FERMI NEWS

FERMILAB A U.S. DEPARTMENT OF ENERGY LABORATORY

Photo by Reidar Hahn

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INSIDE:

Physics Without Borders

by Judy Jackson

In particle physics, the particles of matter behave according to the Standard Model of Particle Interactions. Particle physicists, on the other hand, behave according to the Anatomical Model of Experimental Attraction: They follow their noses and vote with their feet. Their noses find laboratories where they can do forefront experiments, and their feet take them wherever these facilities are operating.

"Physicists will go where they can do the physics," says Fermilab physicist Roy Rubinstein. "A high-energy accelerator is like the 'Field of Dreams:' If you build it, they will come."

Perhaps the character of the science itself helps to make particle physics an international effort.

"By its very nature," said U.S. Department of Energy Associate Head for High Energy and Nuclear Physics Peter Rosen recently, "physics is a science that knows no national boundaries. Particles move according to the same laws of motion in Alaska, Africa, or the South Pole. Indeed, we believe that the laws of physics, those known today and those yet to be discovered, apply throughout the universe and govern its destiny. Thus it is not surprising that physicists come from all corners of the globe, and that transnational collaborations are second nature to them."

In fact, not only are such collaborations second nature, they are essential for modern high-energy physics. To study the smallest pieces of matter requires particle accelerators and detectors on such a scale that they exceed the means of any single nation. Thus, progress in the field of particle physics depends as much on international cooperation as on technological advances.

As the funding agency for more than 90 percent of the nation's federally-supported high-energy physics research, the U.S. Department of Energy builds and operates national accelerator facilities where scientists from across the U.S. and around the world collaborate on forefront research in this very basic science. Recent allegations of the passing of classified technology to the Chinese from DOE's Los Alamos National Laboratory have focused attention on foreign scientists working at DOE labs around the country. Secretary of Energy Bill Richardson is among many who have pointed to the critical difference between the necessity to prevent foreign access to classified military research at the nation's defense laboratories and the imperative for international collaboration in non-classified basic research at open laboratories such as high-energy physics labs.

"I am committed to strengthening security and protection for the classified research at DOE facilities," said Secretary Richardson recently. "At the same time, it is in our interest as a nation to preserve and strengthen international cooperation in areas of basic research. As the primary steward of our nation's particle physics research, the Department of Energy will keep the U.S. a world leader in this field by working with other nations to create the best possible research opportunities at the frontiers of high-energy physics. For fifty years, high-energy physics has thrived because of international scientific

DZero experimenters include Americans, Argentinians, Armenians, Australians, Belgians, Bolivians, Brazilians, British, Byelorussians, Canadians, Chinese, Colombians, Czechs, Ecuadorans, Filipinos, Finns, French, Germans, Greeks, Hungarians, Indians, Indonesians, Iranians, Israelis, Italians, Japanese, Kazakhstanis, Koreans, Latvians, Lebanese, Lithuanians, Mexicans, Peruvians, Poles, Puerto Ricans, Russians, Swiss, Turks and Ukrainians.

Norbert Holtkamp
Citizen of: Germany
Job at Fermilab: Accelerator physicist
Why I came to Fermilab:
"Fermilab is the lab with a future in high-energy physics. It's a chance to contribute to the future of the field."

Hugh Montgomery
Citizen of: The United Kingdom
Job at Fermilab: Cospokesman of the DZero experiment
Why I came to Fermilab:
"I thought the best physics was going to be at the Tevatron."

Maria Spiropulu
Citizen of: Greece
Job at Fermilab: CDF graduate student
Why I came to Fermilab:
"I wanted to do proton-antiproton physics."

Harry Weerts
Citizen of: The Netherlands
Job at Fermilab: Cospokesman of the DZero experiment
Why I came to Fermilab:
"When I was a kid, I thought the U.S. must be a great country, because they had these big cars. I wanted to see if I could prove myself as a physicist in the U.S. It's a challenge."

Aesook Byon-Wagner
Citizen of: South Korea
Job at Fermilab: Physicist, electronics expert for CDF
Why I came to Fermilab:
"Hopefully, in about a year, there will be more exciting physics than anyplace else."

Franco Bedeschi
Citizen of: Italy
Job at Fermilab: Cospokesman of the CDF experiment
Why I came to Fermilab:
"Almost twenty years ago, [University of Pisa physicist] Giorgio Bellettini said, 'Why don't you go to Fermilab? I did, and I'm still here.'"

Matthias Kasemann
Citizen of: Germany
Job at Fermilab: Head, Computing Division
Why I came to Fermilab:
"Managing Fermilab's Computing Division is an interesting job, and I am an adventurous man."

Keith Ellis
Citizen of: The United Kingdom
Job at Fermilab: Head, Theory Group
Why I came to Fermilab:
"Faute de mieux. And for all its faults, Fermilab does try to maximize the potential of the people they've got, wherever they come from."

Shekhar Mishra
Citizen of: India
Job at Fermilab: Physicist, in charge of commissioning new Main Injector
Why I came to Fermilab:
"Fermilab is the frontier of physics right now. And it's an open facility; that's very important."

Fermilab Photo

In 1972, in the depths of the Cold War, seven Russian scientists arrived at Fermilab to collaborate with U.S. physicists in Experiment E36, the first Fermilab experiment ever to take data. See The Talk of the Lab, p. 14.

As Others See Us

When the Large Hadron Collider at CERN begins accelerating protons in 2005, it will have seven times the energy of Fermilab's Tevatron. The LHC represents the first large-scale U.S. contribution to an accelerator on foreign soil.

French physicist Philippe LeBrun, who heads CERN's LHC Division, commented recently on the U.S. role in the LHC:

"While CERN is a European organization, the LHC is really a world project. It is supported by a large majority of the world community of future users, and it is being constructed—and co-funded—by almost all regions of the world active in the field of particle physics. Although it is not customary for the U.S to invest in large scientific projects not based in America, the U.S. scientists became convinced of the importance of joining in, and convinced the U.S. Congress to join and contribute.

"As engineers building this technically difficult and challenging project, we are grateful to have the help of collaborators from prestigious labs such as the Department of Energy's Fermilab, Brookhaven Lab, and Lawrence Berkeley National Lab. They have done pioneering work in the design, construction and operation of superconducting devices and accelerators, such as the Tevatron and RHIC, and they bring their experience and know-how to the LHC project. They have responsibilities in design, construction and procurement of essential LHC components whose performance will determine the luminosity of the Collider.

"A number of key materials and components for the LHC are produced by American industry. We are pleased that we can rely on their competence.

"Although the style and organization of work can be somewhat different in Europe and the USA, our collaboration is running smoothly and, in fact, benefiting from such cultural differences in the approach to technical (and non-technical) problems."

collaboration and, today, continued progress depends on international cooperation in building and operating the next-generation machines."

From the start, Fermilab's machines have made it an international destination for physicists who want to work at the energy frontier. In 1999, about one third of Fermilab's users come from foreign institutions. And when they come to Fermilab, they bring brains, hands, expertise, funding and state-of the art equipment.

"We wouldn't have a CDF without foreign participation," said CDF cospokesman Al Goshaw of the collider detector, one of two detectors now preparing for Collider Run II. "Japan and Italy have contributed about 40 percent of the resources to build CDF. We have added 10 institutions in the past year, all from outside the U.S. They come because right now, the physics action is at Fermilab. When I walk down the hall, I hear Japanese, Italian, Spanish, German… It's like a United Nations of Science, that works."

Across the accelerator ring, at DZero, cospokesmen Hugh Montgomery and Harry Weerts confirmed the importance of international participation in their collaboration.

"At DZero, the foreign contribution is primarily intellectual, in getting the science out," Weerts said. "Wherever there is good science to be done, it attracts the best scientists. And we need them all!"

If you build it, they will come. And they will go. The worldwide flow of physicists is far from one way, and at high-energy laboratories in other countries, it is U.S. scientists who are the "foreign" users. At CERN alone, there are about 560 U.S. scientists collaborating on physics experiments. Other U.S. physicists work at laboratories in Germany, Japan, Russia, Italy and France.

For the future, says Rosen, "as high-energy physics continues its pursuit of the fundamental at smaller and smaller distances, we have reached the point where the entire international community must work together to achieve our goals on a practical time scale."

Physicists will have to follow their noses and direct their feet to a future of truly international physics, of physics without borders.

The High-Energy Cosmic Mystery

Groundbreaking in South America means Pierre Auger Observatory is on the case.

by Mike Perricone

Photo courtesy Pierre Auger Observatory

Pierre Auger, who discovered the first high-energy cosmic rays in 1938.

They came from outer space.

We can't explain them, they're like nothing we know here on earth, and an international team of scientists is setting up an array of 1,600 detectors in a remote desert area of South America, trying to determine where they're from and how they got here.

That's not the plot of a science fiction film, but the mission of the Pierre Auger Observatory, a project to track and analyze high-energy cosmic rays—and at $53 million, the cost of the project is lower than the price tag for one of Hollywood's major motion pictures with state-of-the-art special effects.

The Auger collaboration of more than 250 scientists and engineers, from 60 institutions in 19 countries, is placing 3,000-gallon water tank detectors in the Argentine desert to survey atmospheric showers created by these puzzling cosmic rays, which carry an energy more than 100 million times that created in Fermilab's Tevatron, the highest-energy particle accelerator in the world.

"We are nowhere near understanding these things," said Nobel laureate James Cronin of the University of Chicago, leader of the project along with Alan Watson of the University of Leeds in England.

"Nature is trying to tell us something by showing us something extraordinary," Cronin continued. "These are the most energetic particles in the universe. There's nothing more energetic."

High-energy cosmic rays are those with an energy above 10^{20} electron volts (Tevatron energy levels reach 10^{12} electron volts). Their source must be relatively close to the earth, or else their energy would be diminished by interactions with the cosmic microwave background radiation. Physicists say that because of the microwave background, space becomes "opaque" to particles with energies above 10^{19} electron volts; those particles will eventually interact with the cosmic background, and the interactions diminish their energy.

At these tremendous energy levels, particles are deflected only to the slightest degree by magnetic fields. Their paths should point straight back toward their approximate origins, but they don't point toward anything recognizable as a high-energy source.

"When we look at this handful of very high-energy events," said project manager Paul Mantsch of Fermilab, "none of them points back to obvious things that are violent enough even to be candidates for a source. In fact, the ones we've seen don't point back to any objects at all. This really is a mystery."

So scientists theorize that the particles must come from a relatively close source (within 50 to 100 megaparsecs), which wouldn't allow the time or space to interact with the cosmic background. Yet no observations anywhere

Photo by James Cronin

"ENCANTO Y PROGRESO" ("Enchantment and Progress") is the credo of the city of Malargüe, noted on the sign marking the construction site.

“NATURE is trying to tell us something by showing us something **extraordinary.”**

have uncovered a source in our cosmic neighborhood which is sufficiently violent to produce such high energies. The cosmic ray detector in Japan, AGASA, recently published observations of four more events with energies above 10^{20} electron volts, adding impetus to the search.

“This is an exciting area of physics,” said deputy project manager Carlos Hojvat. “Either there are very powerful sources near our galaxy, or there is some kind of new physics in effect. Possibly it’s the decay of some exotic particles, which is an exciting topic in itself.”

While the earth is constantly bombarded with cosmic radiation, the highest-energy cosmic rays (those above 10^{20} eV) make up a relatively rare group of visitors. They strike the earth an average of once per square kilometer per century. High-energy cosmic rays are analyzed indirectly, through the atmospheric showers they create.

To make the observations, the Auger collaboration is constructing an array of 1,600 surface detector tanks and four fluorescent detectors (called “fly’s eyes”) near the town of Malargüe, in the Mendoza Province of Argentina. The rest of the province is noted for its wine, olives, and choice beef, but the site of the Auger Observatory is a 3,000-square-kilometer expanse of desert about 10 times the size of Paris—equivalent in size to the entire state of Rhode Island.

Groundbreaking ceremonies were held at the Argentine site on March 17, with pledges of support from the mayor of Malargüe, the governor of Mendoza province and the chief of the cabinet of Argentina. Schoolchildren paraded with flags and banners, and some local people wore traditional *gaucho* costumes.

“It’s just like any little town in the southwestern United States, filled with very nice people,” said Fermilab collaborator Peter Mazur. “They really made us feel very welcome. They made us feel like we ought to come back there. With that kind of support, we have a good chance of making this experiment a success down there.”

Photo by Peter Mazur

Mariette Auger Berl, daughter of Pierre Auger, takes time to visit with *guanacos*, relatives of the *llama*.

Photo by Reidar Hahn

A prototype surface detector developed at Fermilab.

The groundbreaking was also graced by the presence of Mariette Auger Berl, daughter of Pierre Auger, who discovered the atmospheric showers produced by high-energy cosmic ray particles in 1938. During World War II, Auger conducted research at the University of Chicago, then moved to Canada, and went on to join the Free French forces in London. Mariette also studied at Chicago, but unknown to her family joined the Free French forces in New York. She served in Algeria, Italy and France, reunited with her family only after the war.

“She says she has lived a peaceful life ever since bearing and raising three children,” Cronin said. “She is a strong woman despite her 75 years. All the participants at the groundbreaking ceremony were charmed by her. Needless to say, she was delighted that a large observatory has been named for her father.”

Within the next year or so at Malargüe, the Auger collaboration will install 40 prototype surface detectors and one fluorescence detector in what is called the “engineering array,” testing and confirming the design before going into full production. Fermilab is involved in developing the surface detectors and the data acquisition system, and serves as the host institution for project management.

“With our experience on very large projects and international experiments,” Mantsch said, “we can contribute to the project in a unique way.”

The surface detectors, placed 1.5 kilometers apart, are cylindrical tanks holding 3,000 gallons of pure, de-ionized water. These Cerenkov detectors discern the presence of charged particles by measuring the light produced when the particles move through the water faster than the speed of light in the water. The effect is analogous to shock waves generated in the atmosphere by planes flying at supersonic speeds.

“The water Cerenkov detector has a large sensitive volume, not just a sensitive area,” explained Mazur, who has been involved with their design. “When the showers become more horizontal, they would

Celso Jaque, the Mayor of Malargüe, reads a proclamation during the ceremonies.

Photos by Peter Mazur

Some local people wore traditional *gaucho* costume to the ceremonies.

Photo by James Cronin

The commemorative plaque for the groundbreaking ceremonies.

still pass through the water and be detected, because the water tank has a reasonable cross section from any angle."

Water fits the bill, and it's cheap.

The surface tanks are self-sustaining, powered by solar cells to run the electronics for the Global Positioning System and the communication links to the central data-collecting station in the site. An entire detector is run on just 10 watts of power, capitalizing on low-power technology developed for laptop computers. When a cosmic-ray-induced atmospheric shower occurs, the detector sends that information to the data collection station using phone technology virtually identical to the ubiquitous cellular phone. The information is then available to collaborators through the Internet.

The fluorescence detectors have been developed at the University of Utah, where experimenters observed the highest-energy cosmic ray ever detected on October 15, 1991—3.2×10^{20} electron volts. These detectors use photomultiplier tubes to spot the light emitted by the cascade of charged particles created when high-energy cosmic rays strike the atmosphere.

But the "fly's eyes" only generate useful data about 10 percent of the time, combining with the water tanks only on the darkest and clearest nights. The rest of the time, the surface detectors go it alone.

The array's goal is to measure the arrival direction, energy, and mass composition of cosmic ray air showers above 10^{19} electron volts. The 40 surface tanks and fly's eye in the engineering array could begin taking data in a year, but more meaningful data will appear as the array moves toward its full complement of detectors. There are additional plans for a northern array in Utah, though that site has not yet been funded. The U.S. commitment, through the Department of Energy and the National Science Foundation, is 15 percent of the total cost of the project.

But until the status of a northern array is settled, the Pierre Auger project is already the largest cosmic ray experiment in the Southern Hemisphere, where no air showers have yet been observed, and where the sky is wide-open for exploration, at a fraction of the cost to build a particle accelerator.

"Someone once called cosmic ray experiments 'the third world of physics,'" Mazur said, "because the experiments tend to be substantially less expensive, and run more on a shoestring, than accelerator experiments. But we don't have to build an accelerator to run this experiment. Something is already running an accelerator out there some place. And we're going to find out where."

INNOVATION

Innovation Alive and Well at Fermilab

FOSTER AND JACKSON RECOGNIZED FOR THEIR NOVEL USE OF PERMANENT-MAGNET TECHNOLOGY.

by Sharon Butler

Uncharacteristically attired in suits and ties, Fermilab's Bill Foster and Gerry Jackson stood on stage in the cavernous ballroom of the New York Marriott Marquis on Broadway for some theater of their own.

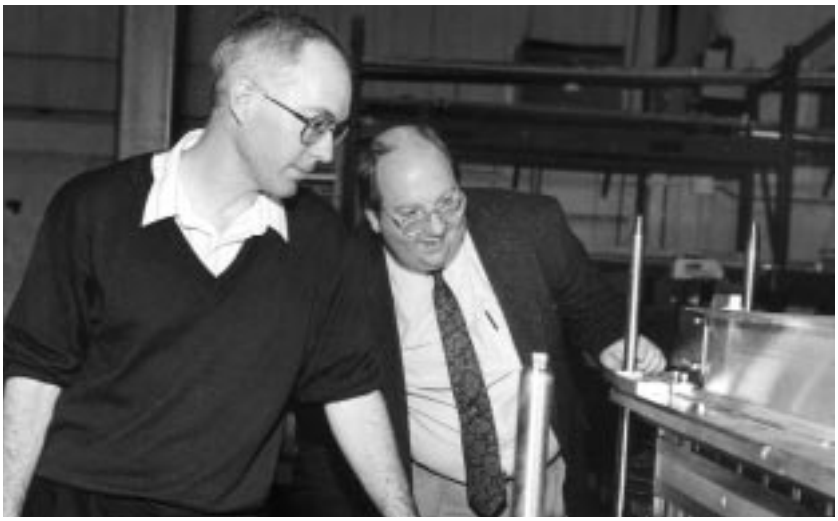
As the roomful of particle accelerator physicists finished off their dinners with strawberries dipped in chocolate, Foster and Jackson stood under stagelights to receive the prestigious Particle Accelerator Science and Technology Award of the Institute for Electrical and Electronics Engineers. The two were cited for their leading roles in applying energy-saving permanent-magnet technology to Fermilab's new 8-GeV Line and Recycler.

The occasion was the annual Particle Accelerator Conference, a five-day marathon of technical talks and poster sessions where physicists from all over the world share their knowledge, designs and ideas.

Accelerators at other Department of Energy labs use permanent magnets, but not nearly so many as in the 8-GeV Line and the Recycler.

"Foster and Jackson demonstrated that a beam line based on permanent-magnet technology can be made operational for accelerator service," said Matthew Allen, who headed the award committee. "Their tenacity and ingenuity will help overcome the reluctance of others to use these ideas."

For Steve Holmes, head of Fermilab's Beams Division, the award "demonstrated that innovation is alive and well at Fermilab."



Physicists Bill Foster (left) and Gerry Jackson inspect a permanent magnet.

Permanent magnets flank beam monitoring instruments, a vacuum pump and a short "trim" electromagnet for course correction in the 8-GeV Line.

Bricks of magnetized strontium ferrite, stacked inside permanent magnets in the 8-GeV Line and Recycler, create the magnetic field.

Photos by Reidar Hahn

The Recycler, at the top of the photo, needs no power, cooling water, or fancy control systems to run.

"Using magnets and saving energy—it's great!" said Igor Alexeff, president of IEEE's Nuclear and Plasma Sciences Society, as he handed Foster and Jackson their awards.

Permanent magnets can be used in accelerators whose magnetic fields don't vary—for example, in transfer lines and storage rings. And they offer distinct advantages. Specifically, unlike conventional magnets, they don't consume large amounts of electrical power, require cooling water systems or need elaborate controls, Allen explained, all of which are costly to build and/or maintain. Indeed, without all these devices, the 8-GeV Line, which transfers protons from the Booster to the Main Injector, and the Recycler, which recovers and stores antiprotons, both look remarkably simple. The Recycler, for example, is just a ring of "rainforest-green" (Jackson's adjective) steel cases mounted on steel hangars, unencumbered by the electrical buses, power lines, shut-off valves and copper pipes that line the Main Injector stationed beneath.

Steel cases hold bricks of magnetized strontium ferrite (the same material found in refrigerator magnets) that create the magnetic field.

Permanent magnets do have one problem, though. They are sensitive to fluctuations in temperature. But Foster and Jackson took the suggestion of former Lab employee Kirk Bertsche, who found a simple solution: a "temperature compensator" made of an alloy that is used in home electricity meters. Inserted between the magnets, the compensators "steal" the flux in the magnetic field, canceling the effects of temperature changes.

Demands on the permanent magnets in the Recycler are particularly stringent. The beam of antiprotons has to circulate 100,000 times per second for up to 36 hours before it is injected back into the Main Injector. By comparison, beam in the Main Injector circulates for a maximum of only 2.4 seconds before it passes into the Tevatron.

But the first test of the permanent magnets in the Recycler proved them able. A beam of protons moved through about one-third of the Recycler ring on January 12, needing no course adjustments from corrector magnets.

Largely because it uses permanent magnets, the Recycler, the eighth-largest particle accelerator in the world, was a bargain at less than $15 million. Not only that, but it will increase the luminosity, and hence the number of collisions per second, of the Tevatron when it starts again for Run II.

Foster said that the award took him by surprise. When Allen, who is at SLAC, contacted him, Foster's first reaction was that there must be some mistake. "From the way Allen described it, I thought it was some sort of internal SLAC thing," Foster said. When he was besieged by requests for his social security number and other identifiers useful to the Internal Revenue Service, he said, "it slowly dawned on me that there was some sort of cash handout that went with the prize."

Foster has pledged that he won't pocket the $1,000 cash award. Instead, he'll endow the long-bankrupt Main Control Room coffee fund. His current thinking on the rules for the endowment: "If you do something really great for Fermilab (like answering a pager at 4 a.m. to find and replace a flaky power supply controller, or finally get the Tevatron's cryogenic system leak-tight so it can be cooled down), then you get a free cup of coffee. Otherwise, you have to pay."

Jackson is thinking along refreshment lines, too. He's contributing his $1,000 to a refreshment fund for upcoming meetings on yet more novel ideas for future hadron colliders.

TRIAL

Prairie burning has survived controversy

BY

to produce state-of-the-art restoration results.

FIRE

by Mike Perricone

Fire brings its restorative influence to Fermilab's prairie, with Wilson Hall in the background.

Restoring the native prairie grasses and other vegetation now resplendent on much of Fermilab's 6,800 acres was always a welcome idea. Using fire as a restoration method was not.

"Imagine being a settler on the prairie in the 1840s," said Mike Becker of Fermilab's Roads and Grounds Department. "Imagine how fearful you would be of a prairie fire that could sweep through your farm, burning everything.

"That outlook was entrenched: Fire was terrible and there was no place for it on the Illinois prairie," Becker continued. "It took some persistent people putting the puzzle together to see why prairies are what they are, and to learn what kind of natural management took place."

Lightning provided the natural management, igniting trees or brush, leaving behind an expanse of scorched and blackened earth. But a man-made practice had an even greater impact: fires set by Native American peoples. They cleared out tall grasses and heavy undergrowth, thinning out wooded areas to create a sparser, oak-dominated forest—a landscape where they could more easily travel, hunt and ward off enemies.

Over the centuries, the fires created a cycle of growth, burning and vigorous re-growth. The native vegetation adapted to the cycle, growing hardier with time—until the era of fire aversion, which allowed imported Eurasian vegetation to spread with no natural checks.

"The native prairie plants are a diversified system," said Bob Lootens of Roads and Grounds. "But without burning they would be replaced by a monoculture of one weedy tree or shrub infesting an area and allowing nothing else to grow.

"Only a few insects would be interested in the vegetation. Only a few birds would be interested in those insects. By contrast, a diverse area holds many different insects, attracting many different birds, producing more extensive hunting grounds for hawks. The whole food chain is encouraged."

Lootens listed some of the prime imported offenders: European buckthorn, multiflora rose, garlic mustard and autumn olive, all highly aggressive. A different evolutionary history has left these foreign species vulnerable to the cycle of growth, burning and regrowth, recreated at Fermilab with a quarter century of success.

"Fire," said Lootens, "is the most effective tool we have."

Dr. Bob Betz, the naturalist who established the prairie as a priority in the earliest days of the Lab, rediscovered the importance of cyclical burning in his studies of Native American lore. He worked frequently with Ray Schulenberg, who established a prairie restoration at the nearby Morton Arboretum, and their ideas have stood the test of time.

"This method has become the state of the art in natural area restoration management," said Becker. "DuPage, Kane, Will and Cook Counties all use fires to some degree. The Nature Conservancy does, too. And there are independent firms that will come in to burn a privately-owned area."

The burns at Fermilab can cover an area from 60 to 100 acres. They are generally done in the spring, when all the growth is still dry and dormant. The preparations for burning an area begin months in advance with the planning of the firebreak, a lane generally 20 to 30 feet wide. This perimeter "barrier" is mowed frequently and kept to short turf, to provide less fuel for the fire.

Photos by Reidar Hahn

Bob Lootens of Roads and Grounds uses a drip torch to ignite a backfire.

On the day of the burn, the fire is set along a strip at the edge of the fire break on the downwind side of the area, with an igniting tool called a "drip torch" that drips a mixture of gasoline and diesel fuel from its nozzle. The fire will creep back into the wind. The perimeter fire break, wet down and offering no fuel, acts as a control against movement in the other direction. Fire is then set on the upwind side of the area; the strategy is aimed at having the flames meet somewhere in the middle, with nothing left to burn and nowhere left to go.

The wind is the key factor on any given day. The fire won't be set in an area where the wind is blowing toward the buildings on the site, though there's always the possibility of wind switching direction. Even on a calm day, the burns wouldn't be successful without the keen eye and sharp sense of a veteran crew that knows any spark can be a hazard. Lootens and Becker know their crew is absolutely reliable.

"There's no such thing as a completely safe fire," Lootens said. "We work with a crew of five to eight people, all experienced. We know they'll keep their eyes open and they know what to look for."

The Fermilab Fire Department is always notified of an impending burn, along with the Lab staff near the burn area.

"We never want to take anyone by surprise," Lootens emphasized. "We don't blow smoke onto Kirk or Butterfield Roads. If an on-site road is close to an area we're burning, we post 'Smoke On Road' signs. We also have two groundskeepers linked by radio to monitor the conditions, and they direct or stop traffic if they need to."

Safety precautions, common sense, research and good science have combined over the years to produce an award-winning prairie restoration.

"Fermilab is really invested in ecological values, and we get good support all the way up to the Director level," Becker said. "The people here really care. We've always thought that morally, the Department of Energy should be a good steward for the land it owns."

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EARTH DAY
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by Mike Perricone

Mark April 22 on your calendar as a day for planting trees, seeds and thoughts for the future at Fermilab.

That's the date of DASTOW-Earth Day '99, the annual combined effort of Daughters And Sons To Work activities and Earth Day plantings for Lab employees and their families.

This year's program will feature extensive mentoring sessions—the opportunity for kids to get together with professionals from all areas of the Lab—from physicists to fire fighters, from buffalo herdsmen to librarians. They'll spend an hour getting to know what each job involves and how it helps make the Lab function.

No more than three kids will be assigned to each mentor, so it's important to sign up as quickly as possible through the DASTOW web site (http://www.fnal.gov/faw/dastow).

If you're especially energetic, you can dig your own holes for tree-planting at the Earth Day activities. There will be enough pre-dug holes for about half the trees waiting to be planted, and both categories of planters will enjoy a picnic lunch at the prairie site. Lunch will also be served in the cafeteria, if you're not going to the Earth Day activities.

The day will also feature a special "Cryo Show" presented by Jerry Zimmerman, demonstrating the effects of super-cooling ordinary objects. Cryogenics are an important factor in Fermilab's research, with cryogenic systems used to cool superconducting magnets to temperatures near absolute zero. When materials reach a state of superconductivity, they lose virtually all their resistance to electricity.

And at the end of the day, you'll be able to take home a special poster commemorating the day's activities—including a group shot of all the participants, which will be taken at 9:00 that morning.

So plan to come out and have a hot dog, plant trees and seeds and learn about life at the Lab. It's a day you'll always remember, and it's a day you won't want to miss.

Photo by Reidar Hahn

The group shot in front of Wilson Hall began the activities for DASTOW '98. Nobel laureate and former Fermilab Director Leon Lederman (front, seated) happened by as the photo was being taken and joined the group.

the talk of the lab

Acqua alle Funi

Acqua alle Funi, or Water to the Ropes, is now more than just the title of founding director Bob Wilson's favorite sculpture—that obelisk in the pond in front of Wilson Hall whose title was as much the rallying cry for the workers who raised the obelisk in Saint Peter's Square in the 1500s as for the builders of Fermilab's accelerators in the 1900s. *Acqua alle Funi* is now the title of a freewheeling webzine published by Fermilab's Graduate Student Association. The eclectic content of "news and views," says its editor, Maria Spiropulu, is intended to "entertain … in one way or another."

The first issue was posted on March 17, and carried a welcome note from Fermilab theorist Chris Quigg that begins: "It is traditional for a revolutionary publication to greet the world with a radical manifesto. The fact that *Acqua alle Funi* has solicited a welcome from what may be mistaken for the establishment is perhaps a sign of just how subversive this new journal intends to be."

One of the links will take you to the site for Les Horribles Cernettes, the world's first particle physics rock band, with lyrics that celebrate the top quark or lament a lover's devotion to his collider. There's also a link to the page of Lynda Williams, who bills herself as a "science entertainer." What's that? "Essentially, I study the nature of the Universe and then I sing and dance and make media about it."

The webzine has more serious links, too: to technical publications and announcements of research results (like the recent observation of direct CP violation by the KTeV collaboration), to science articles published in the general press, and to reviews of science books and science-related movies ("October Sky"). There are also some irreverent profiles of Fermilab physicists in the form of Q&As. Featured in the first issue are graduate student Andrew Green and theorist Joseph Lykken. What did Green want to be when he was a kid? "An astronaut, a fireman, or an astronaut fireman…never quite decided." How many bets has he won? "I made $15 in Las Vegas…, and lost it at Lake Tahoe 12 years later." How many bets were on physics? "It's all physics, right?" For Lykken: What is obsolete? "The Standard Model." What did he think he would be doing 10 years after getting his Ph.D.? "Building warp drive engines." Where does he spend his money? "At Toys 'R Us."

And for those with time on their hands, there's the Cryptic Crossword, by M.C. Kruse, with clues like "Circle bar game backwards," "Not true sorrow," and "Chant the French one."

—Sharon Butler

Matter and Antimatter, Democrats and Republicans

Explaining CP violation to a public audience is a daunting task for anyone, scientist or not. Analogies can help convey difficult subject matter, but finding an appropriate analogy is tough. Kenneth Chang, of ABCNEWS, came up with an unusual one after attending a press conference at the recent centennial meeting of the American Physical Society.

Wrote Chang, in the Web version of ABCNEWS: "Consider kaons as married couples of politicians.

"Under the Law of Legislative Gridlock, one of each pair is a Republican, the other a Democrat. Suppose then that Democrats are easily disillusioned idealists and quit earlier. When they do, they pass one last flurry of national health care and other social

programs. (These are the parable equivalent of the decay products seen when a particle falls apart.)

"When the longer-lasting Republicans retire, they pass tax cuts and raise defense spending (a different set of decay products).

"(To complete this analogy, the mirror transformation would be like changing Republicans into Democrats and vice versa—they look pretty much the same, but act opposite. Charge conjugation, on the other hand, is like giving everyone a sex change.)

"In the 1964 experiment, some of the long-lived kaons spontaneously changed into short-lived ones. The analogy of this type of CP violation is that the Republicans occasionally morph into Democrats, who then pass more social programs.

"The CP violation seen in the latest Fermilab experiment is a much rarer event: the Republicans themselves create new social programs.

"Physicists can distinguish between the two effects, because the debris that cascades outward when a kaon decays differs slightly depending on the type of CP violation. Or, concluding the political analogy, the social programs passed by Republicans are different than those passed by Democrats."

—Sharon Butler

Russian dolls

At *FERMINEWS*'s request, Adrienne Kolb, Fermilab's archivist, kindly combed through the jumble of papers, periodicals, photos and artifacts in the third-floor History Room to track down the origins of the tabletop colorfully painted with seven Russian dolls in Fermilab's cafeteria.

In the February 21, 1974, issue of the *Village Crier*, she found an announcement calling for "original artistic designs" for tabletops. Hopeful artists were to submit their designs to the director's office. Winners would have their designs built by Fermilab's Model Shop, and would get three free lunches courtesy of the cafeteria, to be eaten at their very own tabletops.

One proposal Kolb found in her archival stacks was for a "physics commemorative table." As described, the tabletop "would be made of something like butcher's block wood of a carvable variety. As each experiment is completed, the experimenters would be invited to join with Director Robert Wilson to discuss their results. At that time, they could carve into the table some simple statement of their experimental results. If we made the wood hard enough, the statements would hopefully be short enough that we could understand them."

Kolb dug up other proposals, too, but was unable to find any relating to the Russian dolls.

Ernie Malamud, in the director's office, finally filled in the missing links. Digging into his own stash of undocumented recollections, he remembered that one Anatoly Kuznetsov was the artist. Kuznetsov, Malamud said, was a member of the team of seven Soviets working on experiment E36. It was the first team of Russian scientists to come to work at Fermilab, still in the era of the Cold War, in March 1972.

And the Russian dolls? Malamud said they are the seven wives of the seven Russian scientists—Erna Morosova, Elena Kuznetsova, Valentina Nikitina, Nelly Barteneva, Tamara Pilipenko, Nadia Popova and Irina Zolina—who were not allowed to work even though they were all professional people. Which is the blue-eyed or brown-haired doll, though, he doesn't know.

—Sharon Butler

LAB NOTES

BOOK FAIR

Fermilab will again sponsor a Book Fair, hosted by Books Are Fun, in the Atrium on Wednesday, April 21 from 10:00 AM until 6:00 PM and on Thursday, April 22 from 7:00 AM until 3:00 PM. Books are Fun is offering a new selection of hard cover books with savings of up to 70%. The Book Fair features in excess of 200 titles-Cookbooks, General Information Books, Inspirational Books, Children's Books, Bestsellers and more. They also offer a special section of photo albums, cards and gift items. The Book Fair will accept cash, personal check, MasterCard, Visa, American Express and Discover. Books Are Fun will be pre-displaying some of the titles available at the Book Fair on Monday, April 19 at a table setup in the Atrium. Mark your calendars now!

"SEND HELP" CARDS NOW AVAILABLE

Orange cards with the message "Send Help" can be placed on your car's window in an emergency. These cards are available at the Reception Desk in Wilson Hall, and from Division & Section heads.

LETTER TO THE EDITOR

Regarding the article in the March 19th Talk of the Lab on ARISE we would like to clarify the fact that Angela Dumas is part of a Fermilab education program, the Fermilab ARISE project, with funding for four years from the Illinois State Board of Education and additional support from an anonymous donor. Funding comes to Fermilab through Friends of Fermilab. Whitney Young and seven other Illinois high schools are partners in that project which supports teachers' efforts to develop a three-year coherent standards-based high school science curriculum. The project includes documenting the teams' work so that other high schools may learn from their experiences.

At the same time Leon Lederman is spearheading a national effort, ARISE, to develop a three-year coherent, standards-based high school science curriculum based on the concept of reversing the sequence with conceptual physics taught first.

The ARISE program has its roots in two workshops, one held in 1995 and the other in 1998, of distinguished scientists and educators. Support for the workshops came from an anonymous donor and the U.S. Department of Education. Both were co-chaired by Leon M. Lederman and Marjorie G. Bardeen, Fermilab Education Office Manager. The proceedings of the second workshop were published as the White Paper.

—Marge Bardeen and Leon Lederman

MILESTONES

BORN

First baby buffalo of 1999, on April 9.

RETIRING

Kenneth Isakson, I.D. # 9586, on April 7, from ES&H/EPG Permitting & Monitor.

Nancy Theis, I.D. #10108, on May 27, from the Technical Division/Admin. Her last work day will be April 30.

DIED

Hendrik J. VanLeesten, formerly with the Technical Division, on March 14.

William S. Couch, on April 3, worked in Business Service Section/Procurement.

CUT

The Old Thickwire cable that used to serve as the backbone for all data communications in Wilson Hall. On April 7, the Data Communications Group in the Computing Division transferred all users in the High Rise from a shared, single 10-megabit cable to multiple high-performance networks.

LUNCH SERVED FROM
11:30 A.M. TO 1 P.M.
$8/PERSON

DINNER SERVED AT 7 P.M.
$20/PERSON

Chez Léon MENU

FOR RESERVATIONS, CALL X4512
CAKES FOR SPECIAL OCCASIONS
DIETARY RESTRICTIONS
CONTACT TITA, X3524
HTTP://WWW.FNAL.GOV/FAW/EVENTS/MENUS.HTML

LUNCH
WEDNESDAY, APRIL 21

Whitefish Fillet
with Preserved Lemon Sauce
Roasted Garlic and Rosemary Potatoes
Mixed Grilled Vegetables
Pecan Chocolate Tart

DINNER
THURSDAY, APRIL 22

Baked Portabello Mushrooms
Stuffed Fillet of Sole
with Champagne Herb Sauce
Sauteed Spinach
with Garlic and Lemon
Strawberry Shortcake

LUNCH
WEDNESDAY, APRIL 28

Cannelloni
Tomato, Pepper and Onion Salad
Cold Lemon Souffle

DINNER
THURSDAY, APRIL 29

Booked

FERMI NEWS
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