FERMI NEWS

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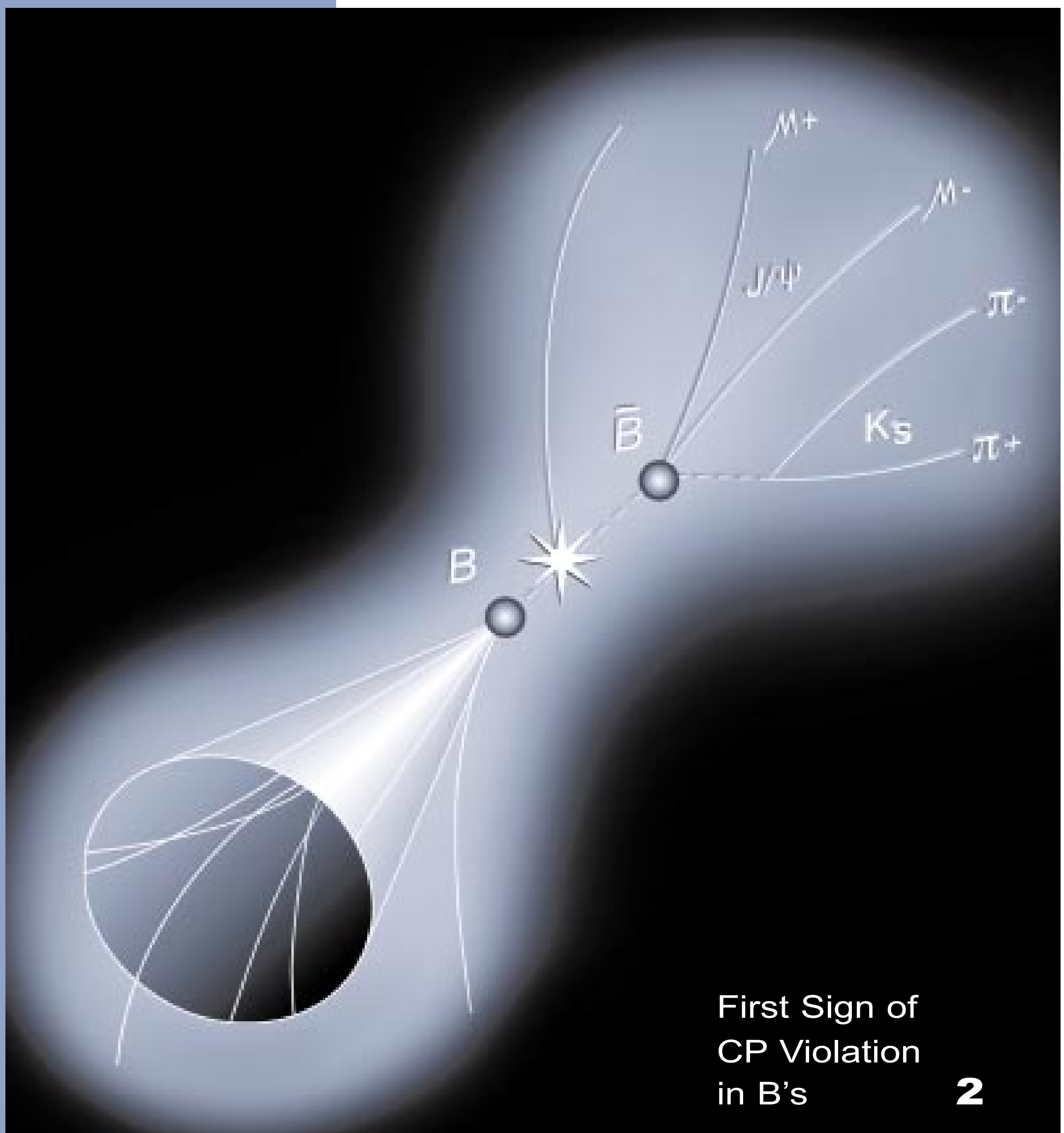

Illustration by Tracy Ellyn

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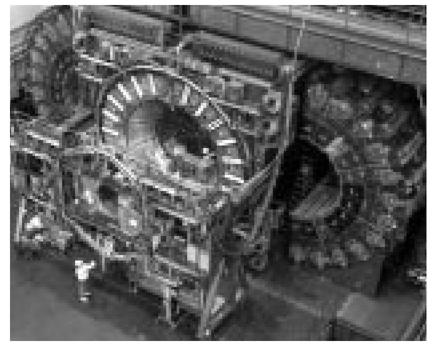
INSIDE:

First Sign of CP Violation in

by Sharon Butler

On February 5, after more than a year of painstaking analysis of data collected from particle collisions in the Tevatron, CDF scientists cautiously reported finding "tantalizing," although not yet "ironclad," evidence of CP violation in neutral B mesons—a phenomenon that could help explain why matter reigns in our universe and antimatter has virtually disappeared.



CDF detector.

Although CP violation, a slight asymmetry in the behavior of matter and antimatter, was discovered 35 years ago, in particles called neutral K mesons, or kaons, this was the first sign of the phenomenon in B mesons.

The CDF scientists were not yet willing to characterize their measurement as a "discovery." More stringent criteria would be required to merit that designation, in particular, more data and, so, smaller uncertainties in the results. But as they argued about whether to call what they found a hint or a suggestion, an indication or evidence, they were sure of one thing: that a whole new arena in the study of CP violation was opening up, and that CDF would be there.

Photo by Walter Kononenko

CDF collaboration members Kevin Pitts (seated), a postdoc at Fermilab, Joel Heinrich (left), a senior research associate at the University of Pennsylvania, and Nigel Lockyer, a professor at the University of Pennsylvania, did the analysis measuring sin(2β) in the decay of B mesons.

A Little History

CP violation was first discovered in 1964 in neutral K mesons, particles consisting of a down quark and an antistrange quark, or, in anti-K mesons, the reverse. The discovery forced the realization that the microscopic laws of matter and antimatter were not entirely symmetric, not just mirror images of each other, as had long been assumed. There was a slight defect in the underlying symmetry of charge and parity. In one in every 500 decays of the neutral kaons, the K and the anti-K decayed at different rates.

In 1972, Makoto Kobayashi and Toshihide Maskawa of Nagoya University showed that charge conjugation and parity could be violated within the logical confines of the Standard Model if there were three generations of quarks, but at the time only two generations were known. Not long after, the third generation of quarks appeared. In 1975, the tau lepton was discovered by Martin Perl and his colleagues at SLAC, providing the first evidence of three generations of leptons. In 1977, Leon Lederman, now Director Emeritus of Fermilab, and other experimenters at the Laboratory discovered the bottom quark, and in 1995, the CDF and DZero collaborations found the top quark.

There was more. The Standard Model predicted that the asymmetry seen in the neutral K meson would be multiplied many times over in some of the decay modes of the neutral B meson, where a much heavier bottom, or b, quark replaces the strange quark of the K. Unfortunately for experimenters,

B Meson Decays

however, B mesons are not produced as easily as K mesons. Moreover, it is not feasible to create a beam of B's for experiments because the lifetime of the B is too short. Kaons, by contrast, in addition to being lighter, live much longer. The KTeV experiment at Fermilab exploits these two features to produce a dedicated kaon beam to study CP violation in neutral kaons.

Dedicated electron-positron colliders dubbed "B factories" have been built at SLAC in the United States and at KEK in Japan and are just entering their final commissioning phases. A dedicated fixed-target experiment is also starting at DESY in Germany. All are intent on amassing B's and delving into the secrets of CP violation. But it was "thanks to the copious production of B's at the Tevatron," said Barry Wicklund, who, with Joe Kroll, is coleader of the B physics group within the CDF collaboration, that the CDF scientists were able to make their critical measurement.

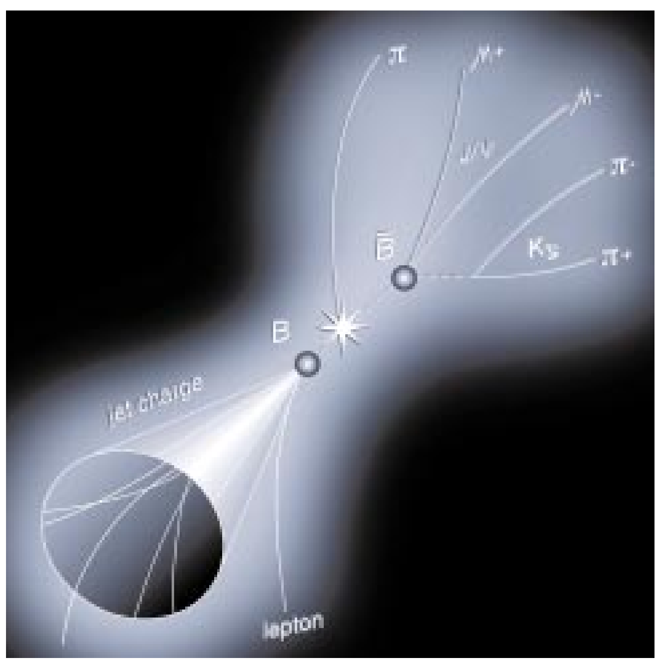
The Analysis

In the past five years, the CDF collaboration has carried on an extensive program to study the properties of B mesons, with important contributions from many member institutions. In the course of this work, several techniques crucial for this analysis were developed. In June 1998, the CDF collaboration published a first look at CP violation in B mesons based on an analysis developed mostly by Massachusetts Institute of Technology physicists.

Building on this previous experience, Kevin Pitts, a postdoc at Fermilab, Nigel Lockyer, a professor at the University of Pennsylvania, and Joel Heinrich, a senior research associate at the University of Pennsylvania, did the current analysis. They amassed piles of data from Run I at the Tevatron, weeded out background noise, and focused in on any event in which a B meson or an anti-B decayed into a J/Ψ particle and a K-short particle. Physicists call this decay the "golden mode" because theorists have been able to relate the extent of the asymmetry in the decay to fundamental parameters of the Standard Model

B DECAY EVENTS

B mesons, emerging here in a collision between protons and antiprotons, are relatively long-lived particles, and so travel some 0.5 mm (dotted lines) before decaying. In this diagram, an anti-B ($\bar{B}$) decays into a J/Ψ and a K-short (K_S) particle. The J/Ψ further disintegrates into two muons, one with a positive charge and one with a negative charge (μ^+, μ^-). The K-short also decays further, into two pions (π^+, π^-). By adding up the momenta of the muons and pions, physicists can determine that they came from a B meson. But to study CP violation, and asymmetries, or differences, in the decay of matter and antimatter, they need to know whether the B meson was a B or an anti-B. To make that determination, the CDF collaboration looked for certain signs: another pion produced in conjunction with the decay products, or a jet or a lepton (an electron or muon) produced by a second B (B mesons always come in pairs: one B and one anti-B). The charge of the pion, jet or lepton tells physicists which "flavor" of B gave rise to the J/Ψ and K-short.



with high precision. But that kind of decay happens only about once in every 50,000 decays of the B meson—not what physicists would call "rare" by their standards, but certainly not plentiful either. In the end, Pitts said, they were able to find 400 such events to analyze for CP violation.

Key to the analysis was figuring out which of the decays came from a B meson, and which from an anti-B meson. For that, they relied on several methods of what's called "flavor tagging," or distinguishing between one "flavor" of B and another. B mesons always occur in pairs—always one B paired with one anti-B—so one method was to look at the decay products of the B that didn't yield a J/Ψ and K-short. If, for example, that B yielded a lepton, and the charge of the lepton was positive, then they could deduce that the lepton came from a B meson. Thus, the B that decayed into a J/Ψ and a K-short must have been an anti-B meson.

All three methods that the experimenters used, however, were imperfect, and caused additional uncertainties in the final measurement. At best, said Pitts, they were only about 85-percent sure that a particular event came from one or the other kind of B particle.

Still, as Pitts said, "we squeezed out every bit of information we could."

The final measurement set out to determine whether there was an asymmetry in the decay of B's and anti-B's—that is, whether B's (or, conversely, anti-B's) more often decayed into J/Ψ and K-short particles. If there were no asymmetry—that is, if of the 400 events, 200 came from a B and 200 from anti-B—then CP was conserved; if there were an asymmetry, then CP was not conserved. In the technical jargon of the physicists, they were looking for a nonzero number for $\sin(2\beta)$.

As it turned out, the number for $\sin(2\beta)$ was 0.79, with an error of +0.41 and –0.44, which is consistent with the range of values, 0.66 to 0.84, estimated from the Standard Model. These numbers indicate that the odds are better than 13 to 1 that $\sin(2\beta)$ is greater than zero—"tantalizing odds," said Pitts, "but still not ironclad proof of CP violation."

The Future

CDF scientists said that while the measurement of $\sin(2\beta)$ was good news for experiments at

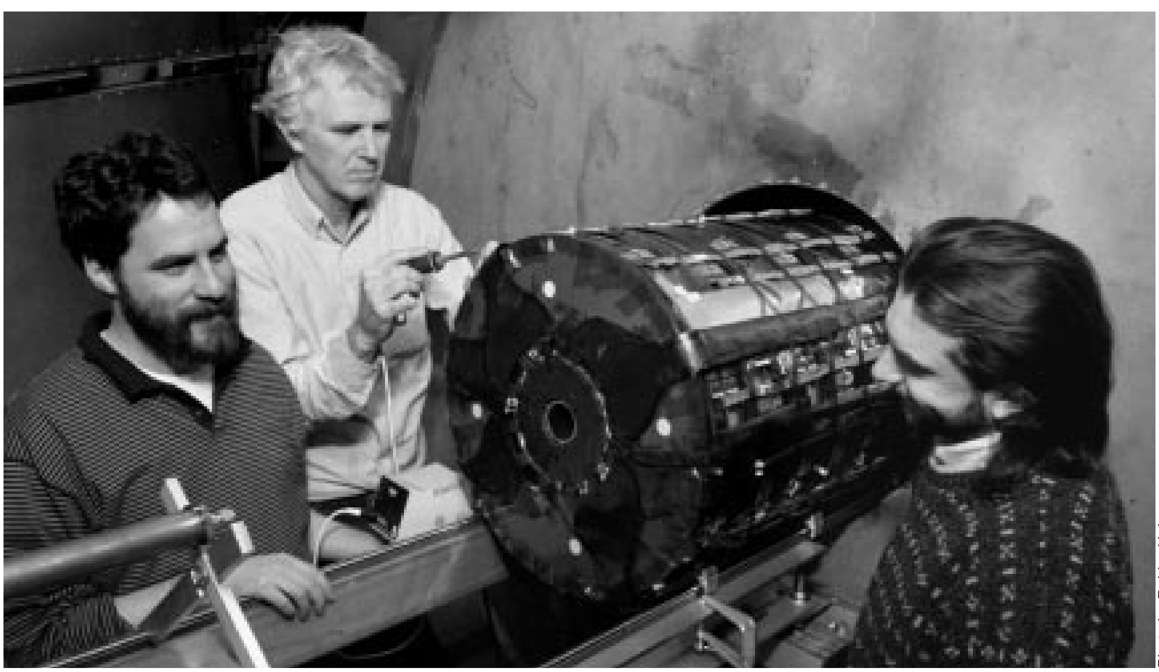


Photo by Reidar Hahn

The VTX chamber and the silicon vertex detector, SVX, being installed inside the CDF detector in 1992. The SVX is indispensable for determining the point where a B decays into its decay products inside the beam vacuum pipe. Left to right: CDF collaborators Carl Haber, of Lawrence Berkeley Laboratory, Morris Brinkley, of Fermilab, and Nicola Bacchetta, of INFN-Padua.

the B factories, it was also good news for hadron colliders like the Tevatron, demonstrating that these colliders can compete in the arena of B physics as well.

"This nails it," Lockyer said. "We're immensely proud we were able to make this measurement even though we're not a dedicated B factory."

To date, Fermilab has "by far the largest sample of events in which a B meson decays to a J/Ψ and a K-short," said Lockyer. Moreover, the collaboration expects to increase its supply of these golden mode events by at least a factor of 30 when the Tevatron cranks up again next year. With many more events to analyze, the collaboration expects to be able to improve the precision of its measurement of sin(2β) by a factor of five to six.

Among the improvements currently under way in the CDF detector are a next-generation silicon vertex detector and a central outer tracker necessary to reconstruct the tracks from B decays. The CDF collaboration is seeking funds for additional detector modifications that will further help distinguish charged kaons from pions and improve the accuracy of future measurements.

Better instrumentation in the detector will also allow the collaboration to collect large samples of other B decay modes. In particular, the CDF collaboration will be studying what are called "strange B's," which contain one strange quark (like the neutral K meson) and one b quark. These mesons offer still more ways of probing aspects of CP violation. CDF has already collected the largest sample of strange B's and is expecting a sample as much as 100 times larger in Run II. The ability to study strange B's in sufficient detail to measure strange-B mixing and CP violation will be a unique capability for CDF until at least the year 2005.

Meanwhile, the B factories will start taking data in 1999, and the CDF collaboration in late 2000, with the hadron and electron-positron colliders offering complementary experimental capabilities to probe aspects of CP violation in the decay of B mesons.

"With this next generation of measurements," Wicklund said, "we should learn whether the Standard Model explanation for CP symmetry violation is correct, or whether there are even deeper truths that explain our material world."

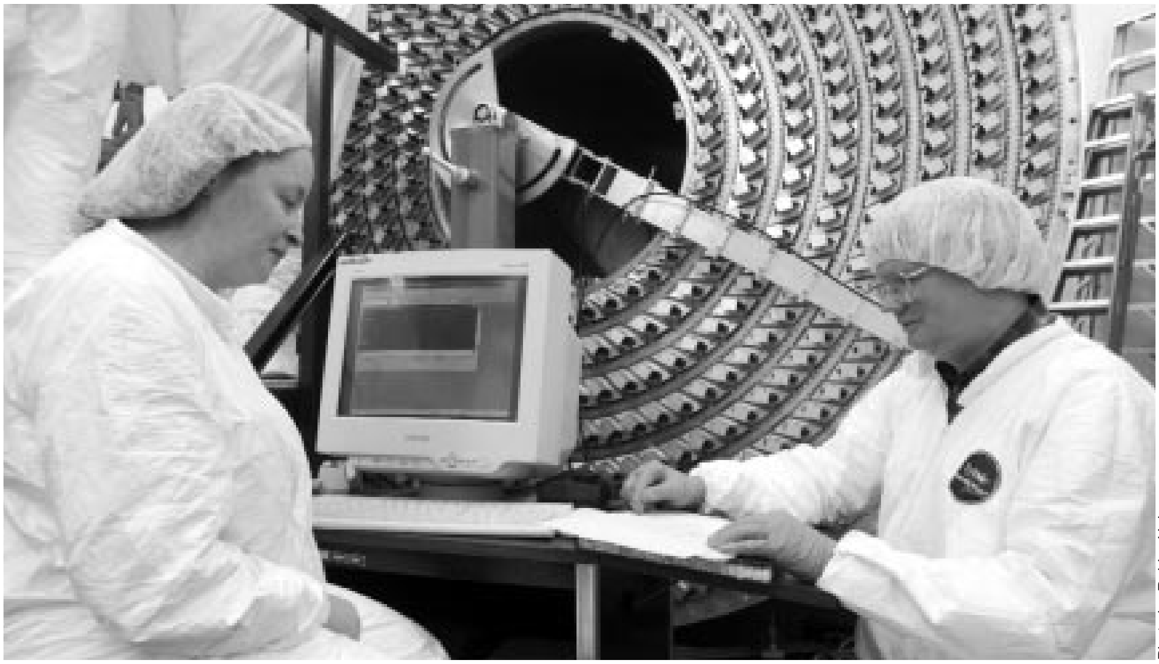


Photo by Reidar Hahn

In a "clean room" at Fermilab, CDF physicist Bob Wagner and technician Robin Denham-Taylor use computer controls to position CDF's new central outer tracker while installing field planes that shape the electric field. The new tracker will improve CDF's ability to identify the decay products of B mesons when Run II begins.

CRITICAL PATH

The Main Injector's final goal:

fast tune-up for the slow spill

by Mike Perricone

The slow-spill extraction process is slow only in relation to the microsecond duration of other Main Injector functions, and the redirection of a high-energy proton beam is far too exacting to fit any conventional definition of the word "spill."

Yet slow-spill extraction, the seventh and final commissioning goal for the $230-million Main Injector accelerator, shares a fundamental quality with every machine ever built, however contradictory its name, both in and out of high-energy physics.

"You don't just turn a switch and, like magic, it works," said Shekhar Mishra, commissioning chief for the Main Injector Project. "It takes time to de-bug the system."

All the more reason to make sure there was no extension of the scheduled 10-day beam shutdown to allow installation of the needed slow-spill hardware in the Main Injector tunnel and service building. And from January 14 to January 23, the equipment went in on time, with beam running again on January 24, exactly as scheduled.

"The key was being organized," said Main Injector Department head Phil Martin. "There was lots of advanced warning about what we'd have to do, and everyone knew exactly what was required."

In a key milestone after the shutdown on January 26, a proton beam with 8-GeV energy was sent through the extraction line to the Antiproton Source. The next step is to commission that extraction line at 120 GeV with the antiproton target removed, sending the 120-GeV beam to the antiproton absorber. Only then can the commissioning crews begin working on the slow-spill process itself, starting at low beam intensities.

Slow spill is more accurately described as "resonant extraction," where the proton beam is enlarged to nearly eight times its normal size. It is pushed to

Photos by Reidar Hahn

Joel Gonzalez (left) and Keith Dillow install slow-spill extraction hardware during the recent 10-day shutdown. The Main Injector is heading for its seventh and final commissioning goal.

the brink of instability before part of it is “kicked” in a new direction, bound for a destination other than the Tevatron. The point where the resonance is created determines the beam’s destination.

Among its planned uses, resonant extraction is critical to the future success of the MINOS long-baseline experiment. The system will be used to compile multiple turns of high-intensity beam for producing neutrinos.

Resonant extraction works on a principle of changing the beam’s “tune” inside the Main Injector. The beam exhibits a motion transverse to the path of its linear direction. The tune is defined as the number of these waves, called oscillations or cycles, the beam experiences in each turn around the two-mile accelerator.

In the Main Injector, that tune is precisely measured at 26.425 oscillations per turn. Resonance occurs at the nearest integer or nearest half-integer to the tune. Raising the tempo of that tune to 26.5 oscillations (the nearest half-integer)—or lowering it to 26.0 (the nearest integer)—creates a thoroughly unstable and unruly beam, which will shake itself to oblivion and be absorbed in the surrounding beam pipe.

Most physics students are given a dramatic example of resonance on a much larger scale: the famous film of the Tacoma Narrows Bridge at Washington’s Puget Sound, which shook itself apart on July 1, 1940, when winds set the bridge oscillating at a resonance of its natural frequency. The resonance caused a steady increase in the amplitude of the oscillations until the bridge literally flew apart.

The trick in resonant extraction, requiring an accelerator operator with the sensitive touch of a safecracker, is to bring the beam closer and closer to instability without actually shaking it apart, but yet making it just unstable enough to detach a “tail” from the high-intensity beam. This tail is then “kicked” into the transfer line by the electric field from a 12-foot wire septum (from the Latin “*septum*,” or “*saeptum*,” meaning partition), splitting the beam and sending the parts in two different directions.

The Mishra Method: Science as Family Fun

by Mike Perricone

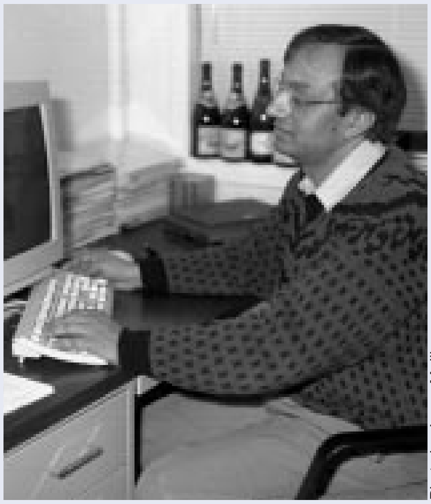


Photo by Jenny Mullins

Whenever an electronic gizmo stops working around the Mishra household in Batavia, that’s when the real fun starts for Pranav, 9, and Monisha, 6, Shekhar Mishra’s son and daughter.

“If anything electronic breaks down, we don’t junk it,” Mishra explained. “We take it apart and see what’s inside. The kids are having quite a bit of fun with it.”

Raising two budding scientists wouldn’t surprise Mishra and his wife,Tanuja, a computer professional for Lucent Technologies.

“Both kids are into science, and sometimes they ask me some very difficult questions,” Shekhar grinned. “Since both my wife and I are involved in science, the kids see it around them all the time. Fortunately, they’re both good in math.”

In his own younger days, Mishra couldn’t wait to get his hands on the physics lab equipment during high school in Patna, the capital of the State of Bihar, a city of about a million inhabitants on the banks of the River Ganges in northern India.

“I always found myself absorbed in the experiments,” he recalled. “When I went on to the Patna University, experimental physics was always my fascination.”

After his bachelor’s degree in physics, he was accepted as a graduate student at the University of South Carolina, Columbia, in 1981. He

achieved his doctorate at Los Alamos National Laboratory, and worked there as a postdoc while also assisting in experiments E772 (Drell-Yan production) and E789 (b quark production) at Fermilab. But the long-distance commuting became "a nightmare," and he resolved to stay at Fermilab.

Mishra joined the Physics Section (now Particle Physics Division) in late 1989 as a research associate and continued to work on E789, then moved permanently to the Main Injector Department in 1991 after some talks with Main Injector Project Manager Steve Holmes, now head of the Beams Division. Since that time he has worked on Main Injector and Recycler Ring design.

Mishra continues his ties with particle physics experiments as a member of the DZero collaboration, and hopes for more time there when the accelerator's commissioning is completed. He is also leading the Accelerator Physics Group for research and development on a possible Very Large Hadron Collider.

"Fiscal realities dictate that we come up with innovative ideas for accelerator and magnet technologies," he said. "I hope young physicists will join these R&D efforts."

Mishra and Tanuja maintain their ties with India, returning with their family at least every other year to visit relatives. Mishra had been scheduled to give a presentation at the recent "Hadron 13" conference in Bombay, India, but was prevented from attending by the diplomatic strain between the U.S. and India over nuclear weapons testing.

"We're all happiest when working in physics without borders," Mishra said. "I hope the ties between governments will improve soon."

Photos by Reidar Hahn

Keith Dillow works on installing the septum for slow spill extraction at the Main Injector.

The resonant-extraction system uses components from the now-dismantled Main Ring, as well as new components. The trickiest, and most delicate, parts of the installations involved the two wire septa and sections of ceramic beam pipe. Ceramic beam pipe is used instead of stainless steel, which might pick up some of the current from the feedback magnets called QXR's.

The wire septa contain precisely aligned lengths of tungsten-iridium sensing wires 0.002 (2/1,000) of an inch thick, up to 12 feet long, spaced 1/10 of an inch apart. As the tail of the beam crosses the plane of the septum wire, it receives a kick from a high-voltage cathode, which sends that portion of beam out of the machine.

All these steps are accomplished with the beam traveling at the speed of light. Turn the switch, and the magic happens—the day-in and day-out magic of organization, planning and precision, the benchmark of life at a particle accelerator.

RED DOG Moves the Magnets

by Sharon Butler

Greg Lawrence takes his nickname, Red Dog, so seriously he has it etched on the front of his hardhat. His red hair earned him the moniker, but he also wears red shoelaces in his workboots and, at least today, a red sweatshirt.

Lawrence has been with Fermilab for 25 years, starting as a Technician I in the Meson Lab, and moving up in responsibility as he gained experience working with magnets and vacuum systems. He helped build specialty devices, including the first generation of Lambertson magnets for the Main Ring and Tevatron. His work with the stainless steel in the magnets had unexpected returns: He recently won a first and third in the Chicago regionals of the American Homebrewers Association, with samples straight out of the stainless-steel vats in his basement shop at home.

Lawrence now supervises the mechanical support crews for all the proton-producing rings. His crews handle the installation of magnets, including replacing them when they go bust.

Changing magnets down in the accelerator tunnel can be tough work, and he has no end of praise for the guys who work for him.

"We'll be down there sometimes 12 hours straight," Lawrence said. "You're under the gun to get the magnet changed and to get the beam up and running again. Problem is, there are no bathrooms; there's no water; you can't eat, you can't drink, and you can't smoke."

Moreover, magnets can break down anytime, day or night. "You might get a call at four in the morning." Lawrence said.

He vividly remembers the night a quadrupole in the Main Ring failed.

"We were called in around midnight," Lawrence remembered. "It was an 11-hour magnet change. We were finally done late the next morning, and everybody headed home. I must have been in bed for about three hours when I got another call: We had lost another magnet…."

"I had to get real creative," Lawrence said. Knowing that some of his crew could sack out immediately after a long night's work, while others were too hyped up to sleep, he split his crew in two.

"I brought in all the guys who were still awake," he said, "and we started the magnet change. Then, when we were getting pretty tired (we wanted to be real careful for safety reasons), the other guys who had slept the whole time came in and finished the job."

In truth, though, Lawrence doesn't mind being roused from a good night's sleep. "I kinda like that stuff," he said. "It's not monotonous. We go from a shutdown like this, where it gets really hectic, to where I almost get antsy."

safety focus

Has a Big Payoff

Whether carrying a heavy carton or caring for a child, the safest method is the best method: bend at the knees, not at the waist.

by Mike Perricone

The message is safety, and the numbers show that Fermilab is getting the message. With an increasing emphasis on safety that included a three-day Lab-wide safety stand-down in December, Fermilab surpassed its goal for the 1998 lost-workday case rate. The goal set for 1998 was 2.1 lost workdays per 100 man-years; the final figure was 1.99 per 100 man-years.

Bill Griffing, head of the Lab's Environment, Safety and Health Section, explained that the lost-workday case rate measures the number of injuries serious enough to cause someone to lose a day of work, or to return to work with duties limited in some way. The Lab-wide score over the previous three years averaged about 3.0, meaning that the 1998 statistics show a significant drop.

"We try not to focus too much on statistics, because we don't want people to think that's all we're interested in," Griffing said. "But we are very much interested in people not getting hurt. This is very good news."

Significantly, the lost-workday case rate statistics include both Fermilab personnel and contractors, indicating that the message has spread to all activities over the entire site.

"That includes all of our service contractors and our construction contractors," Griffing explained. "We don't have the same kind of control over them. But we've made it very clear to these companies that the injury rates are important to us. We want them to work in a safe way. And we have stepped up our oversight surveillance of those workers to make sure they're working safely."

Visualizing a rate of 2.1 lost workdays per 100 man-years is not easily done. Griffing translated that number into a total of 45 serious injuries or fewer at Fermilab as the goal for 1998.

Instead, the total for 1998 was just 43, including 32 for Fermilab employees and 11 for contractors.

The Lab's goal for 1999 is 1.6, or not more than 34 serious injuries for the year—a reduction of 20 percent. Reaching that level would mean no more than 8.5 serious injury cases per quarter, which might sound daunting, but Griffing pointed out that there were just 7, 9 and 10 cases respectively in the final three quarters of 1998—an 8.67 average, well within reach of the 1999 goal.

For the year 2000, the Lab's goal is to halve the rate, to 0.8 or a total of just 17 injuries.

"We adopted the goal of reducing our lost workday case rate to 2.1 or lower early in 1998," Griffing said. "Many people were skeptical about whether we could really achieve this goal. But with the combined and cooperative efforts of a lot of good people, we made it. I'm hopeful this will serve as further encouragement that we can go on to achieve the goal we have set for ourselves this year.

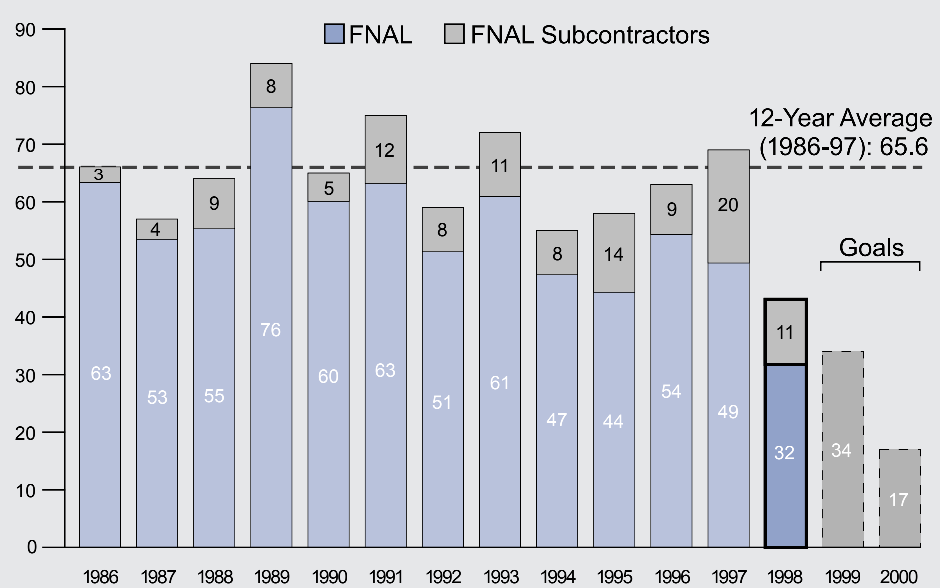
Griffing thought the safety stand-down would have a major impact on work around the Lab for important and specific reasons: the morning presentations in the overflowing Ramsey Auditorium were led by senior managers at the Lab, including Director John Peoples, Assistant Director George Robertson, the heads of the Lab's four divisions, and four section heads; and the afternoon workshops focused on specific projects under way in several areas of the Lab.

"If we had hired someone from the outside to come in and give a talk, it would not have been received as well," Griffing said. "The fact that our senior management led the morning sessions, the fact that it was often first-line managers who led the discussions in the afternoon, and the fact that the training was tailored as much as possible to individual work sites—these all added up to people getting the most meaning out of it."

Griffing also thought that Robertson's history as a former Major General in the Army Corps of Engineers reinforced the credibility of the safety message.

"With his own experience, he can personalize safety," Griffing said. "He's made the case time and again that safety is not something separate from your work, something you do to please outsiders. Safety is integral to your work, and if you think of it in the same way you think of quality and planning, you'll end up with a better product. Coming from the top, and coming very strongly, that message has helped more than anything else to improve our safety program."

Number of Lost-Workday Cases



Workers repaired 4,000 welds in the LCW system—safely.

Kondo Awarded Prestigious Japanese Physics Prize

Photo by Jenny Mullins

by Sharon Butler

Kunitaka Kondo, professor emeritus at the University of Tsukuba and a long-time member of the CDF collaboration, has been awarded Japan's highest prize in particle physics for his contribution to the discovery of the top quark. He was one of three physicists in Japan to receive the prize in 1998.

The Nishina Prize is awarded annually by the Nishina Memorial Foundation to Japanese physicists who have made significant contributions to the field of "atomic physics" (including particle and nuclear physics and astrophysics). The organization was founded in 1955 by Yoshio Nishina, known for the Klein-Nishina equation, to promote physics research. Initial funding came from Japanese financial circles and from individuals in physics all over the world.

Kondo called Nishina the "godfather" of particle physics in Japan. Nishina designed the first cyclotron in Japan in the late 1940s, but when it was only half built, the U.S. occupation army ordered it destroyed.

High-energy physics as an academic discipline in Japan is relatively new, according to Kondo. He first learned the Japanese word for atom—genshi—when the U.S. dropped an atomic bomb on Hiroshima during World War II. Just after the war, Kondo said, the study of atomic physics became fashionable in Japan; indeed, all his friends were studying theoretical physics. His heroes, like those of many Japanese physics students, were Hideki Yukawa, who predicted the pion as the origin of the nuclear force and was awarded the Nobel Prize in 1949 for his meson theory, and Jitiro Tomananga, who, with Richard Feynman and Julian Schwinger, won the Nobel Prize in 1965 for their development of quantum electrodynamics.

Kondo first came to Fermilab under a government-funded U.S.–Japanese collaboration on energy research. ("Somehow high-energy physics was included, along with coal gassification and nuclear fusion," Kondo said.) After experimental work at SLAC and Brookhaven National Laboratory, he joined the CDF collaboration in 1979, heading the group of Japanese physicists in the collaboration until 1986. The group shouldered responsibility for building parts of the detector, including its superconducting solenoid and its electromagnetic calorimeter.

Kondo said he was honored by the award, and felt it recognized not just him but the entire high-energy physics community in Japan.

But at this point in his career, he said, Run II at Fermilab had more meaning for him than the Nishina prize, because "in Run II, we may find something even more surprising than the top quark."

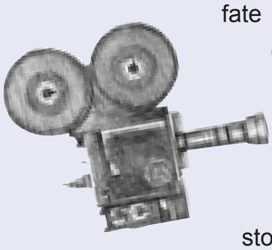
the talk of the lab

Guth, Kolb interpret universe for British TV

The famous old London Bridge is long gone to retirement in the Arizona desert, but other venerable sites in London might be in danger of falling down.

"Big Ben has some big cracks in it," said Stephen Warburton, citing the renowned clock tower at the Houses of Parliament. "There's even some fear the Houses of Parliament might be sinking. A new underground (subway) line was put in beneath it, and it seems it wasn't done very well."

Warburton, a producer with the British Discovery Channel, brought a camera crew to Fermilab while on a transcontinental expedition for the filming of a future four-part series on the birth, growth, state and fate of the universe. Among other sites, the crew had visited Chile, to view the Las Campanas Observatory, and Apache Point Observatory, to view apparatus of the Sloan Digital Sky Survey. Before returning to London, their next and final stop was Cleveland, to interview Lawrence Krauss of Case Western University, author of *The Physics of Star Trek.*

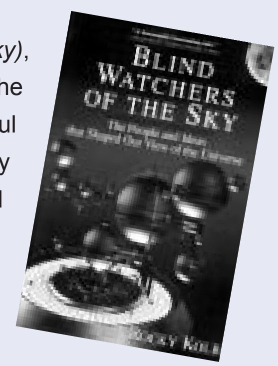


At Fermilab, Warburton had arranged a guest appearance by Alan Guth, the Victor F. Weisskopf Professor of Physics at M.I.T. Guth helped develop the inflation theory of the growth of the universe, describing his quest and findings in *The Inflationary Universe: The Quest for a New Theory of Cosmic Origin.*

The "inflation" theory postulates that the universe underwent an incomprehensibly large expansion in the first fraction of a microsecond of its existence. Much of Guth's outlook was confirmed in measurements of the cosmic background microwave radiation by NASA's COBE satellite in 1992. In *The New York Times Book Review*, Nicholas Wade wrote: "Alan Guth's book is written in a brisk, engaging style uncharacteristic of scientific autobiographies. His story tells much about how science sometimes works, how the universe may work and how on occasion one bright individual can cause an intellectual revolution."

Guth himself, small of stature with salt-and-pepper hair, wire-rimmed glasses and a crinkly-eyed grin, could be mistaken for an elf. But his animated discussion, interweaving conservation laws, negative energy in gravitational fields, the near-uniformity of the background radiation, monopoles, the Standard Model of elementary particles, and the quest for the Higgs boson, put him in clear command of his surroundings—no small achievement in itself, considering the interview was conducted in the cavernous CDF collision hall, where the 30-foot high, 5,000-ton detector will be rolled into place for Run II of the Tevatron in the year 2000.

Guth, who had patiently withstood delays in the filming schedule throughout the afternoon, hurried off to the airport to return to Boston the instant his interview concluded. Fermilab astrophysicist Rocky Kolb, arriving in the collision hall as the next interview subject, was visibly disappointed that Guth had already left, and that he would not have a few extra minutes to talk shop and paradigm-shifts with him.



Also an author *(Blind Watchers of the Sky)*, and also with his timing tight due to the schedule delays, Kolb gave his own colorful discourse on the structure of the early universe. He spoke of quarks and antiquarks able to go it alone in the universe's highest-energy earliest stages, then needing similar friends to hang around with as the universe cooled.

Standing below the gap in the Tevatron beam path where the CDF detector will fit during the collider run, Kolb described the irony of needing bigger and bigger machines to explore smaller and smaller portions of matter.

"To me," Kolb said, "one of the most amazing features of the universe is the fact that there evolved at some point a species with the intelligence, and most important the curiosity, to wonder how the universe came to be."

Kolb described the accelerators and detectors as "time machines," taking us farther and farther back in time, closer and closer to the beginnings. Indicating the space where particles collided in Run I and will collide again in Run II, Kolb said: "In our continuing efforts to replicate the 'primordial soup,' this is Ground Zero."

The Discovery Channel series, more than a year in the making, is scheduled for airing in the fall of 1999.

—Mike Perricone

Nobel for Sale

At a recent convention of the Medals and Orders Society, held in Chicago, Jeffrey A. Schramek sat behind his glass display case hawking his wares. Atop the case was his business card, which read "Lords & Ladies, Statesmen & Heroes," and inside was the half-pound, yellow-gold Nobel medal awarded the physicist James Chadwick for his discovery of the neutron.

Schramek likes to own medals and citations because they represent significant objects in people's lives, which explains why he never bothered with coins and why he cherishes Chadwick's Nobel. But still, he is as surprised as anyone that he owns the prestigious scientific prize. A self-described "middle-income guy," Schramek works as a night watchman at Chicago's O'Hare International Airport. He first spied the medal two years ago on the cover of the catalog of Glendenning's, an obscure auction house in London, and, when it was put up for auction, placed the winning telephone bid.

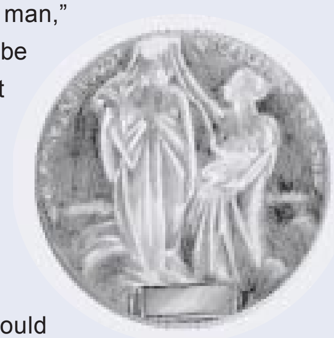
At the convention, Schramek graciously gave visitors a peek at his prize, pulling the shiny disc from its velvet wrappings, and even rummaging in his Sanyo duffel bag, stuffed underneath the display table, to produce more of what he called his "Chadwick goodies."

"If this were Einstein's Nobel," Schramek said, "oh gee, we'd be talking a million bucks on its face." Still, he expects to sell the medal for perhaps "140, 150 grand." He figures the value of the Nobel jumped considerably with the recent publication of *The Neutron and the Bomb*, a book describing the physicist's role in making the atomic bomb.

On slow nights at O'Hare, Schramek has been poring over the book, and he has developed a knack for translating its anecdotes into the vernacular. There's the story, for example, of Chadwick's winning the Nobel. "Marie Curie's daughter, Eve, was also hoping to discover the neutron," Schramek recounted. "She was within an eighth of an inch of beating Chadwick, but she misinterpreted what she was seeing. Then months or years later, Chadwick gets it—he gets it right away. My vague recollection is that he thought, oh gee, you never know about life. The problem was, Madame Curie had it in for him the rest of her life. Her kid could have gotten that Nobel prize."

Through his reading, Schramek has come to admire the physicist, so much so that he probably won't part with his Chadwick goodies, even after he sells the Nobel.

"I just like the feel of the man," Schramek explained. "He could be short at times with folks, but other than that, he was a sane guy. He had a sense of humor. He had integrity and good judgment. And he wasn't a glory hound."



Asked how Chadwick would respond if he knew who owned his Nobel now, Schramek pondered the question carefully and cast about on the ceiling for a reply.

"I've found life to be a surprising thing, and I have to believe that Chadwick would, too," he said. "My guess is Chadwick would be amused by the irony of the situation. 'I can sort of see it,' he'd probably say. 'So, the guy's not a physicist, but at least he's not a rug merchant.'"

—Sharon Butler

VLHC Accelerator Physics Workshop

Fermilab's Accelerator Physics Working Group, on behalf of the VLHC (Very Large Hadron Collider) Steering Committee, is hosting the VLHC Workshop on Accelerator Physics at The Abbey, in Lake Geneva, Wisconsin, from Monday, February 22 to Thursday, February 25.

The key topics for the workshop will be: Single Particle Dynamics Issues; The Role of Synchrotron Radiation; Lattice Issues and Correction Schemes; Multiparticle Beam Dynamics Issues; and Energy Deposition Issues.

For more information, contact Conference Coordinator Cynthia Sazama (sazama@fnal.gov) or Program Committee Chair Mike Syphers (syphers@fnal.gov). The Steering Committee comprises representatives from Fermilab, Brookhaven National Laboratory, Cornell University and Lawrence Berkeley National Laboratory.

MILESTONES

RETIRING

Imre Gonzcy, I.D.# 2312 on March 31, from TD/Engineering & Fabrication. February 12 will be his last work day.

FIRST EVIDENCE OBSERVED

of Spring 1999. Fermilab's Canada geese have paired up, the first sign that, contrary to current appearance, spring will come again to northern Illinois.

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, February 10

Rouladen with Egg Noodles,
Dill and Lemon
Steamed Broccoli
Pear Turnovers

Dinner
Thursday, February 11

Valentines Day
Red Pepper Soup
Heart Shaped Vol-au-Vent with Seafood
Lover's Salad
Champagne Zabaglione with Strawberry and Chocolate Hearts

Lunch
Wednesday, February 17

Grilled Salmon with Sour Cream
and Cucumber Sauce
Rice Pilaf with Vegetables
Banana Bourbon Cake with Bourbon Cream

Dinner
Thursday, February 18

Roasted Garlic and Yellow Pepper Soup
Seafood Kabobs
Toasted Orzo and Rice Pilaf
Lemon Cake

FERMI NEWS

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CLASSIFIEDS

FOR SALE

- '97 Mitsubishi Eclipse, 5 spd, silver/gray leather interior. Great shape, non- smoking vehicle, fully loaded, CD, power moon roof, alloy wheels, $19,000 Call Diana, x3771 or (847) 741-1442.
- '97 Honda Accord EX wagon, 25K miles, black, very good condition. $17,250. Call David, x4001 or dcc@fnal.gov.
- '94 Toyota Tercel, stick w/cass radio, great mileage, $3500 obo, phone x8772 or (630) 584-2897; ask for Ron Zacker.
- Skis 195 Atomic Arc, bindings, poles, boots & bag, $190 obo; king size waterbed frame & headboard needs mattress, $75 obo; wood lathe included are chisels & cabinet w/drawers, $250; dive equipment, Parkway BC vest $85, US Divers wet suit $50; Elvis collector plates 4 different, $25 ea; 2 old style military cots, $15 ea. Call Terry x4572 or skweres@fnal.gov.
- Townhouse, Batavia's Georgetown III, 2 bdrm plus loft,17' cathedral ceilings in LR & DR 2 full ba, 2 car garage. Lots of extras, $169,000.Call Alma x3452 or eve (630) 879-3809.

FOR RENT

- 2 bedroom apartment in Batavia. Garage, fenced yard, washer/dryer. $750/month. Mark, x4776, markl@fnal.gov

WANTED

- Rental space w/heat & electricity for small woodworking shop, 700-1000 sq. ft. (708) 354-2130.

FOUND

- Black leather men's glove on road by D0, missing one? Call Dale x3875, or Dale@fnal.gov.

CALENDAR

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

FEB 10 & 16

Computing Division Seminar:
Help for the year 2000 Computer Issues by Tim Doody, 1 West from noon - 1 p.m.

FEB 14

Valentine's Day Barn Dance in the Kuhn Village Barn, 7-10 p.m. Music by Mike & Val, calling by Paul Watkins. All dances are taught, people of all ages and experience levels welcome. Admission is $5, children under 12 are free (12-18 $2). Sponsored by the Fermilab Folk Club. For more info call Lynn Garren, x2061 or Dave Harding, x2971.

FEB 20

Fermilab Art Series Presents: *William Bennett, Flute in Recital with Clifford Benson* $10. All performances begin at 8 p.m. in Ramsey Auditorium, Wilson Hall. For tickets or more information call (630) 840-ARTS.

FEB 21

Barn dance in the Kuhn Village Barn from 2-5 p.m. Music by Lower Fiddle Class, calling by Paul Ford. All dances are taught, people of all ages and experience levels welcome. Admission is $5, children under 12 are free (12-18 $2). Sponsored by the Fermilab Folk Club. For more info call Lynn Garren, x2061 or Dave Harding, x2971.

FEB 25

Wellness Works Presents: Y-ME a workshop on Breast Cancer Awareness by the National Breast Cancer Organization, "What you need to know about breast cancer" from noon – 1 p.m. in Curia II conference room.

FEB 26

International Film Society Presents: *The Sweet Hereafter.* Dir: Atom Egoyan, (Canada 1997, 110 mins.) Film at 8 p.m. in Ramsey Auditorium, Wilson Hall, $4. (630) 840-8000.

ONGOING

NALWO coffee, 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. English classes on Tuesdays at the Users' Center. Beginners from 9–10 a.m. & intermediate students, 10–11 a.m. Fee of $ 4 per morning. Students welcome to attend both classes. Lessons taught by Rose More, (630) 208-9309.

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