FERMI NEWS

FERMILAB A U.S. DEPARTMENT OF ENERGY LABORATORY

Volume 22
Friday, December 17, 1999
Number 24

INSIDE:

All I want for Christmas is...

a Hydrodynamics Kit

by Judy Jackson

Erector sets, the ones with the brass nuts and bolts, the red tool kits, and the electric motors, head the list. Chemistry sets follow close behind. Those are the presents, say Fermilab physicists, that made their eyes light up on Christmas morning when they were children. Of course, in the case of the chemistry sets, it wasn't just their eyes that lit up. The explosive potential of the early product line of the A.C. Gilbert Company is legendary among Fermilab physicists, whose accounts of youthful chemistry experiments make the week after Christmas sound a lot like the Big Bang.

What are the other presents that physicists remember from Christmas past? CDF collaborator Brenna Flaugher had a set of wheels, curved tracks and straightaways that could be configured in three dimensions to send the wheels flying "off into the dining room."

Tom Diehl, of DZero, loved the model airplanes and boats that Santa brought when he was a lad. He put them together meticulously, he recalls, painting and finishing them with the utmost care ("good training for building wire chambers")—and promptly blew them up with the help of the faithful chemistry set.

Physicist Bill Foster enthusiastically described his Christmas joy, a "hydrodynamics kit," a set of plastic I beams, reservoirs, tubes, pumps and cups that could be put together in a refinery-like assembly that sent water flowing and flying in all directions. Microscopes were popular, and a primitive random-number generator called "electronic dice" fascinated the Beams Division's Paul Czarapata and his brother one Christmas.

Build-it-yourself crystal radio sets had a sizable following, initiating a new generation into the art of soldering. Various electrical kits made their appearance, although it was hard to compete with the electrical challenges associated with keeping strings of early Christmas lights aglow.

Then there were trains. Steve Holmes, who served as project manager for the Main Injector accelerator, remembers the Lionel train set that circled the family Christmas tree one year. Operating the train embodied many principles of physics, Holmes said, particularly after he reached the stage of making speeding locomotives collide. Could those boyhood hours around the tree have prefigured a lifetime's preoccupation with circular tracks, acceleration and collisions?

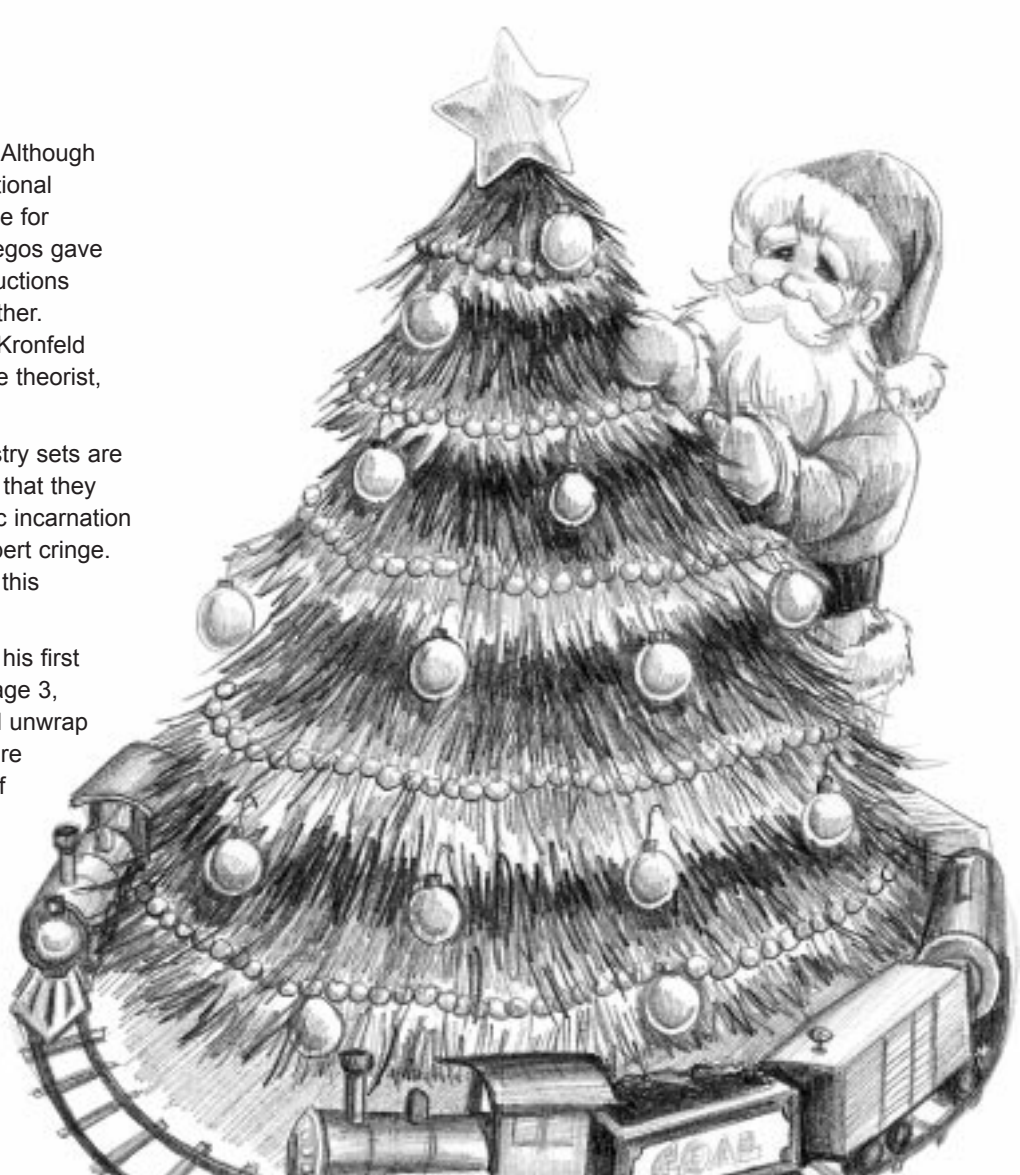
Physicist Steve Geer had a train set, too. Which he blew up. With gunpowder he made from his chemistry set.

Theorist Andreas Kronfeld liked Legos. Although his parents equipped him with the traditional Erector set, he found he lacked patience for tightening all the little bolts and nuts. Legos gave him the means to build fantastic constructions without the tedium of bolting them together. Perhaps it was at this point when Mrs. Kronfeld began to suspect she was raising a little theorist, not an experimentalist.

To hear physicists tell it, today's chemistry sets are pale imitations of the mayhem-in-a-box that they knew and loved; and the modern plastic incarnation of the Erector set would make A.C. Gilbert cringe. So what are physicists giving their kids this Christmas?

Little Alexander Kronfeld will be getting his first set of Legos. And Athena HaunParke, age 3, daughter of theorist Stephen Parke, will unwrap the gift that all the three-year-old girls are hoping for this year: her very own set of socket wrenches from Sears.

You never know: those Christmas Legos and wrenches could just be the inspiration for the next new generation of physicists.



"Hello Boys—

If you like thrills and adventure, you'll like being an Erector engineer."

(From an early Erector set manual)

In 1913, Alfred Carlton Gilbert developed the first Erector set, a boxful of girders, pulleys, gears, and the screws and tools to put them together. "From 1909 until his death in 1961," says the web site of the A.C. Gilbert Heritage Society, "[he] would revolutionize the toys that we would play with. For a little over 50 years, he brought us toys that made science fun."

After the Erector set came something called a physics set that never really caught on, a line of model trains, and the famous A.C. Gilbert chemistry set.

"In truth," the Gilbert site avers, "Mr. Gilbert meets the qualifications that place him among America's greatest men! Medical doctor, Olympic Gold Medal winner [for the pole vault in 1908], industrialist…. You name it…. What a record of accomplishments! His desire was not to accumulate great wealth, but to develop and market toys that would develop the engineers and scientists that our country must have if we are to maintain our position in the world."

If Fermilab scientists are any indication, A.C. Gilbert did the job.

NOBEL '99

a STRONG VOTE for electroweak theory

Photo courtesy University of Michigan

After The Prize was announced, Martinus Veltman (right, with University of Michigan President Lee C. Bollinger) was honored at Michigan's football game against Illinois. Michigan lost, 35-29, but particle physics has been a big winner among Nobel Prizes awarded in the last half-century.

Cover: Particle physicists who have won the Nobel Prize since 1948.

"To me, Nature is a big jigsaw puzzle, and I see it as my task to try to fit pieces of it together."

~Web home page of Professor Gerardus 't Hooft, University of Utrecht, Netherlands

Gerardus 't Hooft

by Mike Perricone

In the early 1970s, Chris Quigg was a young physicist at the State University of New York at Stony Brook, on Long Island. He met another young physicist from the Netherlands, named Gerardus 't Hooft, at a reception for new Ph.D.'s in the home of a Stony Brook professor.

"A card table had been set up with pieces of a jigsaw puzzle scattered over it, and people would come over to put in usually a corner piece or an edge piece," Quigg recalled. "'t Hooft picked up a random piece, not an edge or a corner, but something from the middle. He stared at it intently. Then he put it down on the table, with great confidence, exactly where it should go. At the least, it was a good act. I decided from that moment, that here was a guy with very impressive geometrical insight."

Quigg's intuition was accurate. 't Hooft was already immersed in the work that was to win the 1999 Nobel Prize in Physics for himself and for his teacher, Martinus Veltman, cited by the Royal Swedish Academy of Sciences "for elucidating the quantum structure of electroweak interactions in physics."

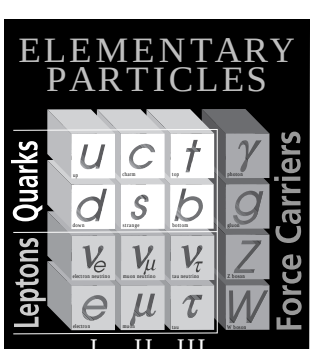
The Academy credited 't Hooft, 53, and Veltman, 68, for placing particle physics theory on a firmer mathematical foundation, for giving researchers a well-functioning "theoretical machinery" which, among other applications, can be used for predicting the properties of new particles. Those new particles may include the Higgs boson, predicted as the source of mass: the next big prize in particle physics, perhaps the key to a future Nobel Prize.

Quigg, a Fermilab theorist, explained that evidence is growing within electroweak theory for a relatively light Higgs mass. A light mass makes it possible for the particle to be discovered in experiments of the Large Electron Positron Collider at CERN, the European particle physics laboratory in Switzerland; or quite possibly at Fermilab in what is called "Extended Run II" of the Tevatron, scheduled to begin in 2001.

"That kind of inference comes from the style of calculations that Veltman pioneered, using tools that [Veltman and 't Hooft] developed together," Quigg said. "With this very practical application, we have guidance for our experiments on where the Higgs mass should be. That clearly has an effect on the everyday lives of particle physicists, if not of people on the street."

A step toward unity

Electroweak theory combines the electromagnetic force with the weak nuclear force, which allows some parts of the nucleus (held together by the strong force) to decay. The electromagnetic force had itself been an early example of unification, proposed by James Clerk Maxwell in the 1860s. Maxwell's theory united electricity with magnetism, and predicted radio waves.



By the 1930s, physicists were attempting to unify quantum mechanics with electromagnetism into a quantum field theory. The result—quantum electrodynamics—was made possible in the 1940s by the work of Sin-Itiro Tomonaga, Julian Schwinger and Richard Feynman. These three (who shared the 1965 Nobel Prize) realized they could back off and view individual particles at a distance to solve the difficulties posed by quantum mechanics (including the existence of short-lived virtual particles).

But uniting electromagnetism with the weak force was tougher. Mathematical operations in quantum electrodynamics could be performed in any order (like addition and multiplication, or moving an object in two-dimensional space). Sheldon Glashow, Abdus Salam and Steven Weinberg shared the 1979 Nobel Prize for formulating a theory of electroweak interaction using operations that depended on their order (like division and subtraction, or moving an object in three-dimensional space). Their theory predicted the new W and Z force-carrier particles, which were detected at CERN in 1983 and immediately won the 1984 Nobel Prize for Carlo Rubbia and Simon van der Meer.

Enter Veltman

Electroweak theory had a problem, however: it produced values of infinity in its equations, signifying infinite headaches for physicists.

Field theories are gauge theories, where individual particles are representations of a group. Individual particles react to an operation the way the group reacts. Another of Feynman's contributions was the Feynman diagram, providing a system for calculations in gauge theories. Veltman took theory and calculations to the next level.

"From some time in the 1960s, Veltman was one of the people very interested in developing techniques to calculate reliably with gauge theory," said Quigg, the author of a noted book on gauge theories. "[To him], the job of a theoretical physicist is to be able to evaluate the Feynman diagrams, and then draw the experimental consequences of the theory."

Veltman, originally of the University of Utrecht and now John D. MacArthur Professor of Physics at the University of Michigan, has a long association with Fermilab. He was a member of the Lab's Physics Advisory Committee while Leon Lederman (1988 Nobel Prize) served as director, and he was a frequent visitor to the Lab's Theoretical Physics Department. Quigg remembers Veltman as being "very stimulating" on the PAC, because "his opinions were completely unedited."

While at Utrecht, Veltman developed one of the early computer-based algebra programs to facilitate calculations in Feynman diagrams. The

A (Relative) Half-Century of Nobel Prizes in Particle Physics

1999

't Hooft, Gerardus
Veltman, Martinus J.G.
"For elucidating the quantum structure of electroweak interactions in physics"

1995

Perl, Martin L.
"For the discovery of the tau lepton"
Reines, Frederick
"For the detection of the neutrino"
Joint Motivation: "For pioneering experimental contributions to lepton physics"

1992

Charpak, Georges
"For his invention and development of particle detectors, in particular the multiwire proportional chamber"

1990

Friedman, Jerome I.
Kendall, Henry W.
Taylor, Richard E.
"For their pioneering investigations concerning deep inelastic scattering of electrons on protons and bound neutrons, which have been of essential importance for the development of the quark model in particle physics"

1989

Ramsey, Norman F.
"For the invention of the separated oscillatory fields method and its use in the hydrogen maser and other atomic clocks" (Ramsey was founding president of Universities Research Association, Inc., which operates Fermilab for the Department of Energy).

1988

Lederman, Leon M.
Schwartz, Melvin
Steinberger, Jack
"For the neutrino beam method and the demonstration of the doublet structure of the leptons through the discovery of the muon neutrino"

1984

Rubbia, Carlo
Van Der Meer, Simon
"For their decisive contributions to the large project, which led to the discovery of the field particles W and Z, communicators of weak interaction"

1980

Cronin, James, W.
Fitch, Val L.

"For the discovery of violations of fundamental symmetry principles in the decay of neutral K-mesons"

1979

Glashow, Sheldon L.
Salam, Abdus
Weinberg, Steven

"For their contributions to the theory of the unified weak and electromagnetic interaction between elementary particles, including inter alia the prediction of the weak neutral current"

1976

Richter, Burton
Ting, Samuel C. C.

"For their pioneering work in the discovery of a heavy elementary particle of a new kind"

1969

Gell-Mann, Murray

"For his contributions and discoveries concerning the classification of elementary particles and their interactions"

1968

Alvarez, Luis W.

"For his decisive contributions to elementary particle physics, in particular the discovery of a large number of resonance states, made possible through his development of the technique of using hydrogen bubble chamber and data analysis"

1965

Tomonaga, Sin-Itiro
Schwinger, Julian
Feynman, Richard P.

"For their fundamental work in quantum electrodynamics, with deep-ploughing consequences for the physics of elementary particles"

1961

Hofstadter, Robert

"For his pioneering studies of electron scattering in atomic nuclei and for his thereby achieved discoveries concerning the structure of the nucleons";

1960

Glaser, Donald A.

"For the invention of the bubble chamber"

1959

Segrè, Emilio Gino
Chamberlain, Owen

"For their discovery of the antiproton"

program was called *Schoonschip*, or "beautiful ship" ("It's probably something more blasphemous in Dutch," Quigg quipped). Together with 't Hooft, his student in the 1960s, Veltman developed new methods for isolating and dealing with the infinities that crop up in the middle of the calculations.

Meanwhile, 't Hooft combined Veltman's teaching with ideas of the late Ben Lee, early head of Theory at Fermilab. He demonstrated that gauge theories like electroweak theory could be used to calculate reliable predictions extending to the high-energy realm. 't Hooft, Quigg said, was also the first to calculate the electroweak theory consequences of such simple reactions as a neutrino scattering from an electron.

Discoveries at CERN in 1973 bore out 't Hooft's predictions, demonstrating the existence of neutral currents and showing that electroweak theory was to be taken seriously. Then Veltman applied electroweak theory to neutral currents with his new calculation methods, making predictions (since borne out at LEP) relating the mass systems of the W and Z bosons to the square of the top quark mass—showing where the Higgs piece fits in the middle of the puzzle.

Sharing the credit

't Hooft and Veltman will share the Prize money of about $1 million, awarded during Nobel Week, December 6-12.

Quigg described Veltman, nicknamed "Tini," as "a crusty guy," adding: "You sometimes can't tell if he's being very nice or very mean, but you love him anyway." It would have been easy (and not unprecedented in science) for the "crusty" Veltman to claim all these results from his own work, with 't Hooft the student following the teacher's ideas.

But Quigg cited a vivid example of Veltman's consistent and early insistence that 't Hooft's work spoke for itself. The event that stood out for Quigg was the Ben Lee memorial conference at Fermilab in 1978. Lee had been killed in a car crash the previous year.

"What Veltman did at that conference was really impressive," Quigg recalled. "He was the professor, and he could easily have signed his name to any papers [that were published]. But Veltman specifically cited 't Hooft's accomplishments. So the intellectual rigor he applied to other people, sometimes in a nasty way, he also applied to himself."

The Prize: Pro and Con

The Prize is an incredible ticket to help one effect socially redeeming activities...what I intend to do is to use The Prize shamelessly to help advance science education in the United States. For this task a second Prize would be helpful."
~Leon Lederman, *The God Particle*

"It's nice that I got some money—I was able to buy a beach house—but altogether, I think it would have been much nicer not to have had The Prize—because you never, any longer, can be taken straightforwardly in any public situation."
~Richard Feynman, *Surely You're Joking, Mr. Feynman*

James Cronin (left) of the University of Chicago, and Allan Watson of the University of Leeds, in England, are co-leaders of the Pierre Auger Observatory investigating high-energy cosmic rays. Says Cronin: "In some sense, the best use of The Prize is its prestige, because it gains access for you."

WAITING IS PART OF THE PACKAGE

Val Fitch

The phenomenon of CP Violation won The Prize for James Cronin and Val Fitch, and has moved to the forefront of everyday thinking in particle physics. But both developments came slowly.

"I'm surprised that it's taken this long to get at the answers," said Cronin, who made the discovery with Fitch in 1964. "In fact, it took about 35 years to get to the point of a breakthrough, of learning something brand new."

Cronin and Fitch won The Prize in 1980, sixteen years after their results.

"I'll probably get some brickbats for saying this," he quipped, "but I think the Nobel Committee was remiss in taking so long to recognize the importance of the result, especially with the relevance to cosmology so clearly pointed out by [Andrei] Sakharov in 1967."

Others have waited longer: 28 years for Leon Lederman, Mel Schwartz and Jack Steinberger. But with the delay, Cronin admitted, "by then I was more mature. It's probably better that The Prize didn't come sooner."

Cronin welcomed recent time asymmetry results from KTeV at Fermilab, and NA48 at CERN, and he was enthusiastic about "B factories" being developed specifically to explore CP violation.

"I would say that within the next five to 10 years, we'll make a lot more progress than in the past 35," he said. "It is kind of amazing to have come upon a discovery that has persisted in interest, and has taken so long to unravel. We still don't know what it is."

Now he's working on another mystery as co-leader of the Pierre Auger Observatory, investigating high-energy cosmic rays. At 10^{20} electron volts, they're the highest energies witnessed in the universe—a million times the energy reached at Fermilab's Tevatron, the world's highest-energy particle accelerator.

"I guess [the shift] is a culmination of the sociology of physics, and of trying to move into something where one feels one can make a difference," Cronin explained. "Physics at CDF, or DZero, or LHC—that's going to happen, whether I participate or not…the attack on the highest energy cosmic rays is a genuine mystery. Nobody knows their origin, but we know nature is creating them. It's different, and it's really exciting."

Cronin remains a close friend of Fitch, who has stayed at Princeton University, but says they don't dwell on their famed experiment.

"It's not our highest priority in conversation," he said. "We follow developments with great interest, but we've both gone on to other things. [CP violation] is in good hands with newer and younger people."

—Mike Perricone

1958

Cherenkov, Pavel Alekseyevich
Frank, Il'ja Mikhailovich
Tamm, Igor Yevgenyevich

"For the discovery and the interpretation of the Cherenkov effect"

1957

Yang, Chen Ning
Lee, Tsung-Dao

"For their penetrating investigation of the so-called parity laws which has led to important discoveries regarding the elementary particles"

1955

Lamb, Willis Eugene

"For his discoveries concerning the fine structure of the hydrogen spectrum"

Kusch, Polykarp

"For his precision determination of the magnetic moment of the electron"

1954

Born, Max

"For his fundamental research in quantum mechanics, especially for his statistical interpretation of the wavefunction";

Bothe, Walther

"For the coincidence method and his discoveries made therewith"

1952

Bloch, Felix
Purcell, Edward Mills

"For their development of new methods for nuclear magnetic precision measurements and discoveries in connection therewith"

1951

Cockcroft, Sir John Douglas
Walton, Ernest Thomas

"For their pioneer work on the transmutation of atomic nuclei by artificially accelerated atomic particles"

1950

Powell, Cecil Frank

"For his development of the photographic method of studying nuclear processes and his discoveries regarding mesons made with this method"

1949

Yukawa, Hideki

"For his prediction of the existence of mesons on the basis of theoretical work on nuclear forces"

1948

Blackett, Lord Patrick Maynard Stuart

"For his development of the Wilson cloud chamber method, and his discoveries therewith in the fields of nuclear physics and cosmic radiation"

Fermilab marks a year of

change

Fermilab marks a year of

discovery

Fermilab marks a year of

safety

by Mike Perricone

Whether or not the end of 1999 officially marks the end of millennium, this year before Y2K marked the beginning of several new eras at Fermilab.

And despite delays in the planned startup for Run II of the Tevatron, the Lab's machines, technicians, engineers and scientists are preparing to use new resources for discoveries that will again push back the frontier of high energy physics.

"We've transformed Fermilab into a much more powerful physics facility—and it's still the world's highest-energy facility for particle physics research," said new Director Michael Witherell.

Witherell, named in March to succeed John Peoples Jr., will preside over a research program that is energized by the addition of a new accelerator, the Main Injector, combined with the unique Antiproton Recycler as its tunnel-mate. Completing an eight-year, $260-million project on time and on budget would be a cause for celebration at any institution, and the Main Injector is at the top of the list of the most important developments at the Lab for 1999.

Dedication: A New Machine

U.S. Secretary of Energy Bill Richardson and U.S. Speaker of the House Dennis Hastert stepped up to the specially-made podium in Ramsey Auditorium, turned ceremonial keys and pushed computer buttons, and officially placed the two-mile circumference Main Injector into operation during ceremonies on June 1.

Secretary Bill Richardson, physicist Steve Holmes, Speaker Dennis Hastert.

Hastert, who represents Fermilab's district in Congress and has supported the project from its inception, declared that the Main Injector "ensures that Fermilab is THE place in the world to conduct high-energy physics."

Speaking to a context of increasing sentiment in Congress opposing foreign participation in U.S. science, Richardson pointed to contributions of many foreign-born members of the Lab. "At a time when some may question the value of scientists from other countries and the ways they benefit America," Richardson emphasized, "I say let them visit Fermilab."

John Peoples, Jr.

Transition: A New Director

Completing and dedicating the Main Injector Project was a fitting climax for Peoples, whose tenure as director (1989-1999) virtually spanned the entire Main Injector-Antiproton

Michael S. Witherell

Recycler effort from conception to commissioning. He was honored with a symposium in June.

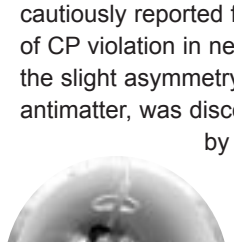
Witherell, a Fermilab experimenter as early as 1978, was named the Lab's fourth director by Universities Research Association, Inc., via a search committee chaired by eminent physicist George Trilling. A former chairman of DOE's High Energy Physics Advisory Panel, Witherell had been a professor at the University of California, Santa Barbara, since 1986.

"We will require new facilities to address pressing scientific questions if the field of particle physics is going to remain vital," Witherell said in his introductory press conference. "I didn't take this job because I thought it would be easy."

Violations: New Asymmetries

The critical glitch between matter and antimatter showed up again, in two new results announced at Fermilab.

In February, scientists at the CDF collaboration cautiously reported finding "tantalizing" evidence of CP violation in neutral B mesons. CP violation, the slight asymmetry in the behavior of matter and antimatter, was discovered in neutral K mesons by James Cronin and Val Fitch in 1964 (see "Nobel '99," Pg. 4). The CDF results were the first evidence in B mesons, and the first results in any particles other than K mesons (kaons).



KTeV detector vacuum tank.

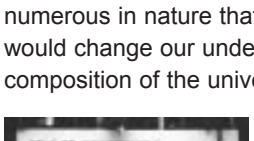
And just a month later, the KTeV (Kaons at the Tevatron) experiment announced a startlingly large value in the special case called direct CP violation. The value of this key ratio, called epsilon prime over epsilon, underscored with greater precision an effect observed in 1988 by the NA31 experiment at CERN, the European particle physics laboratory in Switzerland.

Groundbreaking: Minos and Auger

The Iron Range of Northeastern Minnesota calls itself the "End of the Road," but a July 20 ceremony represented the next step for the Main Injector Neutrino Oscillation Search.

A half-mile underground in the former iron mine, officials from DOE, Fermilab, and the University of Minnesota swung picks to begin opening a cavern where a 5,000-ton detector will be built. A beam of muon neutrinos will be sent though the earth from Fermilab to the Soudan Mine, 450 miles away; if the beam has a different composition in the detector than it did at its source, that change or oscillation will mean that neutrinos have mass. Neutrinos are so numerous in nature that even a small mass would change our understanding of the composition of the universe.

Michael Witherell, MINOS spokesn Stan Wojcicki, Paul Maurer of the Minnesota Department of Natural Resources, Christine Maziar and Ed Wink of the University of Minne



Sign marking construction site of Pierre Auger Observatory in Argentina.

Far south, in the desert of Argentina, another groundbreaking ceremony in March initiated the construction of 1,600 water-tank detectors (3,000 gallons each) over an area the size of Rhode Island. The Pierre Auger Observatory is investigating the mystery of high-energy cosmic rays, which carry an energy more than 100 million times as great as the Tevatron, the world's highest-energy particle accelerator.

Skygazing: New Quasars

Quasars, or quasi-stellar objects, are another cosmic mystery: they pack the brightness of more than 100 galaxies into a space no bigger than our solar system.

The Sloan Digital Sky Survey, aiming for a high-resolution, three-dimensional mapping of one-

Apache Point Observatory.

change

fourth of the night sky, was still in shakedown mode when it produced big news just a year ago: it observed the most distant quasar ever recorded.

The telescope at Apache Point, New Mexico, spotted a quasar with a red shift of five, meaning the light had begun its trek when the universe was less than a billion years old and less than a sixth of its present size. Red shift measures the lengthening of light waves as the source recedes from its observer, similar to the lowering in pitch as a sound's source moves away from us.

Computing: Hub for CMS

Physicist Vivian O'Dell, left, and Computing Head Matthias Kasemann.

Fermilab will become a Regional Center for storing and distributing data when the Compact Muon Solenoid experiment begins generating physics results from the Large Hadron Collider at CERN.

In addition to hosting the U.S. collaboration building subassemblies for the CMS detector, Fermilab will also become the collaboration's host laboratory for software, analysis and computing support. As host, Fermilab will have a continually updated copy of all the data used for analysis at CERN, and will make it available to all scientists at all universities and laboratories in the U.S. collaboration of 35 institutions in 19 states.

Computing Division head Matthias Kasemann is the interim manager for the project, which has received initial approval and funding from DOE and the National Science Foundation.

On the Move: CERN Components

Tug Arkan, left, and Rodger Bossert with LHC model magnet.

The U.S. commitment for LHC accelerator and detector contributions at CERN is $531 million over eight years, and Fermilab is home to two contributing groups.

The US/CMS collaboration, which includes Fermilab, Lawrence Livermore National Lab and Los Alamos National Lab, has gone into production mode with components for the detector. The Fermilab efforts focus on the hadron calorimeter, and on the muon Cathode Strip Chambers.

Another collaboration, coordinating efforts with Fermilab, Lawrence Berkeley National Lab and Brookhaven National Lab, is producing LHC superconducting magnets and their associated systems. Fermilab has delivered a magnet heat exchange test unit; heat exchanger test unit modules have all been delivered to Fermilab from the vendors, and are undergoing final inspection before shipment to CERN. The last in a series of model magnets is being tested, with production due to begin in the spring of 2000.

On the Rise: Lab-Wide Safety

Fermilab's injury rate has improved to the level where it might be the lowest in the Lab's 30-year history. Symbolizing the improvement is the Technical Division's Material Control Department, which has gone more

Material Control Department, Technical Division.

discovery

than four years without an injury serious enough to cause an employee to miss a workday.

That record is all the more impressive considering that much of that four-year period was devoted to handling hundreds of magnets for the construction of the Main Injector and the Antiproton Recycler. Those magnets can weigh up to 20 tons each, and even their components are heavy enough to require lifting by crane, sling or forklift, and transport by tractor-trailer.

Said Director Witherell: “Though the numbers are important, it is the people at the Laboratory who really matter. We owe it to each other to keep our Laboratory a safe place to work.”

On the Mend: Run II Schedule

New CDF end plug.

Plans to begin Run II of the Tevatron in 2000 have been pushed back to 2001, but collaborations at the CDF and DZero detectors are turning a problem around by turning away from the Lab’s historic practice of basing schedules on the most optimistic assumptions.

Competing for manpower and funding has been difficult for the detector groups, whose upgrades incorporate unique systems never designed, built or tested before, requiring extensive research and development. In addition, managing the efforts of 500 independent collaborators has been likened to “herding cats.”

But the Lab has made a top priority of completing the upgrades, and both detector groups are paying rigorous attention to new schedules. At CDF, each member of the collaboration must participate in “installation shifts,” running through June 2000, as a requirement for authorship on any subsequent results.

DZero collaborator Linda Stutte.

The Future: Going Global

Jonathan Dorfan.

Can the world’s accelerator-building nations surmount political and economic obstacles, and join forces for a global next step in high-energy physics?

The high-powered International Committee on Future Accelerators, including the directors of the world’s major particle physics laboratories, met at Fermilab in October to discuss the challenge. The next-generation machine—whether the Next Linear Collider, the Very Large Hadron Collider, or a muon collider—will require money and resources beyond the reach of any single country, and cooperation beyond the scope of any achieved so far.

The conference made no recommendation on a choice of machine, but clearly saw no doubt about the future of the field.

“We must try to write a global road map, and address regional balances over time,” said Jonathan Dorfan, Director of Stanford Linear Accelerator Center. “Intense regionalism is an invitation to extinction.”

safety

LENNOX recognized for NTF contributions

Photo by Reidar Hahn

Arlene Lennox views a patient's CAT scan images at the Midwestern Institute for Neutron Therapy.

by Mike Perricone

In the Neutron Therapy Facility, not all the therapy comes from neutrons.

Arlene Lennox remembers a little Hispanic boy reading a book about dinosaurs he had found in the waiting room, and asking his mother what a "foot" meant. His mother, who spoke little English, couldn't answer. Lennox responded by explaining the unit of measure, pointing out floor tiles that were a foot square, helping the boy count off the length of dinosaurs in floor tiles, and giving him a 12-inch plastic Fermilab ruler.

"The rest of the time he was waiting, he was enthusiastically measuring everything in sight," she recalled. "I feel as if we changed his life that day, as if we opened a door for him."

In her previous life as a physicist, Lennox worked on Fermilab's nascent CDF project, and participated in the first approved collider experiment (Total Cross Section) at the Tevatron. She was asked to manage NTF in 1985, by then Assistant Director Rich Orr.

Since then, she has become what she calls a self-educated medical administrator. The NTF uses a beam of high-energy neutrons to treat malignant tumors. It occupies space at Fermilab, and uses protons from the Linear Accelerator to produce its neutron beam, but the facility is run independently. It rents space, buys beam and pays for staffing.

With Lennox at the helm, NTF has survived the withdrawal of funding from the National Cancer Institute, and even a shutdown in 1995 when Rush Health Services ended its affiliation. Lennox was able to establish a new sponsorship by Provena St. Joseph Hospital in Elgin, for what is now called the Midwest Institute for Neutron Therapy.

Lennox's efforts led to a LUCI (Leading Us in Commerce Industry) Award from the Fox Valley Business Journal. Fermilab Director Michael Witherell underscored his support with an Employee Recognition Award.

"Very few parts of this Laboratory have benefited from a single driving commitment as much as NTF has from Arlene Lennox," said Witherell. "This is a good area for us to be working in. Through all the complications over the years, Arlene has kept the facility alive."

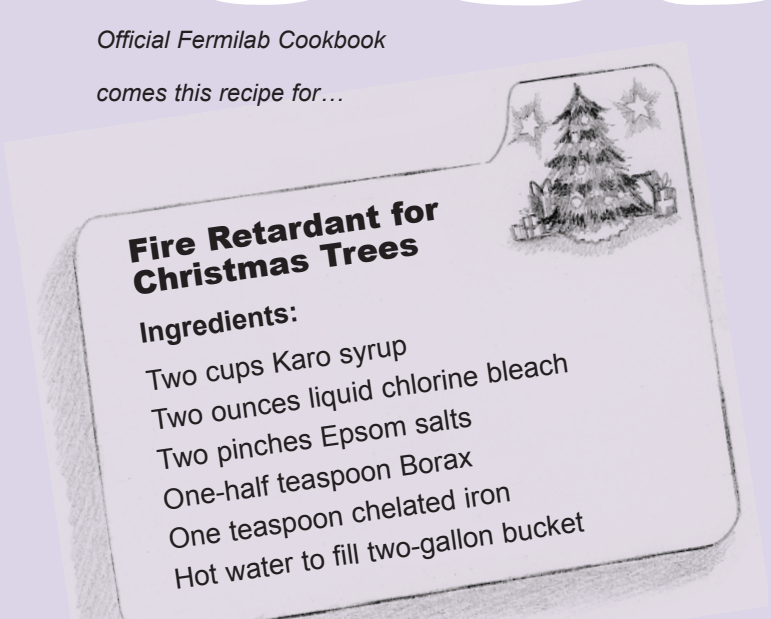
"This ceremony honors every person who has had anything to do with the facility over the years, and it's a good message," Lennox replied.

U.S. House Speaker Dennis Hastert, who represents Fermilab's district, has offered $2 million in funding to help create a stand-alone facility. Lennox also hopes to expand NTF's research capabilities. And she points out that some 30 percent of referrals to NTF are indigent, with no medical insurance. Some important expenses are covered by a fund drawn from contributions and administered by the Lab's Business Services Section.

"Some of our patients can't pay for the train fare from Chicago," Lennox said. "It costs nine dollars. That's one way we use the fund."

the talk of the lab

In the past, FermiNews has explained to readers how to make antiprotons, kaons and muon neutrinos. Now from the Official Fermilab Cookbook comes this recipe for…



You can purchase the Karo syrup, Borax and liquid chlorine bleach from the supermarket. The Epsom salts can be purchased from the drug store and the chelated (pronounced KEY-lated) iron can be purchased from a garden shop or plant store.

Procedure:

1. Fill a two-gallon bucket with hot water to within one inch of the top and add the remaining ingredients. Stir thoroughly, dissolving ingredients. Set aside.
2. With a saw, cut an inch off the bottom of the trunk of your recently purchased tree. Try to make a level cut.
3 Immediately stand the trunk of the tree in the solution and leave for 24 hours.
4. Keep the remaining solution. Place your tree in a tree stand that contains a well for liquid.
5. When the tree is in its final resting place, use a plastic cup to pour solution from the bucket into the tree well. Fill the well.

6 Every day without exception, “top up” the well of the tree with the solution from the two-gallon bucket.

Following these directions will fireproof your tree and help protect your home and family from fire. If you’re curious, after Christmas when you remove your tree, snap off a branch as an experiment and try to set the branch on fire, OUTDOORS.

How does the solution work?

In a nutshell, the Karo syrup provides the sugar necessary to allow the base of the tree to take up water. Up to 1.5 gallons of water can be taken up by the tree over a two-week period. Boron in the Borax allows the tree to move the water and sugar out to every branch and needle in the tree. Magnesium compounds in the Epsom salts and iron from the chelated iron provide components for the production of chlorophyll to help keep the tree green. The bleach prevents mold from forming in the solution. Some of the other beneficial side effects of this procedure are that the needles will not drop, and you will notice an increase in natural evergreen fragrance.

Have a safe and happy holiday!

David Nevin

Head, Facilities Engineering Services Section

LETTER TO THE EDITOR

Disappointed former Fermilab physicist Drasko Jovanovic.

I read today in Nov 19th issue of *FERMINEWS* the following beginning to a paragraph: “Dick Lundy, an engineer involved in building the Tevatron...”

For the benefit of FermiNews:

1. Dick Lundy is a physicist, Ph.D. U of Chicago 1961.
2. Lundy, Orr and Livdahl were the first “troika” bringing the Main Ring to life.
3. Lundy was the head of Meson Lab.
4. Lundy was the head of Neutrino Lab.
5. Lundy was a Business Manager of Fermilab.
6. Yes, Lundy was “involved” in building the Tevatron. He was the head of the magnet section when all 960-plus Tevatron magnets were built. He saved the day by inventing “smart bolts,” thus preventing a twist in the magnet core.
7. Lundy was the Associate Lab Director during Lederman administration.
8. Lundy was the recipient of the Presidential Medal for Technology together with Rich Orr, Alvin Tollestrup and Helen Edwards.

If your writers are that ignorant of the Lab’s history, maybe you should find some new ones, or at least send them to school about Fermilab history.

In such a method of Fermi journalism perhaps ten years from now Peter Limon will be described as a “jovial technician” who did few things here and there!

Dick Lundy: physicist…

Very disappointed,
Drasko Jovanovic

…business manager…

…and winner of the National Medal of Technology with Alvin Tollestrup, Rich Orr and Helen Edwards. (Lundy is second from right)

Physicists Peter Koelher, foreground, and Peter Limon (jovial?) in 1979.

CALENDAR

Web site for Fermilab events: http://www.fnal.gov/faw/events.html

Art Series Presents:
ST. LOUIS BRASS QUINTET
Saturday, January 29, 2000, Ramsey Auditorium, Wilson Hall $16 "Diverse material combined with imaginative presentation marked the engaging concert"-Kansas City Star

ONGOING
English Classes, Thursday at the Users' Center, 10-11:30, free classes. NALWO coffee for newcomers & visitors every Thursday at the Users' Center, 10:30-12, children welcome. In the auditorium, International folk dancing, Thursday, 7:30-10 p.m., call Mady, (630) 584-0825;

SUNDAY, DEC. 19
Afternoon barn dance in the Kuhn Village Barn from 2 to 5 p.m.Music provided by The Common Taters. Calling will be by Dan Saathoof. All dances are taught and people of all ages and experience levels are welcome. Admission is $5, children under 12 are free (12-18 $2). The barn dance is sponsored by the Fermilab Folk Club. For more info, contact Lynn Garren, x2061 or Dave Harding, x2971.

Scottish country dancing Tuesdays, 7:30-9:30 p.m., call Doug, x8194 or e-mail folkdance@fnal.gov.

LAB NOTES

CHARITIES PROGRAM
The Charities Program has a new procedure this year. Check out the Fermilab at Work web page for directions & instructions how to properly fill out your form. If you have any questions, concerns, need assistance or do not have access to the web you may request paper forms by phoning Equal Opportunity Office At x4633, http://www.fnal.gov/faw/charities/charity.html

The standard mileage rate for transportation expenses paid or incurred beginning January 1, 2000 will be 32.5 cents per mile, up from the 31 cents per mile rate in effect since April 1, 1999. Fermilab will use the new IRS rate for mileage reimbursement requests for all travel on and after this date.

FERMILAB LECTURE SERIES presents:
THE ANTARCTIC OZONE HOLE
Dr. Mario J. Molina, 1995 Nobel Laureate in Chemistry Institute Professor of Chemistry, Massachusetts Institute of Technology, Friday, January 7, 2000 at 8:00 p.m. Tickets are $5.00. For more information call 630-840-ARTS.

HAPPINESS is cutting down your own fresh Christmas Tree at Marmion Abbey. You can cut your own tree any day, Sundays included, beginning Saturday November 20 - December 23, from 9:00 am until dusk. There are no lights in the field so come early enough to find your tree in the daylight. Please come prepared: warm clothing, gloves, boots. Bring your own small bow saw or rent one of ours for a deposit of $10 which is part payment on your tree. Also available, wreaths, door swags and crosses made from fresh boughs. Call 630-897-3011 for information.

Please donate your excess clothing this holiday season. Sponsored by Goldie's Place Your donation will assist the homeless as they assimilate back into mainstream society offering resume writing seminars, vocational training clothes etc. It is sponsored by Unity Church of Chicago. Your donation is tax deductible. The primary need is men's clothing, but all clothing in reasonable condition is welcome. Place your donation in the box near the rest rooms on WH1E. Goldie's Place is located at 6238 N. Clark Street. Goldie's Place mission is offering a supportive center for people who are homeless.

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 X451
CAKES FOR SPECIAL OCCASION
DIETARY RESTRICTION
CONTACT TITA, X352
HTTP://WWW.FNAL.GOV/FAW/EVENTS/MENUS.HTM

LUNCH
WEDNESDAY, DECEMBER 22

Lunch Will Be Served at Noon

Christmas Pasta with Shrimp, Red Peppers, Green Onions and Pine Nuts

Endive, Watercress and Radish Salad with Pomegranate Dressing

Chocolate Cranberry Ginger Trifle

DINNER
THURSDAY, DECEMBER 23

Closed

FERMINEWS

FERMILAB
A U.S. DEPARTMENT OF ENERGY LABORATORY

FERMINEWS is published by Fermilab's Office of Public Affairs.

Design and Illustration:
Performance Graphics

Photography:
Fermilab's Visual Media Services

The deadline for the Friday, January 14, 2000, issue is Tuesday, January 4, 2000. Please send classified advertisements and story ideas by mail to the Public Affairs Office MS 206, Fermilab, P.O. Box 500, Batavia, IL 60510, or by e-mail to ferminews@fnal.gov. Letters from readers are welcome. Please include your name and daytime phone number.

Fermilab is operated by Universities Research Association, Inc., under contract with the U.S. Department of Energy.

HELP WANTED: SCIENCE COMMUNICATOR—FERMILAB

Fermilab has an immediate opening for a seasoned science communicator in its busy, high-profile public affairs office. The successful candidate will have: extensive experience writing and editing under tight deadlines; a flair for working with people from all walks of life, whether congressional representatives or school children; and the ability to juggle multiple tasks, and to work both independently and as part of a team in a demanding, creative environment.

The position requires at least two years of professional writing and publications experience, a BA/BS and appropriate word-processing and computer skills. Knowledge of print production and experience with the media a plus. Forward résumé and three recent clips to: Joy Thomas, Attn: FN/000029, Fermilab, P.O. Box 500, MS 116, Batavia, IL 60510. FAX: 630-840-2306.

(EOE M/F/D/V)

CLASSIFIEDS

FOR SALE:

■ '96 Dodge Neon 4dr Highline sedan, blue, automatic, a/c, power steering, AM/FM stereo/cassette with premium sound, dual air bags, new tires, 94k miles, good condition. $6,900 obo. Call Hank x8105 or 630-369-8006.

■ '96 Honda Civic Dx Hatchback. 5-spd std trans, Black, 63k miles (mostly highway). Asking price: $5000 obo frame@fnal.gov x8653

■ 95' Honda — Civic VX, teal, 57 K miles, 5 speed, perfect for commuting (40to 50 mpg!), A/C, cruise control, moonroof, AM/FM cassette, aluminum wheels, new front brakes, first owner, all records available, asking $6700. Ralf Vogelgesang, (708) 386-6830 (h); (630) 252-5469 (o)

■ '90 Ford Tempo GL, 4 door sedan, 2.3 liter engine, 124,000 miles, automatic transmission, front wheel drive, power steering, power door locks, AM/FM Stereo, Kelley Blue Book retail value $2435 and trade-in value $1750. Edmunds Market value is $2175 and trade-in value is $1,360 N.A.D.A. Retail value $2025 and trade-in value $900. Asking $1750 can be driven to Fermilab for viewing. Call Merle at x 3958, or Heidi at 630-960-5326.

■ Four Toyota Supra Aluminum Wheels with P185/70R14 tires in fair condition. First $60 takes all four plus a good compact spare with wheel. Call Mike, x-4755.

■ Pair of speakers "Genesis 2" 3-way, 10"woofer, 8" mid, tuned port. Very good condition $50 Realistic 7" Reel to Reel tape recorder, need minor work, $15 15 gallon sprayer, 12 volt pump, for large volume spraying. Can be mounted on back of lawn tractor or trailer. $75 Call Ed Dijak x6300 or dijak@fnal.gov

■ Boy's 6-drawer dresser (needs refinishing) $50 obo. Green/Gold Plaid couch, love seat and ottoman chair, asking $200; great for family room (815) 726-2301 after 7:00 p.m. or ext. 2326 or carriveau@fnal.gov.

■ 2 ladies' lamb leather jackets with opossum lining - Brown-Medium, $500; Black-Small, $250. 630-840-3644 or 815-729-9072. Jenny Rapovich MS119 rapovich@fnal.gov (630) 840-3644 (phone) (630) 840-3390 (fax).

■ Like new wardrobe and dresser set , black with mirrors, bought for $800 will sell for $350 obo. Contact Tony @ 6527.

■ Samsung microwave oven (carton never opened), Good Housekeeping Seal, .9 cu. ft., 1000 watts, turntable, Sensor reheat & Auto defrost, child lock-out feature, best reasonable offer. bruch@fnal.gov, x2271 or (630) 896-8919.

■ Beautiful 7 1/2 foot lifelike Deluxe Mountain Fir Christmas tree. Easy assembly, natural looking, very full. Original price $150. Asking $40. Please call Mike at 208-1751.

■ Condo for rent Downers Grove, 2 bedrm 2 full bath. 75th and Fairview Streets, 2nd floor w/balcony, laundry facilities in building, club house/swimming pool, ponds, very well maintai property, security entrance to building, pretty ar Heat and water included-$800. 20 minutes to Argonne Lab, 25 min to Oak Broo treend@fnal.gov 630-959-3789.

■ House for rent, St. Charles, old neighborhoo two bedrooms, large yard, nice location, close t river and bike path. $850 steinbru@fnal.gov or phone 587-9464.

■ Lot for sale, 1 acre, St. Charles, northwest of city in established Deer Run East Subdivisio One-half mile west of Denker Rd. on Deer Run $112,000. Call (630) 879-2475.

ROOMMATE WANTED:

■ I am looking for a roommate to move in Dec (My current roommate is getting married and is moving out). I live in the city at 3900 N. Pine Grove Ave. (One block west the lake, just south of Irving Park Rd.) The apt is two bedroom, two bath. Half of the rent is $587.50 per month. There is an indoor parking spot available for an additional $110. If interested, let me know as soon as possible (chill@fnal.gov, x2388). Chris Hill,UCDHEP e-mail: chill@fnal.gov (630)840-2388 office: 139-C in CDF trailers.

WANTED:

■ Single axle boat trailer for 12ft. boat. wilcer@fnal.gov or x2749

MILESTONE

RETIRING

Sharon Beverley , ID 2841, effective December 31, 1999. Laurence D. Sauer, ID 1219, effective January 11, 2000; last day, December 23, 1999. Peter Cross, ID 4027, effective January 5, 2000; last day December 2, 1999. Laura Mae Haish, ID 10084, effective February 1, 2000; last day December 23, 1999. Donald Rissman, ID 8874, effective January 21, 2000; last day December 10, 1999. William B. Fowler, ID 759, effective December 31, 1999; last day December 23, 1999.

FERMILAB
A U.S. DEPARTMENT OF ENERGY LABORATORY

Office of Public Affairs
P.O. Box 500, Batavia, IL 60510

First-Class Mail
U.S. Postage
PAID
Bartlett, IL
Permit No. 125