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The Time Machine

KTeV reports first direct observation of time asymmetry in neutral kaon decay.

by Mike Perricone, Office of Public Affairs

Take a videotape of yourself jumping over a bar. Stop and roll the tape backwards, and watch yourself reversing your jump—but landing upside-down at your starting point.

Can't happen? But it did happen in a small way in the KTeV (Kaons at the Tevatron) experiment's observations of neutral kaon decays. KTeV experimenter Mike Arenton, of the University of Virginia,

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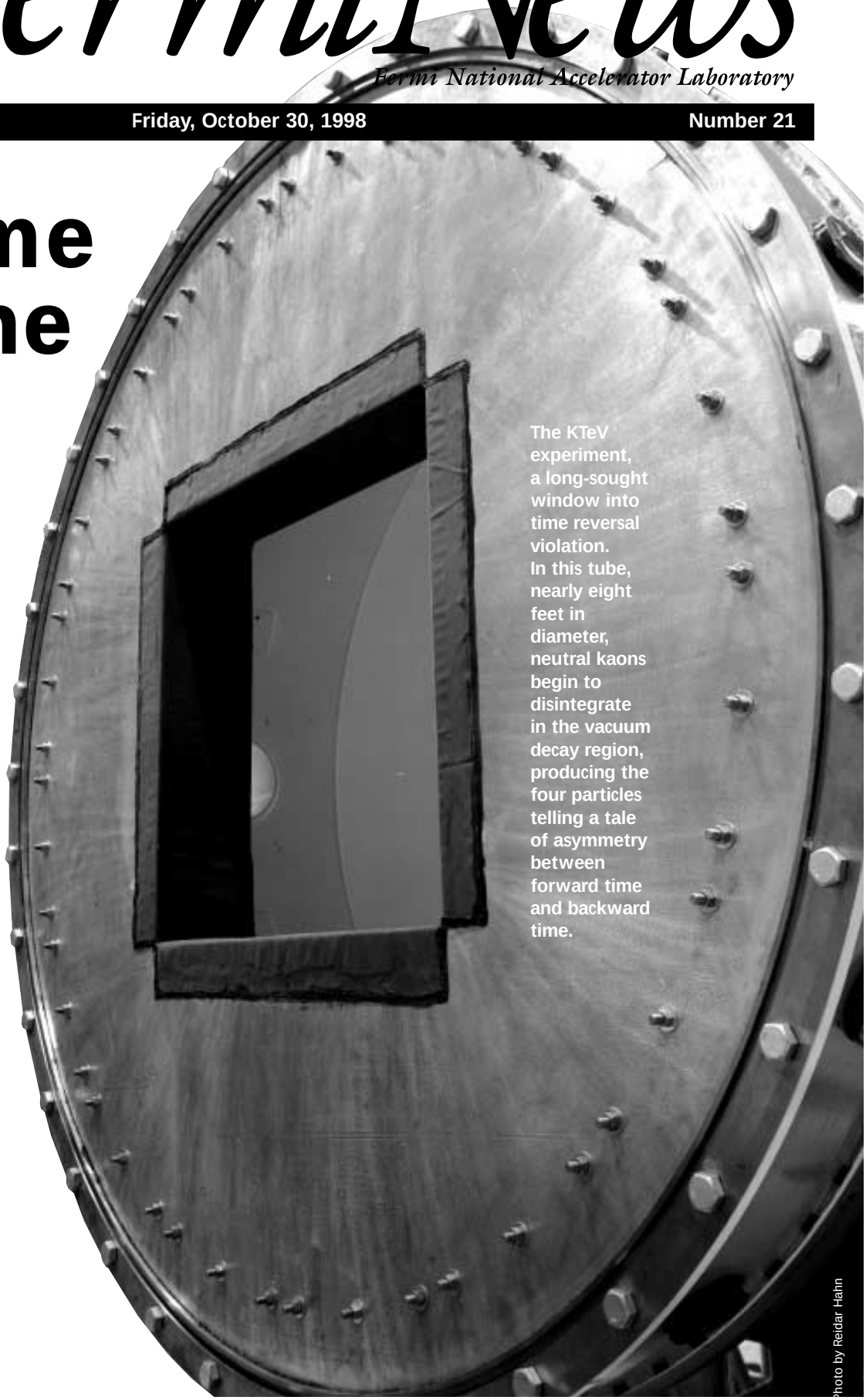


The KTeV experiment, a long-sought window into time reversal violation. In this tube, nearly eight feet in diameter, neutral kaons begin to disintegrate in the vacuum decay region, producing the four particles telling a tale of asymmetry between forward time and backward time.

Photo by Reidar Hahn

INSIDE

reported the rare-decay results on Monday, October 12, at the final session of Fermilab's Workshop on Heavy Quarks at Fixed Target.

KTeV, a fixed-target experiment at Fermilab, reported the first direct observation of time-reversal asymmetry. The phenomenon, called a "T-odd effect," indicates that a process is not symmetric with respect to the forward and backward directions of time.

"In T-violation, if you play an event backwards, it's not quite the same," said KTeV cospokesperson Bob Hsiung of Fermilab. "The difference will depend on how large the asymmetry is. [Landing upside-down] would be a very big asymmetry. More likely, there may be just a tiny movement that is different—perhaps one of your fingers or toes is in a different position. These kinds of very small differences are hard to detect."

The time-reversal phenomenon is a rare event even in the subatomic world, which is very different from the macroscopic world of our experience.

"Most fundamental physical processes are symmetric in time," said KTeV co-spokesperson Bruce Winstein, of the University of Chicago (Taku Yamanaka, of Osaka University, and Yau Wai Wah, of the University of Chicago, are also KTeV spokespersons). "The motion of the planets in the gravity field of the sun is reversible—a film of the motion of a planet about the sun can be shown backwards without anyone being able to see a difference.

"Similar to gravity," Winstein continued, "the strong and electromagnetic forces are also time-symmetric. Only the weak force appears to violate this symmetry, and thus far only in the behavior of the neutral kaon."

KTeV has amassed data from more than 1,800 events of a kind so rare that it occurs only once in every 3 million kaon decays. But from that tiny sector of a vast number of events (called the branching ratio or the branching fraction), KTeV has witnessed a matter-antimatter asymmetry on the order of 13.5 percent—a huge effect compared to previously observed CP violation decays.

"The reason we were able to see this mode for the first time is that KTeV is so sensitive," said collaborator Brad Cox, leader of the University of Virginia group at KTeV.

Of the other experiments studying this mode, one in Japan has seen 14 events and one at CERN (NA48) has seen a few hundred. But so far, no other experiment has a sufficient number of events to see the violation of CP or T symmetry, as KTeV has.

The decays

A kaon is a meson, defined as a combination of an even number of quarks. In this case, the neutral kaon (having no electrical charge) is formed by a quark-antiquark pair: a down quark and strange antiquark, or the reverse, bound by the strong force but disintegrating by the weak force. In the rare event identified by KTeV, the kaon decays into four particles, two matter-antimatter pairs: $\pi^+(pi^+)$, $\pi^-(pi^-)$ and e^-, e^+ (the latter two particles are an electron and a positron, or anti-electron).

A violation of charge (+ and -), parity (analogous to left and right) and time, known collectively as CPT, indicates that matter and antimatter behave differently. To imagine T reversal, think of antiparticles as particles moving backward in time. If T is conserved, the distribution of decay products should remain the same on each side of an event. Previous experiments have inferred T violation as being necessary to balance the product of C and P, but no experiment had directly observed T violation until KTeV.

In the accompanying diagram (Figure 1), the paths of π^+ and π^- create a wedge-shaped section that defines a plane; the paths of e^- and e^+ define a second plane. Construct a normal at

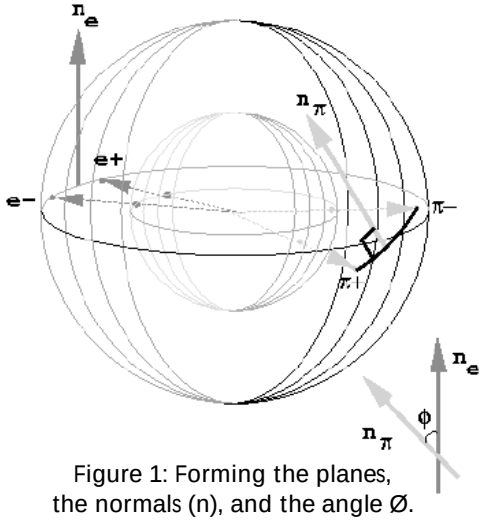


Figure 1: Forming the planes, the normals (n), and the angle Ø.

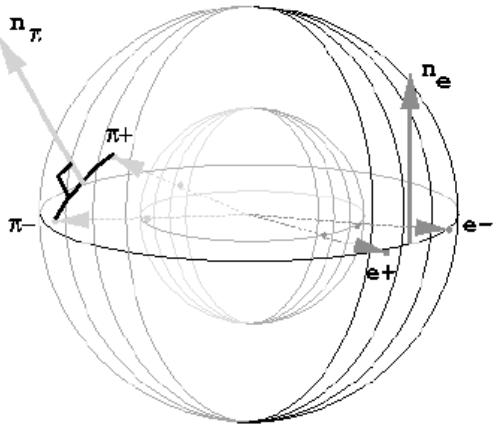


Figure 2: Rotating the planes.

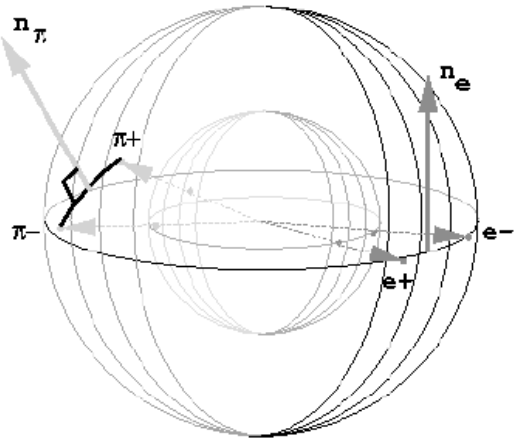


Figure 3: Returning the normal of the e^-e^+ plane to its original position.

a right angle to each plane. Rotate the planes arbitrarily with respect to one another (Figure 2); the angle between the normals is where T-violating asymmetry is found. To check whether T-conservation is respected, change the sign of the angle, in effect reversing the decays to collisions. For comparison, rotate the planes (Figure 3) so that the normal to the plane of e^- and e^+ is back in its original position. The distribution of the decay products within the angle Ø should be symmetric to preserve T-symmetry. But KTeV showed the distribution to be asymmetric, and by a wide margin.

This specific imbalance had been predicted since 1993, and T-violation had been sought since the 1964 experiment of James Cronin and Val Fitch that won a 1980 Nobel Prize for showing CP violation. But KTeV's observation is the first of its kind—a T-violating correlation among final-state particles.

"Time reversal violation implies that particles and antiparticles behave slightly differently," Cox said. "In the early universe, we think there was just enough difference in behavior to generate a small excess of particles, which survives to this day. The vast majority of particles and antiparticles annihilated into background radiation, with little or no antimatter surviving.

"Therefore, we think that some type of time reversal violation is a necessary condition for our universe to exist as it does today—and, indeed, for us to exist."

The workshop

The four-day heavy-quark workshop was the fourth in an international series, following annual gatherings at Frascati, Italy; at the University of Virginia; and at St. Goar, Germany. The Fermilab conference organizers added a distinctive flavor with a Sunday night dinner at the Shedd Aquarium, at Chicago's lakefront museum campus.

About 120 participants from around the world heard more than 40 presentations of experimental results involving heavy quarks, defined as the strange, charm and bottom quarks (the heaviest of all quarks, the top, is described as "obese").

The conference led off with a Friday afternoon seminar featuring noted theorists Lincoln Wolfenstein, of Carnegie Mellon University; Anthony Sanda, of Nagoya University; and Jonathan Rosner, of the University of Chicago.

"Most of the younger people in physics have grown up with the Standard Model," said conference organizer Joel Butler of Fermilab. "The older generation grew up when the Standard Model was being developed, dealing with ideas without a very powerful theory holding them together, when quarks weren't taken very seriously. I think it was especially notable to hear Jonathan Rosner say he hoped we'd be in a period when things broke down, and people would need to bring their thinking out of the box." ■

"The KTeV result is important for three reasons: it uses the same physics [we know]; it shows a big effect in a rare decay—nearly 14 percent; and it is direct time-reversal violating."
—Workshop summarizer and Fermilab theorist Chris Quigg

Photos by Jenny Mullins

"Our experimental challenge was to find an asymmetry amidst several thousand events of a decay mode never previously observed."
—KTeV experimenter Mike Arenton, of the University of Virginia, presenting results at the Fermilab's Workshop on Heavy Quarks at Fixed Target

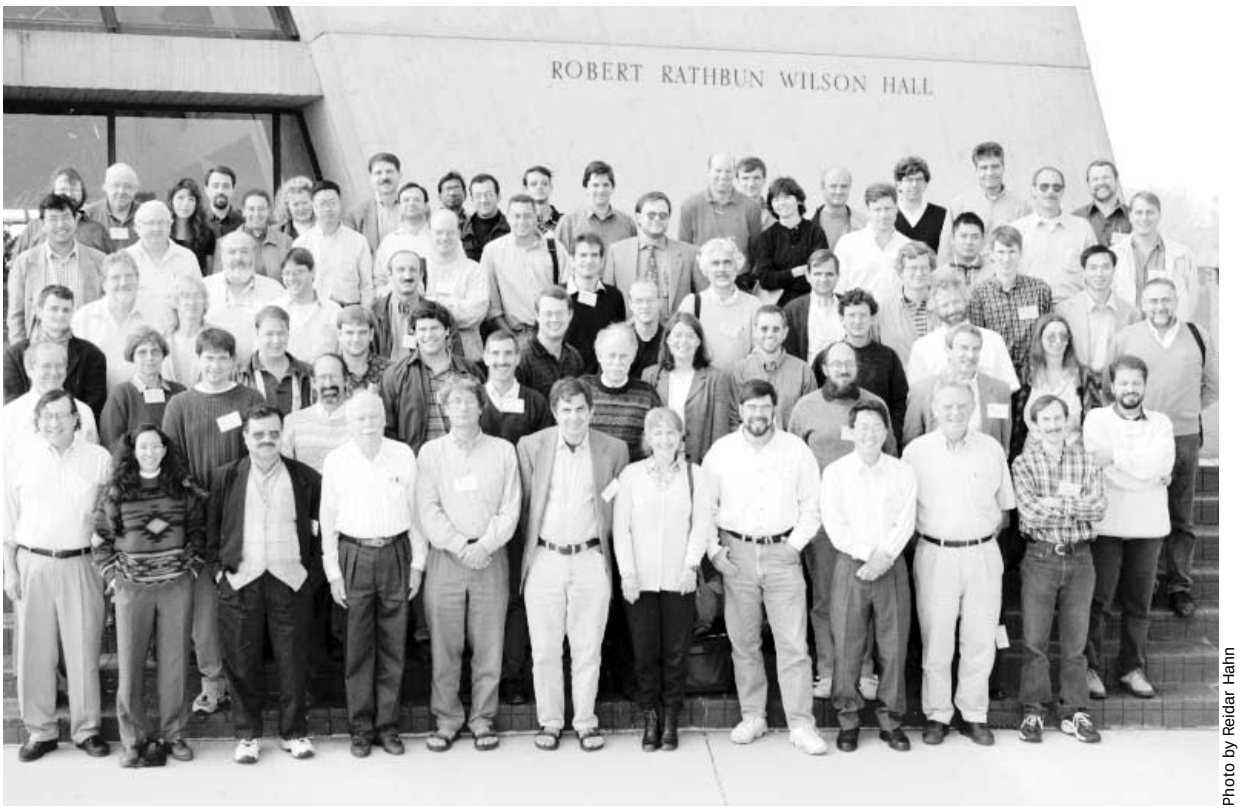


Photo by Reidar Hahn

◄ The Group: Participants in the Workshop on Heavy Quarks at Fixed Target take time out for a group photo on the steps of Wilson Hall.

BIG PHYSICS
IN A SMALL PACKAGE

When last we heard back in June, the MiniBooNE collaboration had just won scientific approval from Fermilab's Physics Advisory Committee for its experiment on neutrino oscillation. But PAC approval isn't enough. To be an experiment, MiniBooNE has to find the money that will build its beamline and detector.

MiniBooNE scrounges for money.

by Sharon Butler, Office of Public Affairs

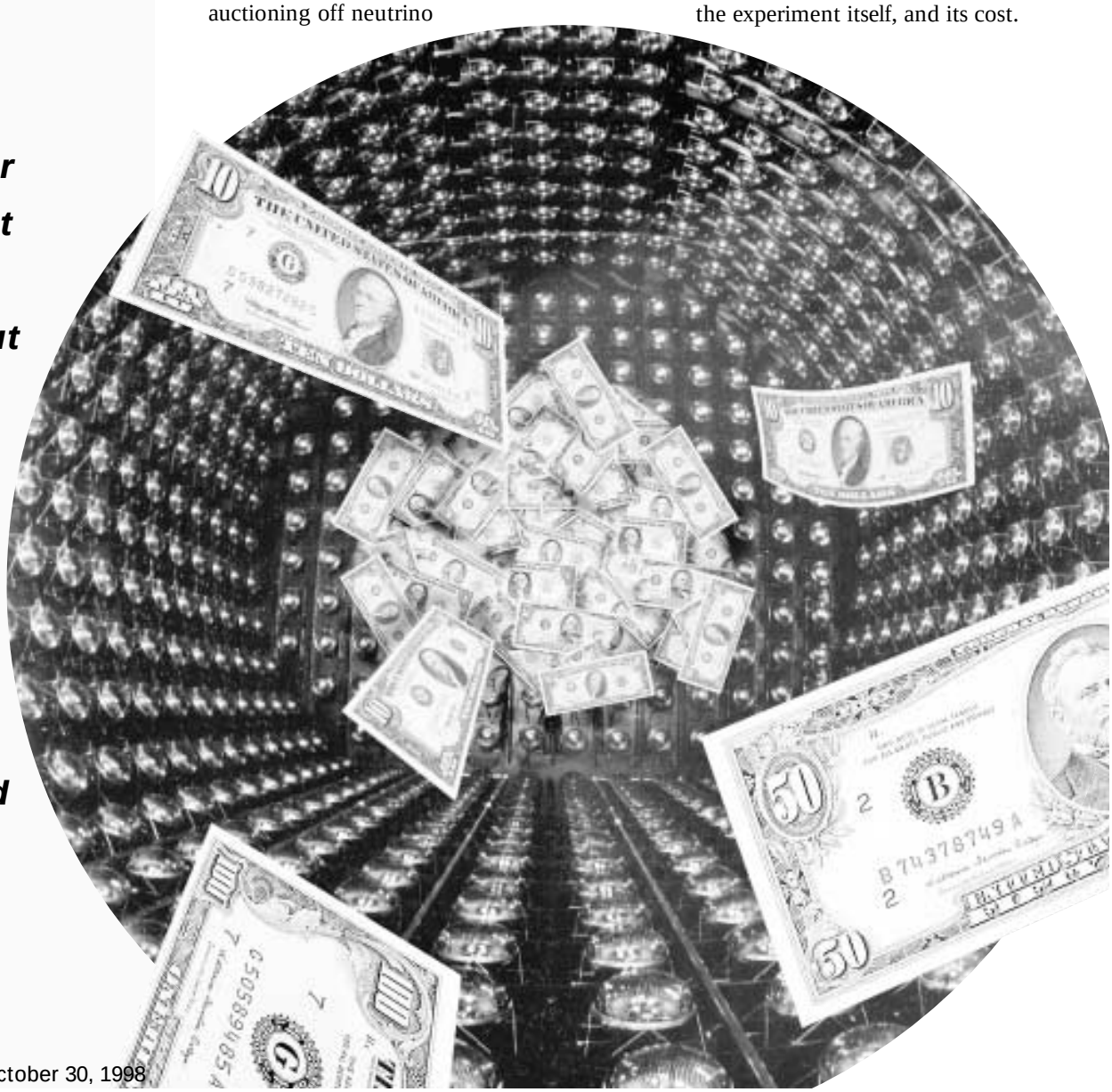
Money can't buy you love, but it can buy you a heck of a lot of other things: a neutrino experiment, for one.

But where, and how, do you get the money?

At one point last spring, Janet Conrad, of Columbia University, was phoning every funding agency in Washington asking for support for the MiniBooNE experiment. "I felt like a telemarketer," she said. Fellow scientific collaborators half jokingly proposed auctioning off neutrino events. Imagine an oscillation named in your honor.

But MiniBooNE's more serious quest for funding began last summer, after Fermilab's Physics Advisory Committee granted it scientific approval.

The collaboration made three trips to Washington to appeal to the National Science Foundation and the nuclear physics, high-energy physics and universities program offices at the Department of Energy. The scientists arrived prepared to go into details about the experiment itself, and its cost.



Penny lane

The pitch was, in so many words: exciting physics can come in small packages. At just under $10 million for both beam and detector, MiniBooNE is a relatively inexpensive experiment (just $9.95, collaboration member Hywel White likes to say) designed to answer an important physics question (whether neutrinos have mass) in a reasonable amount of time (by 2001, the experiment could begin taking data).

"We're a small experiment tackling a physics question that deserves an answer," said collaboration member Ray Stefanski. He was referring to MiniBooNE's intention to settle, once and for all, whether the signal seen at the liquid scintillator neutrino detector at Los Alamos National Laboratory was "real." "It's a valuable measurement even if we don't confirm the LSND effect; it's a measurement that has to be done."

He firmly believes that "the cost of this experiment is commensurate with its goals."

Along with White, at Los Alamos National Laboratory, Stefanski compiled the final dizzying spreadsheet of MiniBooNE's total cost estimate from entries supplied by staff all across the collaboration and all across Fermilab, even staff from the Facilities and Engineering Services Section (FESS estimated the cost of construction work). The cost estimate, broken down by year and by agencies' funding cycles, covered everything from the instrumentation and controls for the beamline to the water system and the 770 tons of mineral oil for the detector. Included were contingencies as high as 30 percent or more for some items for unanticipated costs.

"Cost estimates are a constant of nature for us," said Stefanski. "In dealing with just about anything in high-energy physics, the cost issues become paramount very quickly."

Nevertheless, coming up with a good cost estimate during the planning stage is difficult. "You have to deal with the fact that you have sketchy information," said Stefanski. "The thing is, you need funding in order to do design, and you need design in order to get your funding. It's an iterative process."

Linked to the budget is the schedule for building the facilities for the experiment. "If the experiment can't be done in a timely fashion," Stefanski said, "it loses its importance because we have competition." Rumor has it that proposals have been submitted at CERN for similar experiments.

"We'd like to be first," said Stefanski. "It's not that being second isn't valuable; it's just not quite as satisfying as being first."

The fact that MiniBooNE is asking for a modest amount of money may play in its favor. Despite bipartisan support in Washington for doubling the science budget over the next 10 years, Washington is still pinching pennies, especially in its funding of high-energy physics.

"There's no question that money is short," said Bill Louis, cospokesperson for the MiniBooNE experiment. "Federal agencies can't fund every particle physics experiment that's out there."

A little help from friends

MiniBooNE's presentations in Washington were well received, but whether funding will materialize, and how much, is still in question.

Meanwhile, though, the collaboration got a boost in profile. At a recent review of DOE's intermediate-energy nuclear science program setting out scientific opportunities and funding priorities, MiniBooNE won praise. "Subject to a successful technical review, this program is viewed … as having major consequences for physics and, therefore, high priority," the committee reported. Words like that from peers always help an experiment in the moneyed corridors of Washington.

Photo by Reidar Hahn

Janet Conrad and Bill Louis, cospokepersons of the MiniBooNE experiment, with a model of the support structure for the detector's phototubes.

The collaboration has also collected some funds from unexpected quarters.

Rod Walton, associate head of Fermilab's Environmental, Safety and Health Section, found some extra money in his bank of funds for waste minimization projects, and offered about $20,000 to refurbish old magnets from the dismantled Main Ring for the collaboration's new beamline—magnets that might otherwise go to waste.

Members of the collaboration from Los Alamos National Laboratory won a fiercely competitive grant from that lab, part of which will be spent on devising clever ideas for improving MiniBooNE's trigger and data acquisition system.

And Conrad was awarded a Faculty Early Career Development Grant from NSF. Intended to enable young faculty to pursue innovative programs at the forefront of research, the money will be spent largely on designing and building the collaboration's detector.

The amount so far is just a financial trickle, but enough for MiniBooNE collaborators to breathe a collective sigh of relief: they may not have to resort to auctioning events after all.

Still, though, Conrad says they'd be happy to accept all contributions ("send checks c/o BooNE …."). ■

" We're a small experiment tackling a physics question that deserves an answer."

~ Ray Stefanski, MiniBooNE collaborator

Completing the Circle

Beam circulates through the entire Main Injector without a hitch—and ahead of schedule.

by Mike Perricone,
Office of Public Affairs

An hour after the Booster cranked up the proton supply on Saturday afternoon, October 10, all hands in Fermilab's Beams Division weren't just smiling, they were beaming.

Not only had they circulated a beam of protons through the entire two-mile Main Injector, and not only had they moved the beam along the path with surprising speed and ease, but they had also beaten the target for this milestone that had been set more than five years ago—and beaten it by a month.

The news traveled fast. Beam was established at about 5 p.m., and those present for the event in the Main Control Room got on the phone to other colleagues who have been part of the big show during the eight years of the Main Injector Project. By 6 p.m., an informal but historical ceremony was well under way, with signature after signature affixed to the beam plot documenting the achievement—a declaration of integrity for the machine and everyone connected with it.

The signed beam plot is destined for a frame and for a prominent place on the wall of the Beams Division office, located near the Main Control Room.

By the end of the weekend's commissioning efforts, the Main Injector was storing an 8-GeV beam for periods of up to 20 seconds. While 20 seconds might not seem like a long time, consider that beam circles the entire two-mile ring about 100,000 times per second. Thus, a 20-second lifetime means beam is circling the Main Injector about 2 million times.

"A lot of things had to work right for this to happen," said Beams Division Head Steve Holmes. "Circulating beam means that, fundamentally, this machine is put together correctly, and we didn't get the magnets backwards or anything like that.

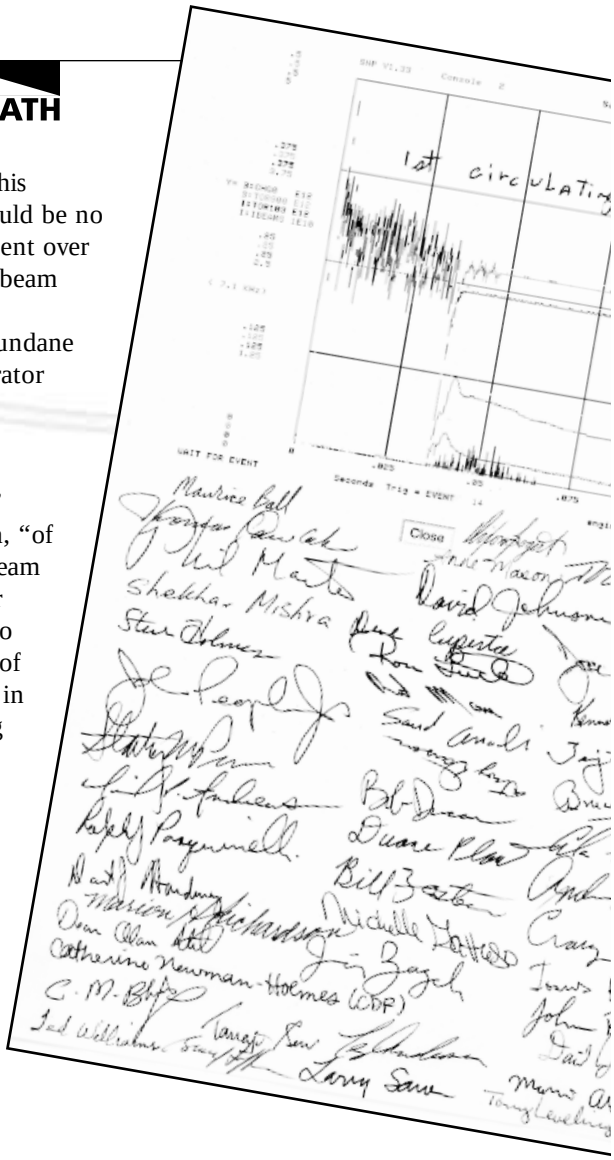
"The fact that we had beam circulating in the Main Injector within an hour of taking beam from the Booster—that's pretty amazing," Holmes continued. "We're happy about beating the milestone by a month. This means lots of things were put together right the first time, and it's a tribute to everybody's efforts on this project. There are a lot of happy people here."

CRITICAL PATH

Achieving the milestone this smoothly also meant there would be no faces reddened by embarrassment over distinctive obstructions in the beam path. Those obstructions have sometimes been irritatingly mundane items, over the years of accelerator development at the Lab and elsewhere.

"We have an unfortunate sort of tradition around here," Holmes admitted with a laugh, "of leaving things behind in the beam pipe, whether it's Kimwipes or hunks of plastic. There was also an instance, though not here, of someone leaving a beer bottle in the beam pipe. But if anything was left behind in there, the beam would never last as long as it did."

Holmes said the beam life in the Main Injector was already better than it had ever been in the Main Ring, which it is replacing in the accelerator complex.



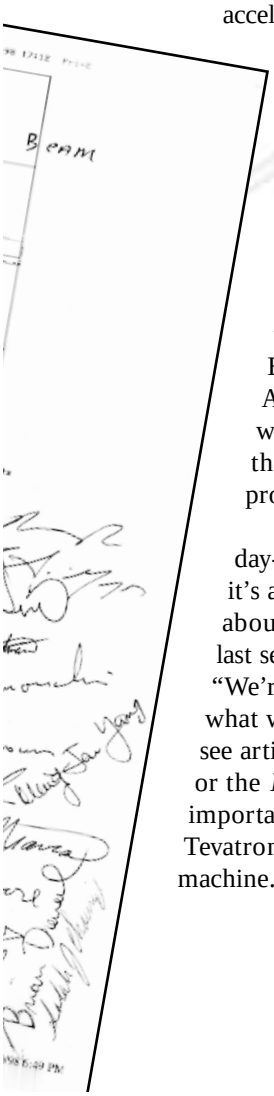
The signed orbit plot shows beam remaining in the Main Injector for 0.7 second, or about 7,000 turns around the two-mile ring.

"It should be better," he added. "That's how we designed the Main Injector."

The commissioning work on the Main Injector continues its step-by-step process. While contractors continue working in the tunnel, commissioning remains a weekend activity until switching into full-time mode sometime around Thanksgiving.

Following up the successes of previous weekends, the commissioners soon hope to activate the radiofrequency cavities and begin accelerating the beam, incrementally increasing its energy level from 8 GeV to the ultimate goal of 150 GeV—the level at which beam will be transferred to the Tevatron for the collider experiments of Run II.

First, all the Main Injector magnets must be filled with cooling water. Holmes said cooling water was circulating to about 80 percent of the magnets, but that total should be 100 percent before raising the energy of the beam. If a small number of leaks can be repaired quickly on the magnet bus, the system delivering power to the magnets, the entire magnet system can be filled and acceleration attempted by the end of October.



So for a while, the beam-commissioning activities will focus on circulating beam and learning more about beam properties in both the Main Injector and the new 8-GeV / MI8 line, which transports beam from the Booster to the Main Injector. And maybe, just maybe, there will be a moment here and there to think about the big project's Big Picture.

"It's easy to focus on the day-to-day crises and details, but it's also very gratifying to think about how far we've come in the last seven years," Holmes said. "We're on our way. In the end, what will really be satisfying is to see articles in *Scientific American* or the *New York Times* about some important discovery made at the Tevatron which was enabled by this machine." ■

Photo by Fred Ullrich

Fermilab Director John Peoples (left) and Beams Division Head Steve Holmes (right) sign the Safety Assessment Document in the Director's office on September 25, 1998, clearing the way for introducing beam in the Main Injector. Witnessing the ceremony are (from left) Ron Lutha, of DOE; Shekhar Mishra, of the Beams Division, coordinator of Main Injector commissioning; Pepin Carolan, of DOE; Andrew Mravca, of DOE; Paul Nesson, of DOE; Bill Griffing, Head of Fermilab's Environmental, Safety and Health Section; and Phil Martin, of the Main Injector Department.

Intense Safety Survey Preceded Beam in MI

by Mike Perricone, Office of Public Affairs

It's called a SAD, but the signing of the Safety Assessment Document was definitely an upbeat part of the process in commissioning the Main Injector.

Before beam could be introduced into the new two-mile accelerator, Beams Division Head Steve Holmes had to submit the SAD to Fermilab Director John Peoples, who forwarded the document to the Lab's Environmental, Safety and Health Section for approval.

"For new facilities where we have not previously run beam, we also need the Department of Energy's concurrence," said ES&H Head Bill Griffing. "That's why DOE was there, to concur with our recommendation to commission this phase of the Main Injector project."

ES&H conducted an "accelerator readiness review," checking conditions at the Main Injector against the SAD, which is an exhaustive survey showing that the facility can be operated safely.

The reviewers determine the status of such obvious safety measures as the interlock system and radiation shielding, but also look into issues such as the posting of radiological area signs; procedures for searching and securing the tunnel before the machine is turned on; and evidence that people have been trained in the new procedures for operating and securing the Main Injector. Any discrepancies were noted on a "punch-list," which included 16 items.

"As long as some items are open, it means there are ways in which the facility does not conform to what's described in the SAD," Holmes explained. "None of us signs this document until the punchlist is complete."

Representatives of DOE's Fermi Group and DOE's Chicago Headquarters observed the entire readiness review to expedite approval and preclude the need for the mandated 30-day "concurrence period" from DOE. Their presence meant the beam permit for the Main Injector was in effect as soon as the SAD was signed in Peoples's office on Friday, September 25. Beam was introduced into the Main Injector the next day.

The current permit allows beam to be circulated in the Main Injector but not beyond. Another documentation and review process will be needed before beam can be transferred from the Main Injector into the Tevatron. ■

Toward a New National Science Policy

Vernon Ehlers, Vice-Chairman of the House Committee on Science

by Sharon Butler, Office of Public Affairs

On September 24, the House Committee on Science released its much-anticipated "interim report" laying down guidelines for revamping the nation's science and technology policy and ensuring that "science…be given the opportunity to thrive, as it is the precursor to new and better understanding, products and processes."

"The clear message of this report is that, while not exactly broken, America's science policy is nonetheless in need of some pretty significant maintenance." said James Sensenbrenner (R-Wis.), the committee's chairman. "This is not, then, a visionary document, but a document for visionaries."

"The nation's scientific enterprise is much too important to be left on auto-pilot," Sensenbrenner added.

"…Science…[must] be given the opportunity to thrive, as it is the precursor to new and better understanding, products and processes."

The 74-page report, entitled "Toward a New National Science Policy" and completed in just one year, touches on major themes ranging from the shift of national needs from military to economic, the contribution of science to policy-making, and the importance of strengthening and sustaining science in the United States through education.

The report recognizes that basic research is in the nation's interest: "Our experience with 50 years of government in basic research has demonstrated the economic benefits of this investment." Moreover, the importance of science to society makes it imperative that Congress "make stable and substantial federal funding for fundamental scientific research a high priority."

At the same time, the report acknowledges that federal resources are limited, and competition for those funds severe. Given this situation, and the "irreplaceable role" of government in funding basic research, as contrasted with targeted or applied research, the report recommends that priority be placed on support of fundamental research.

The report warns against the dangers of concentrating funds in a particular area, however, and advocates spreading research funds over a "broad spectrum of scientific disciplines, mathematics, and engineering."

"The practice of science is becoming increasingly interdisciplinary, and scientific progress in one discipline is often propelled by advances in other, often apparently unrelated fields," the report notes, citing as an example the contribution of nuclear and particle physics to scanning devices used in medical technology to diagnose cancer.

Of interest is a novel recommendation in the report that the federal government "consider allocating a certain fraction of grant monies specifically for the pursuit of particularly creative, groundbreaking research," since "innovation and creativity are essential to basic research and must be encouraged."

The private sector is held responsible for what Massachusetts Institute of Technology President Charles Vest calls "mid-level" research: research serving the gap between basic science and product development. But more and more, companies have been focusing their research on technologies closest to being marketable. Thus, the report supports using tax incentives, such as a permanent R&D tax credit, to help companies make more substantial research investments.

The research and development done at federal agencies, departments, and the national laboratories, the report says, "should be highly relevant to, and tightly focused on, agency or department missions, and must focus on essential programs that are well-managed, long-term, high-risk, non-commercial, and have great potential for scientific discovery. Furthermore, once this focus is established the emphasis must be placed on performance of the research function, with a conscious effort to minimize administrative and auditing expenditures."

"The practice of science is becoming increasingly interdisciplinary, and scientific progress in one discipline is often propelled by advances in other, often apparently unrelated fields…."

The study, led by Vernon Ehlers (R-Mich.), vice-chairman of the House Committee on Science, was undertaken in February 1997, when the Speaker of the House, Newt Gingrich (R-Ga.), charged the committee with developing a new long-range science and technology policy for the nation that was concise, comprehensive and coherent. As Gingrich pointed out in his letter to the committee, the model under which the nation has been operating in funding science dates back to 1945, when Vannevar Bush issued his report to the President entitled "Science: The Endless Frontier." Gingrich said that that model "served us very well during the Cold War, because Bush's science policy was predicated upon serving the military needs of our nation, ensuring national pride in our scientific and technological accomplishments, and developing a strong scientific, technological, and manufacturing enterprise that would serve us well not only in peace but also would be essential for this country in both the Cold War and potential hot wars.

"With the collapse of the Soviet Union, and the *de facto* end of the Cold War, the Vannevar Bush approach is no longer valid….[The] competitions we are engaged in now are less military and largely economic."

To gather ideas for the Ehlers report, the Committee held seven hearings and two roundtable discussions, and set up a Web site to allow individuals and organizations to participate even if they were unable to join the meetings in Washington. The Committee received 350 letters and heard from 10,000 scientists.

Guiding the report was the idea that the United States "must maintain and improve its preeminent position in science and technology in order to advance human understanding of the universe and all it contains, and to improve the lives, health, and freedom of all peoples."

The study, Ehlers said, was not intended to be "the greatest science policy report you have ever seen." Also, because of the short time allowed for the study, Ehlers said, it didn't contain "as much detail as I would [have] liked…. [But] the concepts are there." He criticized current science policy as no more than a budget policy.

Ehlers's colleagues on the House Committee on Science supported the report's conclusions, although to obtain their approval he apparently had to eliminate some of the discussion on international cooperation, which some members view as foreign aid. The full House endorsed the report in a resolution passed in early October.

Sensenbrenner commented that in passing House Resolution 578 and endorsing the National Science Policy Study, the House is "sending an unmistakable signal that America's scientific enterprise will no longer be taken for granted in the halls of Congress."

The report is available at http://www.house.gov/science/science_policy_report.htm. ■

Photo by Reidar Hahn

James Sensenbrenner, Chairman of the House Committee on Science

Energy Bill Leaves Fermilab Temporarily a Little Short

… but funds for Wilson Hall and NuMI are guaranteed.

by Mike Perricone, Office of Public Affairs

Money often presents a "good news-bad news" situation, and the 1999 Energy and Water Development Appropriations Act (H.R. 4060) signed into law was another case in point for the U.S. Department of Energy and for Fermilab.

"The good news is that our bill passed, so we're not dependent on a series of continuing resolutions," said Fermilab Associate Director Bruce Chrisman. "There have been years when we've had to wait until January for our funding to pass, so this is actually quite timely."

But...

"The bad news is that, at least so far, we're getting less money than we anticipated," Chrisman concluded.

Under DOE's financial plan prepared in August, Fermilab was expecting a budget of $253.7 million for FY1999. However, of the $2.67 billion allocated to DOE, Fermilab's apparent share is $248.3 million, an interim shortfall of $5.4 million.

Fermilab Deputy Director Ken Stanfield stressed the "interim" nature of the shortfall.

"The preliminary budget was put together before the actual budget bill existed," Stanfield explained, "and it was based on the most pessimistic projections.

Since then, the bill has passed, and it included the greater of the amounts being considered for high-energy physics."

There's good news about two "line item projects," which are specifically listed in the bill. The Wilson Hall improvement project is funded at $6.7 million; and the NuMI (Neutrinos at the Main Injector) experiment is funded at $14.3 million in its second year, up from $5.5 million last year.

These amounts are locked in, Chrisman emphasized. They are not subject to a fine-tuning as funds are channeled through the Byzantine process of transformation from an overall appropriation to an actual dollar amount for the high-energy physics program.

Chrisman and Stanfield were encouraged that the high-energy physics program was allocated $696.5 million—more than $5 million higher than the President's original request of $691 million. The total includes what Congress called an "adjustment" from a prior-year balance of $7.6 million, left over from the closeout costs of the Superconducting Super Collider, to be apportioned among different programs.

There was good news from the Senate, which passed by acclamation the Frist-Rockefeller authorization bill (S. 2217), calling for a doubling of funds for civilian research and development in the next 12 years. Frist-Rockefeller has no counterpart bill in the House, so it will not become law this year.

Nevertheless, Illinois Senator Richard Durbin, one of Frist-Rockefeller's 36 cosponsors (along with Illinois Senator Carol Moseley-Braun), saw the bill as a key vote of confidence for research, especially at Fermilab.

"This legislation is an important investment in our nation's future," Durbin said in a statement from his office.

"Fermilab's work is critical to maintaining our leadership in science and technology and improving the quality of our lives." ■

Photo by Jenny Mullins

Illinois Senator Richard Durbin (left), shown on a recent visit to Fermilab, says work at the Lab "is critical to maintaining our leadership in science and technology." Also shown is Beams Division Head Steve Holmes.

CALENDAR

NOVEMBER 3

Wellness Works sponsors inoculations by the Visiting Nurses Association of Fox Valley: flu ($10), pneumovax ($20) and tetanus diphtheria ($7), from 11–2, ground floor east, ES&H training room. Reservations required through the Medical Office. Fees due upon time of service, payable in cash or check.

NOVEMBER 5

Wellness Works presents: *"Dollars & Sense; Preventing the Post-Holiday Credit Card Blues,"* Kris Fox-Kellogg, Director, Consumer Credit Counseling of Aurora, noon, 1 West.

NOVEMBER 6

NALWO potluck at the Village (Kuhn) Barn. Drinks at 6, dinner 6:30. Bring a main dish serving 6-8 people, or a salad/side dish serving 8, or a dessert serving 12. You can also pay $3. Pizza for the kids, soda provided for all. Questions? Call Sherry Nicklaus, (630) 761-3139.

NOVEMBER 8

Barn dance, Kuhn Barn, 7-10 p.m. Music by Fred Campeau & Friends, calling by Paul Watkins. All dances are taught. All ages & levels of experience welcome. Admission, $5; children <12, free; 12-18, $2. Sponsored by the Fermilab Folk Club. More info, call Lynn Garren, x2061 or Dave Harding, x2971.

NOVEMBER 13

Fermilab International Film Society presents: *Guantanamera.* Dirs: Tomas Guitierrez Alea & Juan Carlos Tabio (Cuba, 1994, 105 mins). Film at 8 p.m., Ramsey Auditorium, Wilson Hall. Admission, $4. (630) 840-8000.

NOVEMBER 15

Barn dance, Kuhn Barn, 2-5 p.m. Music by Stephanie Coleman & Friends, calling by Paul Watkins. Stephanie, 13 years old, is already making a name for herself as a fiddler. All ages & levels of experience welcome. Admission, $5; children <12, free; 12-18, $2. Sponsored by the Fermilab Folk Club. More info, call Lynn Garren, x2061 or Dave Harding, x2971.

NOVEMBER 21

Fermilab Art Series presents: Bimbetta: *The War of Lov*, $17. Performance begins at 8 p.m. Ramsey Auditorium, Wilson Hall. For tickets or more information, (630) 840-ARTS.

ONGOING

NALWO coffee mornings, Thursdays, 10 a.m. in the Users' Center, call Selitha Raja, (630) 305–7769. In the barn, international folk dancing, Thursdays, 7:30–10 p.m., call Mady, (630) 584–0825; Scottish country dancing Tuesdays, 7–9:30 p.m., call Doug, x8194.

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

LAB NOTES

Charities Program

The Charities Program has a new procedure this year. Check out the Fermilab at Work Web page (http://www.fnal.gov/faw/charities/charity.html) for directions & instructions on how to properly fill out your form. If you have any questions or concerns, need assistance or do not have access to the Web, you may request paper forms by phoning Ruby Coiley, x8365.

Winter Coed Volleyball League

Play begins Nov. 16 in the gym on M & F evenings. A captains' meeting is scheduled at noon, Nov. 2, in the Atrium. All interested persons or teams should contact Elizabeth Gallas, eggs@fnal.gov or Jean Guyer, x2548, jeanm@fnal.gov. Must be a current facility member to participate.

URA Scholarships Require SAT Test

Candidates for URA scholarships are awarded on the basis of SAT scores. Seniors are reminded to sign up for a fall testing date if they have not already taken the tests.

URA awards a number of scholarships to regular, full-time employees' children who are currently high school seniors & who will begin a 4-year college degree program next fall. The maximum amount of the scholarship is $3,000 for tuition & fees and is renewable for 4 years if the student progresses in good academic standing.

Scholarship applications will be available after the first of the year, and are due March 1, 1999.

New Employment Manager

Please note that Beth Hecht is the new employment manager. She can be reached at x4203 or bhecht@fnal.gov.

LETTER TO THE EDITOR

I would like to correct two misperceptions from your last issue. The first is that there is a nationwide chain of quick-service restaurants called "MacDonald's." The familiar golden arches are instead associated with "McDonald's."

The second is that a physicist's talents would be under-utilized at McDonald's. After receiving my SB in physics and before I entered graduate school, I worked for a year and a half at the corporate headquarters of McDonald's in Oak Brook (near the first Fermilab offices, as it happens). The corporation found the problem solving skills that are developed in the course of a physicist's training to be extraordinarily useful in the operation of a large multi-national business. I worked on projects as diverse as improving the uniformity of heat distribution on a grill to predicting a store's crew turnover based on other factors to statistical analysis of test kitchen data: how much pulp should be in the orange juice and which ketchup goes best on hamburgers. While I will admit that these problems were not as fundamental as those we work on at Fermilab, they could be every bit as challenging.

While the number of jobs doing physics may not be as large as we would like, that doesn't mean the number or quality of jobs for physicists is small.

Tom LeCompte
Argonne National Laboratory

Chez Léon

MENU

Lunch served from
11:30 a.m. to 1 p.m.
$8/person
Dinner served at 7 p.m.
$20/person

For reservations, call x4512
Cakes for Special Occasions
Dietary Restrictions
Contact Tita, x3524
http://www.fnal.gov/faw/events/menus.html

Lunch
Wednesday
November 4

Moroccan-Spiced Game Hens
Lentil and Rice Pilaf
with Toasted Cumin Seeds
Sauteed Broccoli
with Garlic and Red Pepper
Buttered Rum Baked Apples

Dinner
Thursday
November 5

Corn Bisque with
Red Pepper and Rosemary
Grilled Duck Breast
with Citrus Sauce
Basmati Rice with
Currants and Nuts
Vegetable of the Season
Apple, Endive and
Parmesan Salad with
Walnut Vinaigrette
Pear Strudel

Lunch
Wednesday
November 11

Rushing Waters Broiled Trout
Cauliflower Gratin
Zucchini and Corn Sauté
Coconut Pecan Cake

Dinner
Thursday
November 12

Cheesy Clam Chowder
Grilled Veal Chops with
Herb Marinade
Garlic Potatoes
Vegetable of the Season
Baby Greens with Blue Cheese
and Pecan Dressing
Pear Cardamon Pie
with Almond Crust

CLASSIFIEDS

FOR SALE

■ '93, Ford E150, Cargo Van, 68.5K miles, exc. condition, $7,300. Contact (630) 202-6881.

■ '90 Mercury Cougar LS, Bostonian ed. w/gold emblems, V6, a/c, am/fm cassette, cruise, tilt steering wheel, digital dash, power windows, doors & seat, good condition, $3,800 obo. (630) 898-1369.

■ '86 VW Golf GTI 3-dr htchbk, black, 5-sp, 133K miles, a/c, CD am/fm, sunroof, tint windows, looks & runs great, no rust, maint. records for last 6 years, $1,750 obo. Dima x3601(w), x4922(h), vavilov@fnal.gov.

■ Matching Basset sleeper-sofa, loveseat & club chair, Hunter green w/light tan pattern, just over 2 yrs, good cond., like new. Moving soon, must sell, $900 obo, bhect@fnal.gov, Beth, x4203 or Mike (630) 778-9194.

■ Kenmore 21 c.f. side-by-side refrigerator-freezer w/ice & water dispenser, almond, $200; Upright freezer, 17 c.f., white, works good, $150; Washer, Kenmore lrg cap., 3 yrs old, white, $200; Dryer, Kenmore gas, white, $150; Room a/c, Air temp, for track windows, works well, $75; Time-Life WW2 books & videos, $200; Coffee table, 6′ long solid pine, $75; Phonograph & AM radio (50s-60s); Head board/bed frame, full size, black & gold wrap-around; Priscilla curtains for 56″ windows, 3 pair, white & black. Welders gloves, jacket, apron, spats of leather and misc. (no torches or bottles). All items not priced are best offer. Call after 6 p.m. (630) 393-6744.

■ Entertainment Books, big savings on area restaurants, hotels, airlines, dry cleaning, videos, etc. 30% larger but still $35. Come see & purchase at the Recreation Office, WH15W, x2548.

■ Kenwood single CD player for a component stereo sys., DP840, $75 obo; 250 MB tape drive uses DC2120 tapes $15; king size waterbed frame & headboard needs mattress $75; wood lathe included are chisels & cabinet w/drawers $250; Dive equipment, Parkway BC vest $85, US divers wet suit $50; gas dryer $100; Skis 195 atomic arc, bindings, poles, boots & bag, $200 obo; assorted kids' skis; 1 sm. Subzero frig, $95; Lots of computer (DOS/WIN) software (shareware & boxed titles) for details, Terry x4572 or skweres@fnal.gov.

■ Queen-sized mattress w/boxspring & frame, exc. condition, $150. Laminate (simulated oak) bookcase, 6' tall, $30. Andreas, x3753 or ask@fnal.gov.

■ Greeting cards, big discounts (40% off catalog) on beautifully imprinted Christmas & Holiday cards. Also same discounts on wedding/formal invitations & accessories. View at the Recreation Office, WH15W, x2548.

RENT

■ Townhouse, Warrenville, Edgebrook subdivision (near Rtes 56 & 59) 3 bdrms, 1.5 baths, 10x14 kitchen (washer/dryer/dishwasher), 11x24 living rm w/tracked lighting, 1 car garage/work shop w/advanced lighting, lrg rear deck, new furnace. $950 per mo. (+security deposit) or furnished $1,150/mo. Available for inspection Oct 31st, ready for move in Dec 1st (possibly sooner). Call Russell or Nancy Block (708) 614-8217 eves, or (847) 533-2044 x4365 days.

WANTED

■ Professor, wife, & two young infants searching for a furnished house near Fermilab, Jan 1999 -Jun 1999. Need at least three bedrooms, prefer a single level, and are flexible on dates. Call Craig Dukes 510-486-7286 or dukes@fnal.gov.

■ "Rent-a-Tech" single father is seeking mature female for before and after school care for 3 special-needs children (two 12-yr-olds; one 14-yr-old) in my apartment. Some cleaning involved. All 3 children learning disabled. Call after 6 p.m. (630) 393-6744.

■ Photographer. Need b/w & color still product photos for press releases & catalogs. Call Krause Racing (630) 5113-1007, ask for Vic.

MILESTONES

ELECTED

■ Chris Quigg, Vice-Chair, Executive Committee, Division of Particles and Fields of the American Physical Society.

■ Greg Snow, Chair, Users Executive Council, Fermilab.

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Please send your article submissions, classified advertisements and ideas to the Public Affairs Office, MS 206 or e-mail ferminews@fnal.gov.

FermiNews welcomes letters from readers. Please include your name and daytime phone number.

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