A ski champ dreams of physics; the incredible shrinking cancer treatment; the Science Express packs 'em in; SLAC's brilliant mylar mirage; a happy clash of human ions; letters.

Photo courtesy of 4sports & Entertainment AG

Ski champion's wish comes true at CERN

She could take her pick of extreme adventures—rock climbing, skydiving, trekking through some exotic wilderness. The Swiss TV show *Sportpanorama* gave Dominique Gisin, winner of two International Ski Federation World Cup downhill victories in 2009, the chance to do anything she'd like.

She chose to visit CERN.

"It's always been a dream of mine," she says. As a physics-smitten high school student, Gisin had heard about experiments at the international particle-physics research center, a few hours' drive from her hometown of Engelberg, Switzerland. "I never had the time to see CERN, though," the 24-year-old says, "and I also wasn't sure it was really possible."

CERN physicists made her dream come true on July 3 with a close-up look at the seven-story face of the Compact Muon Solenoid detector and the Large Hadron Collider's super-cooled magnets.

"It was an awesome experience," Gisin says, "especially because everything was explained to me by a physicist. I never expected it to be so huge." She adds that she ran out of time to get all her questions answered, and plans to learn more about physics on her own.

For their part, the show's producers say they were happy to give viewers something unexpected and cutting-edge. "Dominique is known for her versatility," says Thomas von Grünigen, "but still we were quite surprised about her pick."

Between conversations about particles and magnets, Gisin talked skiing with Michael Hoch, a CMS physicist and professional ski instructor. The lab is full of amateur skiers; there's a small ski station just 10 minutes from the laboratory, and members of the CERN Ski Club organize frequent outings.

"It was very nice to find out that we shared these two interests," Gisin says. "And I hope there are more skiers now who will be interested in CERN and its research, too."

The episode can be viewed online at: http://tiny.cc/diqwO

Tona Kunz and Rachel Carr

Shrinking the cost of zapping cancer

Dejan Trbojevic's work on one of the world's largest particle accelerators helped him think small.

Building on knowledge gleaned as a physicist with the Relativistic Heavy Ion Collider at Brookhaven National Laboratory, he designed a smaller, lighter system for bombarding cancerous tumors with subatomic particles, such as protons and heavy ions. This form of therapy is used to treat tumors near delicate areas, such as the brain, spine, and prostate gland, and to reduce radiation doses to healthy tissue, which is especially important in growing children.

"This design greatly reduces the cost, weight, and size of the particle-delivery system for cancer treatment facilities, and simplifies its operation," Trbojevic says. "That should make such facilities more economical to build and operate."

Unlike conventional radiation beams, which deposit energy as they travel through healthy tissue, particle beams made of protons or charged ions deposit most of their energy at the tumor. This results in more cancer-killing potential in fewer doses, and with less collateral damage (see "The power of proton therapy" in the December 2008 issue of *symmetry.*)

But particle therapy facilities are expensive, in large part due to the size and complexity of the system that delivers the beam. In one common design, the equipment that generates the beam and the magnets that steer and focus it are mounted on a steel gantry that rotates around the patient to pummel the tumor from different angles. Trbojevic's design uses smaller, lighter magnets, reducing the weight of the gantry 100-fold. Further, he says these magnets could be manufactured at Brookhaven. The lab has applied for a patent on the new design.

Karen McNulty Walsh

Science Express pulls a carload of particle physics

When designers laid out their vision for an educational train called the Science Express, they almost left particle physics standing on the platform.

Some thought particle physics was not forward-looking enough or close enough to practical applications. But Hannelore Hämmerle, the manager of the exhibition, argued that the mysteries of particle physics excite all ages.

"They are convinced now," Hämmerle says. "They see that people like it."

During the first two months of the train's tour of 62 German cities, more than 10,000 people browsed through 12 cars packed with multimedia presentations, interactive exhibits, and a hands-on laboratory. All cars highlighted research in dynamic fields that will help to shape our world in the coming two decades, including nanotechnology, new industrial materials, mobility, sustainability, and global networks.

The particle physics car, named "The Search for our Origins," is "the one that blocks everyone" as people slow down to take it in, Hämmerle says. "People read all the text. They look at everything in detail."

The exhibit starts with the origins of life and where matter comes from. "You learn that scientists address the question in two ways: They can look to the universe with astrophysics and telescopes, or they can recreate the conditions [of the early universe] on Earth with accelerators and detectors," Hämmerle says.

Visitors also find information on the Higgs boson, the Hubble Space Telescope and ROSITA X-ray astronomy satellite, the cosmic microwave background radiation, string theory, supernova explosions, and loop quantum gravity. A detector phototube from IceCube and part of the ATLAS calorimeter are on display, along with pictures of ATLAS and the other three general-purpose detectors at CERN's Large Hadron Collider.

The Max Planck Society-sponsored exhibit continues through November and likely will tour again, possibly through other countries or at the 2010 World Expo in Shanghai.

A similar science train, also sponsored by Max Planck, was designed to tour India. So far, 2.2 million people have boarded that train to learn about science and absorb some particle physics.

Tona Kunz

Photos courtesy of ArchiMeDes

Sunscreen for an accelerator

A visitor wandering around SLAC last July would be forgiven for thinking the hot California sun had triggered a mirage.

A parking lot at the Stanford Synchrotron Radiation Lightsource had transformed into a glistening lake—albeit one made of thin, reflective sheets of aluminized Mylar. Attached to the asphalt with screws and duct tape, the polyester film created a 13,500-square-foot, 0.05-millimeter-deep "pool" that rippled with the wind and reflected sunlight with such strength that onlookers had to wear green welding glasses.

Mylar, commonly used to keep emergency victims warm, had a decidedly different purpose at SSRL: to protect the accelerator from the sun.

"We're hoping that by reflecting the sun's rays away from the tarmac, we can reduce beam instability at SSRL," says SSRL mechanical systems supervisor Ben Scott, who oversaw the installation project.

Researchers theorized that as the sun's rays heat the asphalt, it expands and presses against the concrete slabs under the accelerator, upsetting beam alignment.

SSRL creates extremely bright X-rays that are often used to investigate the properties of atoms and molecules. The small targets and precise nature of the research make beam alignment and stability essential.

"We are now sensitive to motion at the micron-per-meter level," says beamline development group leader Tom Rabedeau. That means a ground shift as small as one seventy-fifth the thickness of a piece of paper across a one-meter stretch of concrete can throw off the beam.

Scientists first noticed this shifting because the beam stability increased on cloudy days. "We thought that the clouds were regulating the temperature of the asphalt, keeping it cool during the day and warm at night, and limiting its motion," Rabedeau says.

Early analysis suggests that, despite its aesthetic appeal, the Mylar is having little effect. The analysis also suggests that the motion of the concrete slabs is closely related to temperature variations in the accelerator's tunnel walls.

"More data and more analysis are needed to say for sure," Rabedeau says. "This is really a very complicated—and interesting—environment."

Kelen Tuttle

Photo: Bradley Plummer, SLAC

Human ions collide for charity at BNL

The blue team rounded the bend first—sweaty, jovial, and headed toward the halfway point of the 2.4-mile path circling Brookhaven National Laboratory's Relativistic Heavy Ion Collider.

Suddenly, from the other direction, the yellow team emerged. A cheer erupted from the crowd as the two bunches of human ions pushed forward, with raised hands, to collide in a sea of blue and yellow T-shirts.

The humans mimicked the actions of their ion counterparts in the tunnel below, albeit 168 million times slower than the particles and in numbers far smaller than the one billion ions in each RHIC bunch. Still, the simulation accomplished what pure nuclear physics experiments cannot: raising the collider's visibility while raising money for a good cause.

More than 400 life-sized particles, whose day jobs range from Brookhaven graduate student to visiting scientist, participated in August's "Collide-the-Ions" walk to thank a local company for its help in keeping RHIC running.

In 2006, RHIC's scheduled

polarized-proton run was almost canceled due to budget constraints and an unexpected increase in electricity costs. But thanks to $13 million provided by several partners at Renaissance Technologies, Inc., RHIC and its 1000 visiting researchers were able to continue their explorations.

To recognize Renaissance's help, Brookhaven Science Associates—the company that manages and operates the lab—decided to pass the good fortune along. For every participating walker, BSA contributed $10 to the Autism Science Foundation.

Sloppier, slower, and even more competitive than their tightly packed ion counterparts, the human bunches proved scientifically accurate in at least one respect: Each pass of RHIC's ion bunches produces just one actual collision, at most—and many times none. Most of the ions fly past each other unharmed. None of the human ions hit head-on, either, and all left intact.

Kendra Snyder

Photo courtesy of Brookhaven National Laboratory

letters

No glow from neutrinos

On page six of the August 09 issue of *symmetry* is an article on SNO+, which says in part: "Its transparent spherical detector was filled with heavy water that gave off Cherenkov light when a neutrino passed through."

I thought that Cherenkov light could only be given off when a charged particle passed through matter. The author probably means that Cherenkov light was given off when a neutrino interacted to produce a charged particle.

Don Lichtenberg, Indiana University

The editors respond: *You're right! Thanks for pointing this out.*

Psyched for Manga!

I'm a Manga reader and a physics student. When relating my ideas to non-physics students, I had a hard time. Once I asked a cartoonist to draw a figure that would impersonate a particle, which I described to him. My main goal is to relate physics concepts like I would relate the mysteries of Manga stories. I assume that they prefer to read a Manga than physics books. That is why I loved the August 2009 issue of *symmetry*. I hope there will be more issues about other media which can be used for physics education.

Eli Estrecho, Western Mindanao State University, Philippines