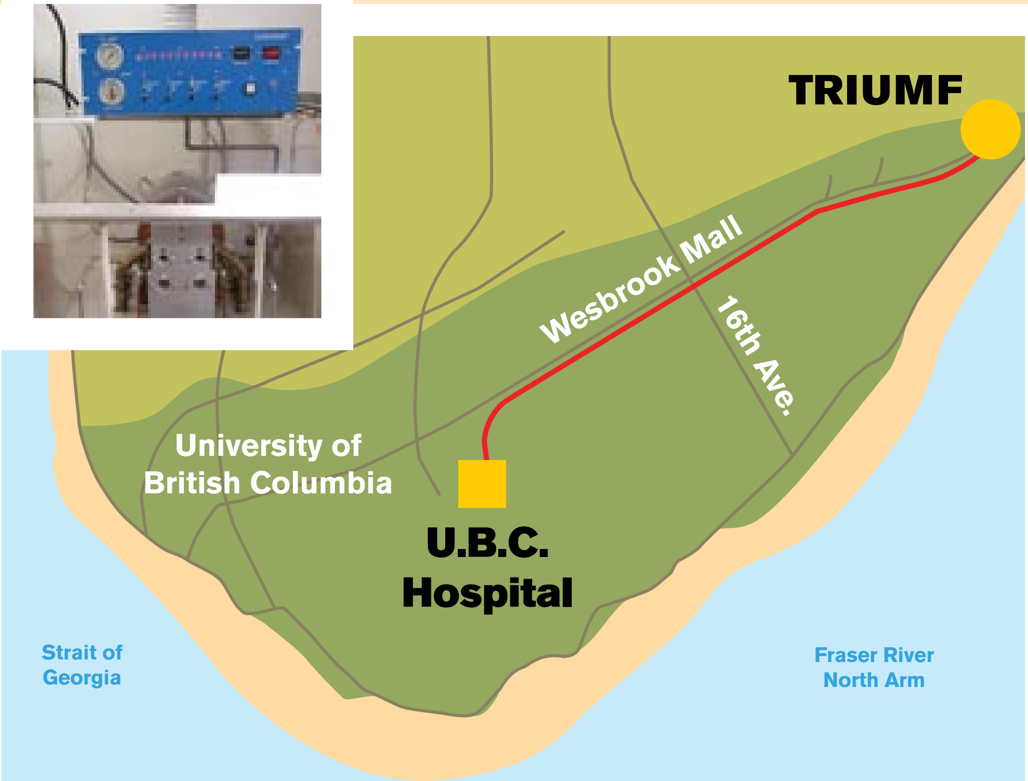
When objects weighing thousands of pounds have to be moved, the call goes out to riggers—specialized teams that work with hoists and cranes. They're required to wear proper safety gear; and at some point, the riggers at SLAC decided to make a statement with their helmets.

"We always try to wear the same helmets," says rigger Scot Johnson. "It helps us identify each other on the job site and is also a form of solidarity."

The group first began following the helmet design of lead rigger Dave "Davey" Engesser, who has been at SLAC the longest and knows all the ins and outs of hoisting and rigging.

"He has a mind like an elephant," says Johnson. "He can

Photo: Ken Kingery



Source: TRIUMF

remember where he put equipment in the grass from 20 years ago."

Engesser began wearing an American flag helmet to work every day, and soon the rest of the riggers followed. When Engesser's helmet had to be retired because of chips and cracks, the whole team ordered white helmets. Stickers are not allowed on helmets because they can hide defects, so wearing the same color is one way the team can express its camaraderie.

No one remembers how the tradition began or who came up with the idea. "It just sort of ended up that way," says Johnson.

Recently Engesser went back to an American flag-style helmet, though the rest of the team still tends to wear plain white.

"He just likes to get saluted," Johnson jokes.

Ken Kingery

Run, Rabbit, run

The problem: How to get short-lived radioactive drugs from the nuclear physics lab that makes them to a hospital 2.5 kilometers away, on the far side of a busy campus, in two minutes flat.

At the University of British Columbia in Vancouver, the solution is the Rabbit—an old-fashioned pneumatic tube that zips freshly made radiopharmaceuticals at 75 kilometers per hour from TRIUMF national laboratory to the university's Health Sciences Center.

Pneumatics—using pressurized gas to do work—is a concept dating back to Hero of Alexandria in 60 A.D. Pneumatic tubes were first used in the 1800s to carry mail across European cities; Paris alone had 467 kilometers of tubing in its system. People even envisioned a future in which pneumatic tubes transported people across the globe. The tubes are still used, more modestly, to transport small parcels in banks, hospitals, and office buildings.

TRIUMF's Rabbit has been making the hop across campus since 1983. As part of a collaboration between the laboratory and the medical center, radioactive isotopes are created in TRIUMF's cyclotron, which is dedicated to this work, and processed in a chemistry lab on site. Then they're rushed to the hospital for use in Positron Emission Tomography (PET), a technique that allows doctors to create real-time images of the brain at work.

Why the haste? The radioactive isotopes have half-lives as short as 20 minutes; if a shipment is delayed, the drug will be useless. "It can take quite a long time to meet regulations for the transportation of dangerous goods—to package, carry out the paperwork, and actually get it to the place you want it to go," says Mike Adam, head of PET Chemistry at TRIUMF.

Although pulling thousands of meters of tubing through existing pipes beneath Wesbrook Mall Road was difficult, and the Rabbit's route has shifted as the campus grows through construction, the results are worth it, Adam says: "The system is a great advantage in our research on cancer and movement disorders."

Ken Kingery

Letters

Antimatter: pro or anti?

In the April 2007 edition a letter was printed debunking the idea of antimatter-powered spaceships. The argument was that since antimatter is so difficult and expensive to produce, this use is impractical.

But do we know that our present method of making antiprotons is the only one possible? Or might some future scientist find a different way to produce or capture antimatter? After all, at one time transistors were too expensive to be used in computer memories.

Ed Foster, Geneva, Illinois

Dave McGinnis, a physicist at Fermilab, responds:

Obviously, I cannot predict the future and it might be possible that some future scientist will discover a more efficient way to produce antimatter. But the transistor analogy is more the exception than the rule. In the case of antiproton production, a better analogy would be to ask the car industry to develop a vehicle that can get 5 billion miles per gallon.

The current state-of-the-art efficiency for making antiprotons is about 0.0000004 percent. At Fermilab, it requires 20 megawatts of electric power to produce an 80 milliwatt antiproton beam. This is about 10 times better than it was 15 years ago, but it is still a drop in the bucket compared to what would be needed for powering a spaceship.

Nevertheless, antiprotons are an exceptional scientific tool. They have been used to make very important discoveries at Fermilab and CERN.

MacGyver ethics

Regarding "Masters of improv" (*symmetry*, April 2007) I have one question. The article quotes former Fermilab director Leon Lederman as saying, "…without explanation, we took the student's experiment apart. He started crying, as he should have." Was the student compensated for his loss? Or do Fermilab and its former director consider it to be great to dismantle the hard work of a graduate student?

Stan Vassilev

Leon Lederman responds:

The event took place in the 1950s, about 15 years before Fermilab's existence. The student's thesis experiment was 70 percent and 12 hours of work from achieving what was needed to make one of the most dramatic discoveries of the decade. Marcel [Weinrich] quickly got over his tears and became a co-author of the discovery paper. It became his PhD thesis, probably saving him at least a year. It also ensured his future in particle physics.

How many grad students have the opportunity to participate in the excitement and scientific thrill of a major discovery?

Correction

In the story "Universal Accord" (*symmetry*, March 2007), an analogy describing the difference in power corresponding to 120 orders of magnitude was incorrect; it was removed from the online version of the story.

Letters can be submitted via letters@symmetrymagazine.org

ATTENTION SYMMANIACS!
Another *symmetry* challenge:
Particle sudoku

Sudoku is *so* 2005, but this logic puzzle still has plenty of fans. Invented in 1979 by an American, the puzzle really took off in Japan. In the years since, it has distracted aficionados daily, appearing in the pages of newspapers worldwide alongside the traditional crossword puzzle.

But have you played particle sudoku? To solve this puzzle, all you need to do is make sure that each row, column, and 4x4 sub-grid contains each of the 16 observed particles usually listed as the components of the Standard Model. Those are the six quarks: *u, d, s, c, t, b*; the six leptons: e, μ, τ, ν_e, ν_μ, ν_τ; and the four force carriers: γ, g, W, Z. There is only one solution to this puzzle, but be warned: Don't expect to solve this in five minutes. And don't let those pesky neutrinos confuse you!

David Harris

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	ν_e				τ	ν_μ			d		c		e		μ
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