# FERMI NEWS

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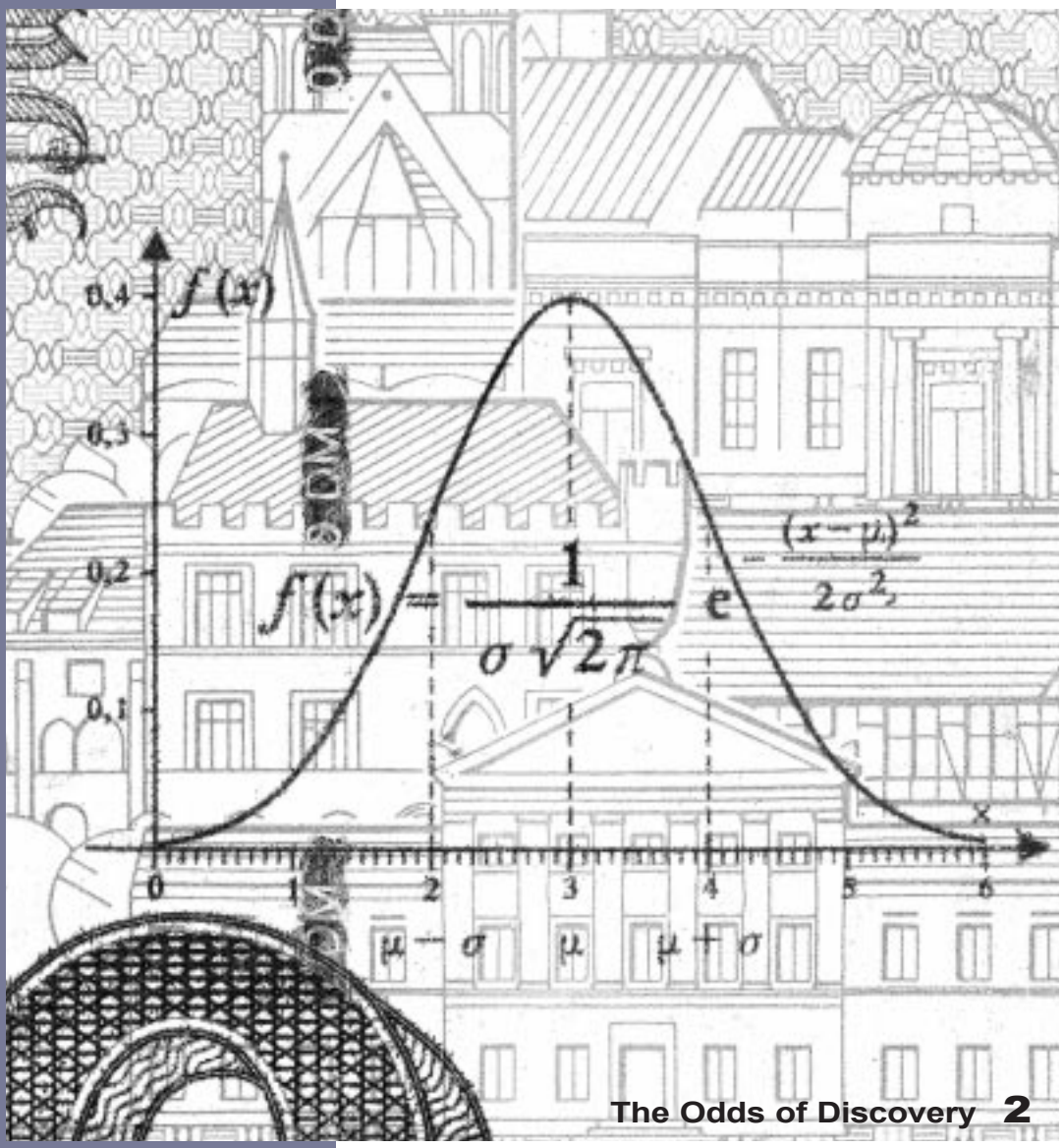


Fermilab Illustration

**The Odds of Discovery** 2

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## INSIDE:

# The Odds of Discovery



The German 10-mark bill features a portrait of Carl Friedrich Gauss and a picture of the famous Gaussian curve, which describes the probability distribution of simple experiments. In the background are buildings of historical Göttingen, where Gauss was director of its observatory.

# How SCIENTISTS *KNOW*

## *"God does **not***

by Kurt Riesselmann

How do scientists know when their experimental results add up to a discovery? If they are 99 percent sure, is that sure enough?

In day-to-day experience, a chance of 99 percent often seems like a sure thing. Many people would bet a month's salary on an event with such a probability. But it's easy to imagine cases in which a one-in-a-hundred chance seems far too high.

Would you cross the bridge over a deep canyon if there were a one percent chance it would collapse?

Scientists analyzing their experimental data are also cautious. For them, claiming a result with 99 percent certainty leaves plenty of room for Mother Nature to prove them wrong—with career-wrecking consequences. Accordingly, scientists have developed a careful language to describe a promising result. Their keywords are "hint," "indication" and "evidence," all of which fall short of the actual claim of a "discovery."

The criterion used to decide which word to pick is hidden behind a simple Greek letter: σ. Pronounced "sigma," this symbol is the unit that describes how reliable a result is.

"Most people in the field would agree that if the significance of data is less than 3 sigma then the result might be just a fluctuation," said Bill Carithers, physicist at Lawrence Berkeley National Laboratory. "If the significance is greater than 5 sigma it is a discovery. In between, there are various shades of gray."

Scientists refer to sigma as the "standard deviation." It is the decisive parameter of the Gaussian curve, a mathematical function that describes the distribution of data from many simple experiments. Citing a certain number of sigma directly translates into a probability. Three sigma, for example, is equivalent to a 99.75 percent chance that a future experiment will yield a compatible result. Scientists, though, wouldn't trust such a result to withstand future scientific scrutiny.

"We have published hundreds of papers with thousands of numbers," said Carithers, a member and former spokesman of the CDF collaboration at Fermilab. "You expect some of the results to be outside the 3 sigma range."

# when they FIND the ***TRUTH***

# *play dice.”*

– Albert Einstein, physicist, 1879-1955


Photo by Reidar Hahn

On April 26, 1994 CDF cospokesperson Bill Carithers presented the first evidence for the top quark at a Fermilab press conference. It took another year before physicists at CDF and DZero had enough data to claim a discovery.

Physicists think that only a 5-sigma result, indicating a 99.99995 percent chance that the result can be reproduced, is trustworthy and can survive the test of time.

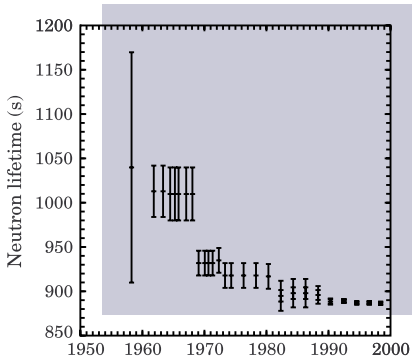
In 1994, Carithers and about 400 CDF colleagues faced the dilemma of evaluating the significance of the first top quark data. The collaboration decided to publish a paper proclaiming “evidence.”

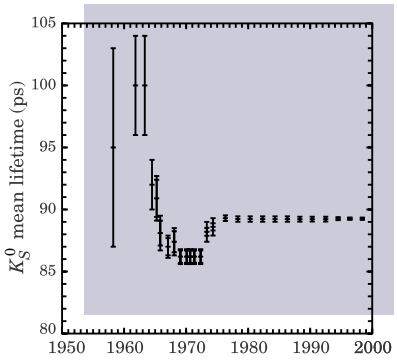
“There was a long pause in data taking during Run I,” Carithers said. “We had analyzed the first data, and we thought it was important to tell our colleagues what we had. If we had been able to immediately continue collecting more data, then we might have held back on publishing the results.”

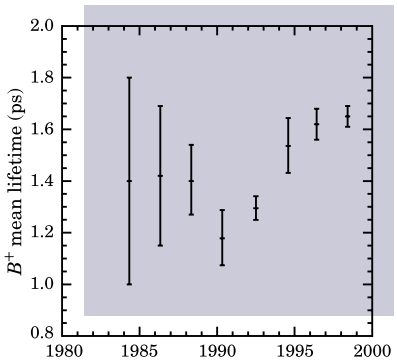
It took another year before new data boosted the significance of their original result and allowed for claiming the top quark discovery, simultaneously with the DZero collaboration at Fermilab.

“Our discovery paper [in 1995] was based on 4.8 sigma,” Carithers recalled. “But there were corroborating pieces of evidence. We had the feeling that the case was actually stronger.”

Identifying a new particle and determining the significance of its signal is quite different from rolling a pair of dice and calculating the probability of the score. Particle physicists have to study background events, which are created by other particles and leave similar signals. Separating a desirable signal from background look-alikes amounts to identifying the face of a specific person in a blurred photo of a large crowd.




The evolution of lifetime measurements of three different particles over the years: neutron lifetime (in seconds, top), kaon lifetime (in picoseconds, center) and B+ meson lifetime (in picoseconds, bottom). Generations of experiments have greatly reduced the uncertainties (error bars indicate 1σ deviation). New measurements are expected to lie within a 3σ range of previous measurements, which is true for most data points shown. *(Particle Data Group, D.E. Groom et al., The European Physical Journal C15 (2000) 1.)*

# *"God **does** arithmetic."*

– Carl Friedrich Gauss, mathematician, 1777-1855

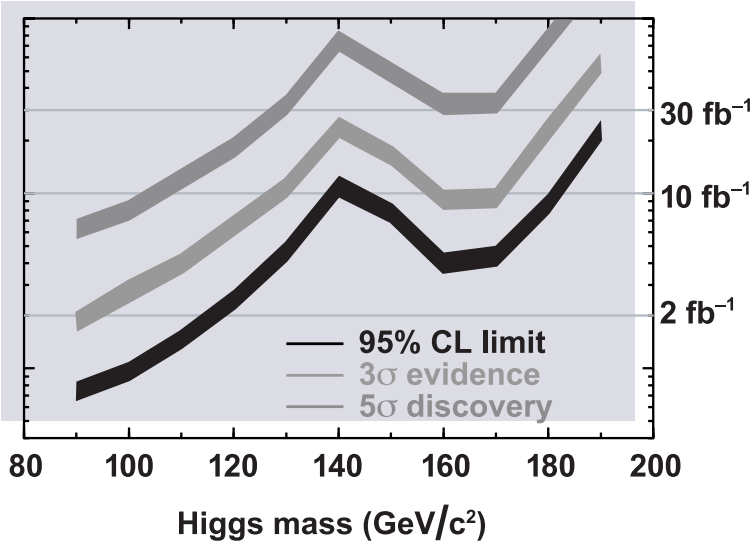
Scientists need to know characteristic details of both signal and background events to filter the data and obtain a sharper image. If plenty of "photos" and good filtering techniques exist, physicists can reconstruct the "image" of a new particle.

Simulations are important in order to judge how much an anticipated signal could differ from the expected background noise.

"We use both data and simulation to understand the background and the reliability of our results," explained John Conway, CDF physicist at Rutgers University. "To calculate the significance of a discovery, we actually simulate a large ensemble of pseudo experiments. For each pseudo experiment we generate a certain number of events that we would have seen in the detector."

Carrying out the simulations involves plenty of challenges and opportunities for error.

"You have to understand exactly how your detector is working to determine the background with particular uncertainties," Carithers pointed out.




"Your detector can miss a track or can manufacture a signal out of noise. These uncertainties enter every single event."

In a recently completed a report on the discovery potential of the Tevatron, Conway and several colleagues studied how many proton-antiproton collisions it would take to produce a significant number of Higgs bosons, postulated force carriers that could explain why some but not all particles have mass.

Identifying enough Higgs events among the wealth of particle signatures produced in the collisions of Collider Run II will take several years (see graphic). If the Higgs is too heavy to be produced at the Tevatron, physicists could report the first exclusion limits in less than three years. Those limits rely on a 95 percent confidence level, a lower standard than the one used for discoveries.

"We don't worry as much about falsely excluding the Higgs boson," Conway said. "It is much more important to avoid a false positive."

Of course Conway and his colleagues are much more excited about the chance of finding a true positive signal of the Higgs at the Tevatron.

However, you can bet they won't take a chance on claiming its discovery too early.

**On the Web:**

**Introduction to the Gaussian curve:**
**http://research.ed.asu.edu/siip/briefs/normal/**

**Analysis methods in particle physics:**
**http://www.cerncourier.com/main/article/40/4/14/1**

**Higgs working group for Run II at Fermilab:**
**http://fnth37.fnal.gov/higgs/**

Whether Fermilab physicists will find the Higgs boson depends on its mass and the number of proton-antiproton collisions created in the Tevatron. The accumulation of two inverse femtobarns (fb$^{-1}$) of data during Run IIa by both CDF and DZero, corresponding to 2x100 million million collisions by the end of 2003, would be sufficient to rule out at the 95% confidence level the 115 GeV/c$^2$ Higgs proposed by CERN experiments. If there exists a Higgs with that mass, it will take about 15 fb$^{-1}$, the goal of Run II by 2007, to claim a 5σ discovery. The chart at left does not take into account all Higgs signatures and the possibility that the Higgs has higher interaction strength than suggested by the standard theory, both of which could speed up discovery.

# Would YOU bet on this game?

The Gaussian curve provides a measure to judge how the outcome of a game or a scientific measurement compares to the "true" or "ideally expected" result.

Assume you throw a coin 100 times and you observe 34 heads. Although a single game has no statistical significance, you start to worry. Is the game rigged? Is your assumption that it is a fair coin wrong?

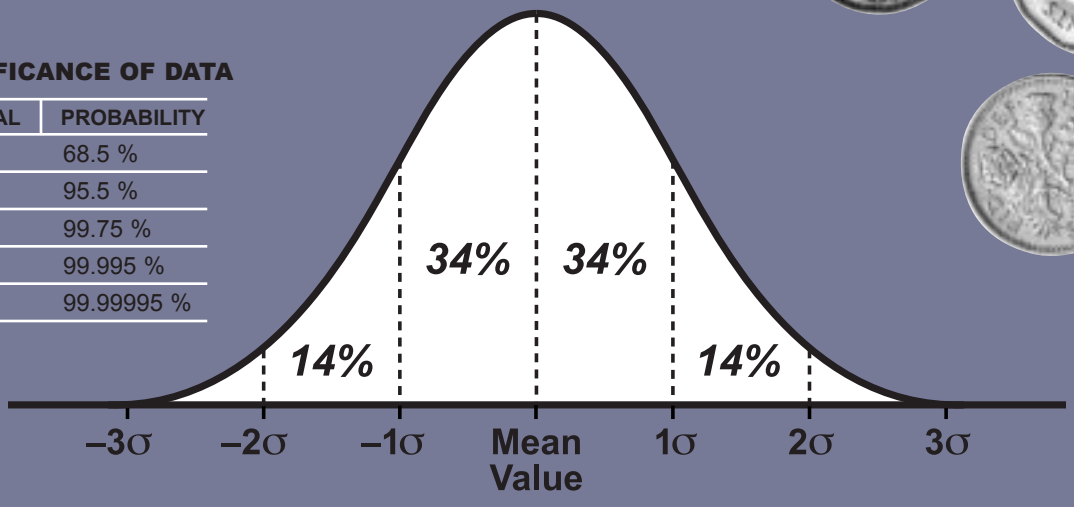
The Gaussian curve helps you to determine how likely your 34-heads score is. The coin experiment has a most likely outcome of 50 heads (called mean value), which can be determined by numerical simulation or by repeating the game with a fair coin many times. The Gaussian curve then introduces a quantity called the standard deviation, denoted by the Greek symbol $\sigma$ (sigma). Through repetition or simulation, scientists are able to determine that $\sigma$ equals 5 in the 100-coin-throw experiment. This fixes the statistical significance of the outcome of the experiment (see table). It states, for example, that 68.5% of all 100-coin-throw experiments lead to 45 to 55 heads, called the $1\sigma$ range ($50 \pm \sigma$, with $\sigma = 5$).

Your result of 34 heads is just outside the $3\sigma$ range ($50 \pm 3\sigma$). The Gaussian curve predicts that less than 0.25% of all games with a fair coin have a result outside the $50 \pm 15$ range. By taking a close look at your coin (the experimental apparatus) and repeating the experiment many times you can reveal whether your result of 34 is a statistical fluke or the coin is flawed.

The Gaussian curve, also called a bell-shaped or normal distribution, can be tall and thin or flat and wide: only its relative height is important. It often fits the data of unbiased experiments that allow for a symmetric outcome of the measurements (equal chance of recording a result larger or smaller than the mean value) and no constraints on the experimental value (numbers from minus infinity to plus infinity). Most experiments, including the coin game, do not satisfy these requirements; but the Gaussian distribution still yields a satisfactory description. However, in experiments looking for rare events, such as the Higgs boson, scientists must find better mathematical distributions to describe their data. After finishing their analysis, scientists usually return to the well-known Gaussian standard deviation $\sigma$ to indicate the significance of their results to people not familiar with the details of their work.

**SIGNIFICANCE OF DATA**

| INTERVAL | PROBABILITY |
|---|---|
| $1\sigma$ | 68.5 % |
| $2\sigma$ | 95.5 % |
| $3\sigma$ | 99.75 % |
| $4\sigma$ | 99.995 % |
| $5\sigma$ | 99.99995 % |



# MARTHA HEFLIN

# She's on Your Side

by Judy Jackson

Time was, when Martha Heflin showed up at a Fermilab job site, everyone immediately went on break.

A decade ago, when the newly-minted safety officer, fresh out of college and barely 22 years old, came to visit a project, workers saw her as a nuisance and figured the best way to deal with her was to knock off until she went away.

"Almost no one took me seriously," Heflin said recently. "Here I was, a very young woman, coming up to some 55-year-old rigger, asking him to take a fresh look at the way he was doing his job. I'm sure they thought it was ludicrous. At first, I'd go out and say 'Good morning,' and they wouldn't even grunt in my direction. I used to hate hearing "Hey, I've been doing this job longer than you've been alive, and I haven't been hurt yet.'"

Times have changed. On March 1, Heflin took on the assignment of senior safety officer in Fermilab's Particle Physics Division. Far from ignoring her, she says, now people often invite her to the work site before an experiment or project begins, to help them plan for safety and environmental considerations right from the start.

"It took awhile, but now people understand that I'm on their side," Heflin said. "I'm here to help."

Coming from her, it actually sounds true.

The turnaround in how people view her has several explanations, Heflin said. She emphasizes that she sees her safety-officer role less as The Enforcer and more as a sort of combination personal trainer and coach for working safely. Her "I'm-on-your-side" message appears to have gotten through to PPD employees.

But Heflin believes that the greatest change has come from Fermilab management's stepped-up and high-profile emphasis on health and safety. Safety stand-downs in 1998, "plus a couple of serious accidents," led to what Heflin sees as a true lab-wide commitment to a safer workplace. An electrical accident in 1997 and a fire in 1998 prompted extensive investigations and discussions of how to prevent future accidents.

"It's terrific that the lab used those accidents as learning opportunities," Heflin said. "I see a big change in attitudes and practices as a result. People think about safety way more than they used to."

# "I'm here to help."

Photo by Reidar Hahn

Heflin should know. She began her safety career at Fermilab 11 years ago as a co-op student, even before graduation from the University of Wisconsin at Whitewater. At the time, Fermilab was her third choice for an internship, mostly, she said, because she had no idea what went on in a high-energy physics lab. When she graduated in 1990, job offers for hard-to-find safety professionals were plentiful; but this time Fermilab was her top pick. She continues to see her safety job at a physics research lab as more exciting, and probably more challenging, than a comparable position at the average widget plant.

"Here, things change constantly," Heflin said. "No two days are the same. And we're often dealing with unique challenges that no one has ever solved before."

Among those unique challenges Heflin counts working with Fermilab users, scientists who come to do research at the laboratory from hundreds of institutions worldwide, with widely varying safety standards. Introducing users to Fermilab's safety-first culture can sometimes be frustrating, Heflin said, but again, she sees a change.

"By now, users mostly understand that if they don't play by the safety rules, they won't be able to use Fermilab research facilities," Heflin said.

"And I have never seen anything like the commitment these scientists have to making their experiments work. This is their life—their whole life. I can't just dismiss that. I'm here to help them succeed."

Besides physics experiments, Heflin has also taken on safety projects closer to home. She met her husband, Fermilab employee Rick Heflin, in the course of her first accident investigation, while she was still a student intern.

"He was driving a truck and he backed into something," Heflin said. "The safety officer told me, 'Come with me. Let's investigate.' That's how we met. His accident rate has dropped significantly since then."

Remember, Rick, she's on your side, and she's here to help.

# Making the Cut

## Experiment sheds light on woodland restoration

by Chad Boutin

Weedy trees under 10 inches in diameter, like this American elm, will be cut to give woodland plants more light in parts of Fermilab's Big Woods.

Environmentalists generally want to save trees. So why is Liz Aicher cutting down circles of them in a Fermilab forest, leaving a single lonely oak standing at the center of each circle?

Let's just say she's not an equal-opportunity tree-hugger.

She is walking through Big Woods, the largest forest on the Fermilab site. "You see all these elms and basswoods?" she says, pointing at the wrist-thin trees surrounding us. They contrast sharply with the stately bur oak we are approaching; even its upper branches are thicker than smaller trees. But the oak is alone among thousands of thin trees, and few other plants are visible.

"Because of these weedy young trees, light isn't hitting the forest floor," she says. "That makes it tough for many native plants to grow. So we are going to remove some of the young trees and watch how the ground flora recovers."

Recovery begins this month. Aicher and her team will cut down all the weedy trees less than 10″ in diameter on three circular plots in the Big Woods. The plots are 40 meters in diameter, and each centers on a bur oak dating from precolonial days. Aicher plans to monitor the sites for at least five years to see how many and what kinds of native plants grow back.

"After a year," she says, "I'll probably seed with grasses, forbs, and sedges as well. We'd like to get the ecosystem close to its presettlement state. The goal here is biodiversity."

It's a worthy goal for any ecosystem. But aren't the younger trees part of the ecosystem as well? Why are native plants having so much trouble on their home turf?

Understanding the trouble requires a vision of how a native woodland fluctuates within a natural prairie ecosystem. And that vision would be incomplete without fire.

"Like southern Wisconsin, northern Illinois is traditionally fire-adapted savannah," says Mark Leach, who manages research programs at the University of Wisconsin-Madison Arboretum. "Prairie fires would over time keep out the trees that are more shade-tolerant, like maples and elms. They would get cooked in a fire while bur oaks would keep growing, because their bark and roots are very fire resistant. The grasses would burn, but their taproots, like those of the oaks, would allow them to grow back quickly."

Eventually, Leach explains, only scattered stands of oak would punctuate the prairie, giving lower-growing prairie plants plenty of sunlight.

"We had this highly flammable landscape, so as a result we have prairie vegetation that is adapted to having more light," Leach adds. "To bring it back

requires that we remove other trees ourselves, because we can't just let wildfires go anymore."

Less than a year after wildfires ravaged the American West, few need to be reminded of such danger. The Department of Energy's Los Alamos National Laboratory was damaged in last year's disastrous blaze, which was itself begun as a prescribed burn. When the blaze raged out of control, the lab had to be evacuated for nearly two weeks.

"We don't have any potential for runaway fires in this part of the country," says Rod Walton of Fermilab's Facilities Engineering Services Section, who is working with Aicher on the project. "But because of Los Alamos, there is still a moratorium on controlled burns on all DOE national lab sites. So we may be able to manage the sites somewhat using natural methods."

Prairie restoration has been an ongoing process at Fermilab for a quarter-century. Since then, over 1200 acres of prairie have been returned to a wild state. Aicher's project is one of the first to focus on Fermilab's woodlands, and will eventually help transform even more lab property into a functioning ecosystem. But it is just the first step.

"Right now we aren't restoring anything, but we hope that what we learn will lead to better restoration efforts in the future," Aicher says. "Our problem with light is not just with the trees. We also have a big problem with invasive species from Europe like garlic mustard, which shades out all the other plants. Without native food source plants to support ants, mice and owls, the whole ecosystem gets out of balance."

Close observation of her three plots should yield the information she and other ecologists need to bring ecosystems back to their original equilibrium, or at least as close as they can manage.

"Hopefully, you someday get to a point where the ecosystem is self-sustaining," Walton says. "But that's pretty much impossible on a site this size. You have to manage it."

For the moment, Liz Aicher will focus on letting in the light.

Photos by Reidar Hahn

Aicher examines a garlic mustard plant that still has seeds from last year. Garlic mustard, an invasive species from Europe, shades out native plants.

NIU Altgeld Hall / Photo by Fred Ullrich

# **NICADD** *strengthens*

by Mike Perricone

Representative J. Dennis Hastert Jr., speaking at the 1995 announcement of the top quark discovery at Fermilab.

Speaker of the U.S. House of Representatives J. Dennis Hastert Jr. added his strong voice in support of scientific research on Wednesday, March 7 when he announced a $4.2 million grant to establish a partnership between Fermilab and Northern Illinois University in nearby DeKalb, Illinois.

The Northern Illinois Center for Accelerator and Detector Development enhances NIU's status as a research university, and offers a boost to Fermilab's future prospects. Still the world's highest-energy particle physics facility as it begins Collider Run II of the Tevatron, Fermilab will lose its position at the energy frontier when the Large Hadron Collider begins operation later this decade at CERN, the European Particle Physics Laboratory in Geneva, Switzerland.

Speaker Hastert made clear his intentions to maintain Fermilab—and the state of Illinois—as a leader in the field.

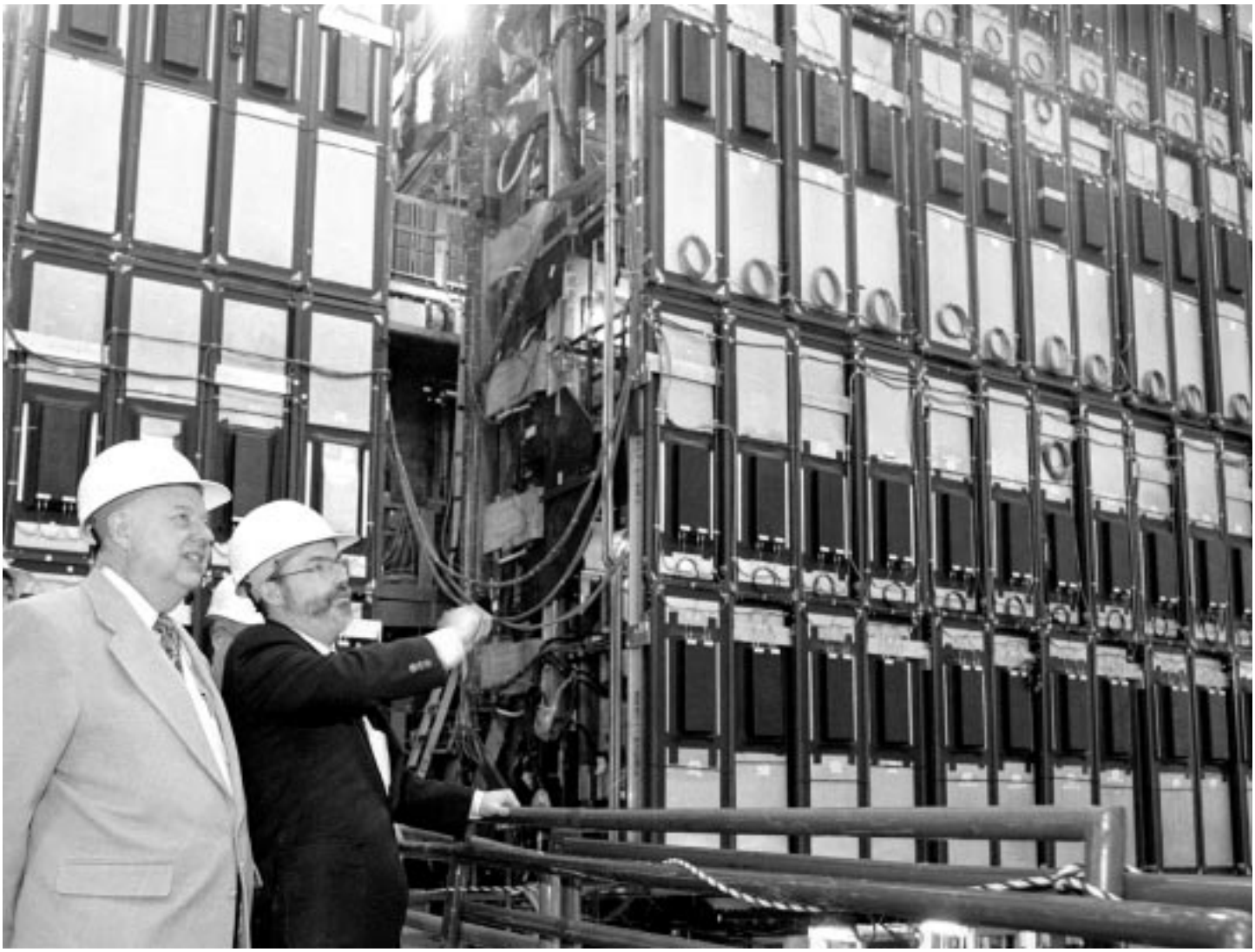
"Right now, Fermilab is the top facility of its kind," said Hastert, whose 14th Congressional District encompasses the laboratory. "Its future is vital, not only to my home district, where the laboratory is a major employer, but to our country if we intend to remain at the forefront of technology. The new research center at Northern Illinois University will help position Illinois to stay on top, while at the same time serving as a laboratory for highly trained scientists and students of physics."

Fermilab Director Michael Witherell stressed the advantages for both the university and the lab.

"As accelerators grew too big for individual universities to build, they became the province of the national laboratories," Witherell said. "Only a handful of universities maintained active programs in developing new accelerators. Accelerators are so important in so many areas of science and technology that universities need to be involved. With NICADD, NIU can offer a first-rate accelerator studies program, and Fermilab can engage in accelerator research and development that it could not otherwise afford."

NIU professor and Fermilab experimenter Jerry Blazey will serve as the center's co-director with Steve Holmes, Fermilab's Associate Director for Accelerators. The center will be housed at NIU's Faraday West building, with nine full-time NIU physicists and grad students and another 10 collaborators from around the country. At least one of the new positions will be for a tenure-track accelerator physicist.

# *Fermilab bond with* **NIU**



Photos by Reidar Hahn

Northern Illinois University president John Peters (left) views the DZero detector with NIU professor and DZero collaborator Jerry Blazey. Peters toured Fermilab on January 17, when NIU and the lab signed a memorandum of understanding for NICADD.

"Our objective with the establishment of NICADD is to ensure the long-term viability and vitality of Fermilab," said Blazey, a collaborator since 1986 at the DZero detector. "That means we must maintain Fermilab's world preeminence in high-energy physics and nurture the long-term health of the field. Just as important for NIU, the new center will bolster research opportunities for graduate students, not only in physics, but in chemistry and engineering as well."

The Illinois Coalition, a non-profit group promoting the state's high-tech development, strongly supported NICADD's creation. Coalition president Shaye Mandle called it a "significant step in the future of Fermilab and particle physics research in the U.S."

The NICADD grant, from Department of Education funding, comes at a time of increasing pressure in the worldwide high-energy physics community to begin planning the successor machine to CERN's

LHC. The issue of the next-generation machine will be a major focus of this summer's Snowmass 2001 conference on "The Future of Particle Physics." Fermilab theorist Chris Quigg is co-chairman of the organizing committee for the Snowmass workshop, sponsored by the American Physical Society's Division of Particles and Fields, and Division of Physics of Beams.

The workshop will serve as a conduit to the High Energy Physics Advisory Panel of the Department of Energy's Office of Science, a critical element in formulating DOE policy. In a position paper issued last year, HEPAP urged "increased support now for the research and development of accelerator technology for an energy frontier facility that will allow the U.S. to remain a leader in the field over the long term." A new accelerator requires at least a decade in the planning and building, a process Holmes knows first-hand from his experience as project manager for Fermilab's Main Injector. In terms of planning, there's no time like the present.

"High-energy physics as a science has always relied on truly forefront facilities," Holmes said. "It's important for the U.S. that Fermilab continue to have a world-class program. If you're not at the energy frontier, you must know how to get back there. That's why our science is called high-energy physics. The field is always redefining itself: today's high energy is tomorrow's low energy."

NIU President Peters (foreground) and Fermilab director Michael Witherell sign the MOU in Witherell's office. Looking on are NICADD's co-directors, Blazey and Fermilab Associate Director for Accelerators Steve Holmes (right).

The NICADD grant also comes at a time of growing concern about the direction of research spending. The American Association for the Advancement of Science analysis of research and development in the FY 2002 Budget Blueprint shows substantial increases for health and defense research, but predicts other federal R&D funding agencies will "most likely see their R&D funding stay flat or even decline in FY 2002."

Hastert, however, was steadfast in his support.

"I have been, and remain, a strong champion of high-energy physics," Hastert said. "Illinois is blessed with the nation's premier high-energy physics laboratory in Fermilab and it is imperative that we in Illinois work to assure Fermilab's preeminence. Soon, Fermilab's Tevatron collider will no longer be the world's most powerful accelerator; so, it is imperative that research and development on the future of high-energy physics, and the training of future accelerator scientists, begin now. NICADD is perfectly suited to fill this important role."

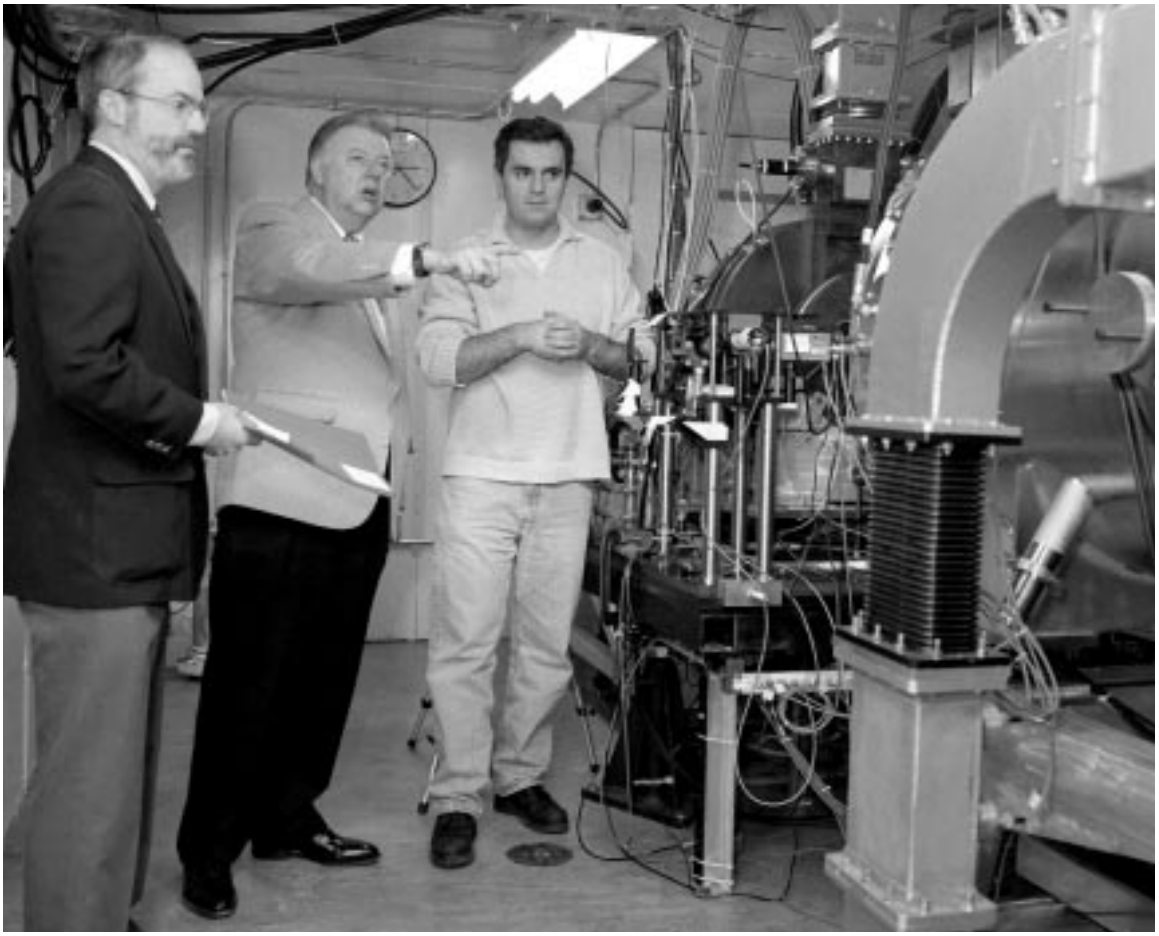
NIU is also a member of the state-funded Illinois Consortium for Accelerator Research, along with Illinois Institute of Technology, the University of Chicago, Northwestern University, and the University of Illinois at Urbana-Champaign.

Chartered in 1895, NIU is about 30 miles west of Fermilab with an enrollment of over 23,000. The university offers 51 undergraduate degree programs and 70 graduate degree programs, including 10 Ph.D. programs, doctoral degrees in Education and the Juris Doctorate. NIU is an NCAA Division I school; the NIU Huskies compete in the Mid-American Conference.

The university is a longtime Fermilab research partner. Theorist Carl Albright, an NIU professor, has been associated with Fermilab's theory group since 1969.

"Because of our long-term relationship with Fermilab, NIU physicists have a keen understanding of the laboratory's importance and future challenges," said NIU President John Peters. "This center will work closely with Fermilab to ensure the laboratory remains on the cutting edge of technology and scientific discovery for years to come."

NIU also recently became one of only three Illinois-run universities offering a Ph.D. program in physics, and was approved as a full member of University Research Association Inc. The non-



Photos by Reidar Hahn

Peters (center) and Blazey visit the newly designated Fermilab/NICADD Photoinjector Laboratory. Fermilab's Jean-Paul Carneiro explains the application of superconducting RF cavities in accelerating a particle beam.

profit consortium of leading research universities operates Fermilab under contract with DOE.

"With our Ph.D. program in physics, and the contribution that our professors are making at Fermilab, I see nothing but bright horizons for us," Peters said. "We're on the rise as a research institution. Just this year, the Carnegie Foundation made us a member of the top research category, and we entered into full membership in URA. In physics, and with our other wonderful science and technology programs, we feel we have a big contribution to make."

Peters and Witherell signed a Memorandum of Understanding on January 17, specifying goals and areas of collaboration:

- R&D in accelerator structures for a linear collider, with work largely centered in the Fermilab Technical Division;
- R&D in detector technology, with the Particle Physics Division;
- Joint operation of what will now be called the Fermilab/NICADD Photoinjector Laboratory, with the Beams Division.

Holmes explained that the two R&D efforts focus on understanding and developing technologies required by future generation machines. Operating the photoinjector, he said, "is looking even further into the future, using some very novel technologies for generating and accelerating particle beams."

In high-energy physics, the future is never far from anyone's thoughts. Even while starting a new journey of discovery in Collider Run II, the lab must focus on maintaining its forefront presence in years to come.

"The question is, what do we do after the LHC?" Holmes mused. "In high-energy physics, if you're not in first place, there really might not be a second place. You might go straight to third or fourth."

**On the Web:**

**http://www.niu.edu**

QuarkNet
VIDEO NEWS PROJECT

# A Student's View

## *Part II:* Putting Together a Team

Hilary Blanchard (left), Zack Brantley (right, West Chicago Community High School), Polina Segalova and Jason Barnes (both of Illinois Math and Science Academy), work on a video about Run II at Fermilab. Other group members are Yisong Yoe and John Carrino (also IMSA).

On our second visit to Fermilab, I feel almost as if I'm playing a physicist for a day. I'm ready to go to work.

Without the need for first-time introductions and tours this week, our group of six gets right down to the QuarkNet video project. We make arrangements for interviewing physicists, and separate into three sub-groups.

With most of us attending different schools in different areas, we were concerned about organizing and planning, and about getting along. But we enjoy each other's company. Our group seems to be getting tighter, a good sign that our work will also be compatible. And our work is intensifying, despite our occasional breaks for socializing, or perhaps because of them. On a smaller scale, we're learning how large physics collaborations, from many institutions and countries, work together to build a team.

After our social breaks, we always turn our attention back to particles, scripts and visuals. Things begin to fall into place, and our final product becomes clearer by the minute.

Although today is only our second session, it also marks the halfway point of our project. I begin to feel a bit of a time crunch, realizing how much we still have to accomplish. We press on, and support each other in our work. It's comforting to know that all of our Fermilab contacts are ready and waiting to help us, and we continue to plan and organize.

I begin to feel like a student again as we anticipate lunch, everyone's favorite part of the workday. This well-deserved break is a brief one. We know there is much to do, and do not waste time. We have learned how precious our time at Fermilab is. It is the one time we are all together and able to work for an entire day.

Back at home, we stay in communication, and each day we continue working toward our goals. Our web-cast is taking form. Our group is working closely and effectively, and all of our contacts are helpful. I'm eager to see the final product.

**—Hilary Blanchard**

Photos by Reidar Hahn

*Hilary Blanchard is a junior at West Chicago Community High School. She is one of 23 students participating in the QuarkNet video news project. This story is the second in a series on the project.*

# CALENDAR

**University of Chicago Lecture Series: 21st Century Science**

*Cosmology*

Sean Carroll, Enrico Fermi Institute
March 19, 2001, 7:30-9:00 p.m.
Tickets: $35, complete series: $75.

Call 1-800-997-9689 for tickets and information.

**Fermilab Lecture Series Presents**

*Living With A Star*
George L. Withbroe, NASA Science Program
March 30, 2001, tickets: $5

Director for the Sun-Earth Connection program, George L. Withbroe has overall responsibility for developing policy and providing guidance for NASA's program to understand the physics of the Sun.

**Fermilab Arts Series**

*Choreographer's Showcase*

Featuring Hubbard Street 2

April 21, 2001, 8 p.m. $17/$9 for ages 18 and under.

This traditional Fermilab Arts Series event features a variety of some of the brightest young dancers and dance companies in Chicago.

For more information call (630)-840-ARTS.

**Website for Fermilab events: http://www.fnal.gov/faw/events.html**

**ONGOING**

**NALWO**

Free English classes in the Users' Center for FNAL guests, visitors and their spouses. The schedule is: Monday and Friday, 9:30 a.m. - 11:00 a.m. Separate classes for both beginners and advanced students.

Coffee for newcomers and visitors. Thursday, March 29, 2001 at the Housing Office (Aspen East) 10:30 a.m. - 12:00 p.m.

**WELLNESS WORKS**

Covert Bailey Video Series
12:00-12:30 in One West

March 21 - Crash Diets and Other Weight Loss Tricks

**CHILDREN'S SUMMER DAY CAMP**

Registration for the Children's Summer Day Camp begins March 1 with a deadline of March 30. The session dates for the Children's Summer Day Camp are: Session I - June 18 - July 6; Session II - July 9 - July 27; Session III - July 30 - August 17. Day Camp information, booklet and registration form can be found in the Recreation Office or on our web page, http://fnalpubs.fnal.gov/benedept/recreation/campbrochure.html.

**DANCING**

International folk dancing, Thursdays, 7:30-10 p.m., Village Barn. Scottish country dancing, Tuesdays, 7:30 - 10 p.m., Village Barn. Call Mady, 630-584-0825 or Doug, x8194, or email folkdance@fnal.gov.

The Fermilab Barn Dance series, featuring traditional square and contra dances in the Fermilab Village barn, presents an afternoon barn dance on Sunday, March 18 from 2 to 5 p.m. Admission is $5 for adults, $2 for age 12-18, and free for under 12 years old. Contact Dave Harding (x2971, harding@fnal.gov) or Lynn Garren (x2061, garren@fnal.gov) or check the webpage at http://www.fnal.gov/orgs/folkclub/

# MILESTONES

**BORN**

■ 2/27/01 Grace Marie 9lbs. 20″ to Greg and Amy Hansen, ES&H fire department.

■ 3/10/01 Brooke Anne 9lbs.-2oz. 20″ to Lisa (FESS) and Steve (ES&H) Carrigan.

**RECONSTRUCTION**

■ Of the Wilson Hall front plaza, starting in March. The horseshoe drive will be closed and the front entrances locked. The project will last until the end of July.

# WRITING CONTEST

**Fermilab Creative Writing Club**
**2001 Short Story & Poetry Contest**

Participation is open to any Fermilab employee or user. All submitted works will be reviewed by the members of the Fermilab Creative Writers Club. Winners will be selected in two categories: short story and poetry. Poetry should be limited to 100 lines or less. Short stories should be no more than 2,500 words. The winning entries will be considered for publication in *FERMINEWS*. Entry is free. Prizes will be awarded to the winner named in each category. Works must be unpublished up to the day of the announcement of the winning stories. Participants will retain full ownership of and rights to their work.

**Competition Guidelines: http://www.fnal.gov/pub/ about/public_affairs/guidelines.htm**

**Entry Form & Agreement: http://www.fnal.gov/ pub/about/public_affairs/form.htm**

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

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

## Chez Léon MENU

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

| LUNCH | DINNER | LUNCH | DINNER |
|---|---|---|---|
| **WEDNESDAY, MARCH 21** | **THURSDAY, MARCH 22** | **WEDNESDAY, MARCH 28** | **THURSDAY, MARCH 29** |
| *Tortellini Carbonara* | *Booked* | *Kebabs with Pita* | *Vichyssoise* |
| *Caesar Salad* | | *Baba Ghannouj* | *Rack of Lamb* |
| *Peach Melba* | | *Hummus bit-Tahini* | *Baby Peas and Escarole* |
| | | *Tabbouleh* | *Tomato with Feta* |
| | | *Baklava* | *Strawberry Shortcake* |


FERMINEWS

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The deadline for the Friday, March 30, 2001, issue is Tuesday, March 20, 2001. Please send classified ads 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.

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# CLASSIFIEDS

## FOR SALE

■ '97 Chevy Malibu LS, 3.1 litre V6, 46,500 miles, dark green w/beige interior, fully loaded-power everything, AM/FM/CD, $12,500, Call ext. 3325 or 630-527-6218 after 6 p.m.

■ '95 Dodge Neon (brilliant blue) – 82K, 5 speed manual, 4 cyl., power steering, power brakes, power locks, cruise control, AM/FM/cassette stereo, roof rack, air conditioning (needs work), tilt wheel, dual air bags, ABS, alloy wheels. No rust. Great gas mileage. $5,300 Call 761-8207 or 761-9661.

■ '94 Mercury Villager Carryall LS 4-dr. auto. a/c, ps, pb, pw, pm, tilt wheel, cruise, AM/FM/Cass/CD. ABS, red/silver color, roof rack, 68,500 miles. Looks & runs like new! $9,500 obo. 630-983-1663, or bellanto@fnal.gov

■ '94 Pontiac Grand Prix SE V6. 2 dr. Blue ext, gray int, 82,000 miles. Excellent condition. $5,900 obo. Contact Greg at 630-272-5985.

■ '93 Eagle Vision TSI, 130,000 miles, red, new transmission, asking $1,800 obo. Call Frank x5701 or 630-393-7996, lehnerf@fnal.gov

■ '92 Toyota Corolla, 90,000 miles, light blue, asking $2,300 obo. Call Frank x5701 or 630-393-7996, lehnerf@fnal.gov

■ '86 Mercedes 500SEL 4 dr blue w/tan interior. 110K mi. Power moon roof, CD player, heated seats. Many new parts incl. exhaust. Very clean. Limo ride. Maint. receipts. $6,300. Gerry, x3930, gerryb@fnal.gov. Eves: 630-232-4061.

■ '85 Honda Goldwing Anniversary limited edition, new tires, brakes & air shocks, 67k, fully equipped with trailer. Too many "Markland" accessories to list. Asling $4,850. 630-859-3789 or treend@fnal.gov.

■ 1984 Sun Tracker party barge 24 ft. pontoon boat, with 1985 90Hp Yamaha outboard motor, trailer and camper package, $4,950. Call Butch at x3700.

■ Older blonde bedroom set, 1 dresser w/mirror, 1 chest, full size bed frame and head board, in good condition $75, 1 corner table, walnut color with drawer, 3 legs 24-1/2″H $25, call Ken x4225.

■ Moving sale: 17″ Daewoo TV, Panasonic faxmachine/phone, lawn mower, kitchen appliances, radiator, fan. Frank x5701 or 630-393-7996, lehnerf@fnal.gov

■ Formal dining room set. 6 chairs w/cream-colored upholstery. With china cabinet, medium brown finish. $500. Call Sue, 630-208-8630.

■ Golf clubs, Orlimar Trimetal woods with graphite shafts, one year old, like new. 14+ 3wood and 18+ 5wood. $125 each. Jim x4293 or 585-0907.

■ Glaesel lightweight shaped violin case, full-sized, blue velvet lining, with 2 interior accessory compartments and room for 2 bows, fair condition, $35. FoldARack trunk-mount bike rack, $45. MTD chain-drive rototiller, model 219-031-000, 3 HP, used only a few seasons, $150. Snowblower, Allis-Chalmers Simplicity 220 Snowbuster, with electric starter, $200. Lawnmower, Murray 20, gasoline powered, $50. Call 708-488-9884 (evenings) or email kaplan@fnal.gov.

■ Bed mattress set, Queen size, pillow top, excellent condition, 3 yrs. old, $250 firm. Call Rich at 690-1691 or 840-3880.

■ Rainbow vacuum cleaner with all attachments included, $600. Contact bennett@fnal.gov/.

## HOUSE FOR SALE

■ Naperville townhouse for sale by owner, 2 Bedroom, 1.5 bath, 2 car garage. Upgraded kitchen & bath fixtures. District 204/Naperville Asking $113K. Located 1 mile west of Rte 59. By appointment only 630-236-1696

## FOR RENT

■ 4 bedroom, 1 bath, far south Aurora near the Fox River. $1,100 a month plus utilities and one month security deposit, 630-801-1775 leave a message.

■ Ranch house for rent in south Batavia. 4 bed, 1-1/2 bath, 2-1/2 car garage $1,250 a month, plus $1,250 security deposit, utilities not included, 1 year lease preferred. Sorry, no dogs. Jeff or Susan 630-761-2965.

## FREE

■ Puppies to good homes. Born 1/31/01. Black and white shepherd/lab mix. 9 boys and 3 girls. Call Shelley at 553-1262 or email shelley@fnal.gov.

## TUESDAY GOLF LEAGUE

■ Pebble Beach is too far away. Bliss Creek is just minutes from here. The Tuesday Bliss Creek golf league will be starting in April. We have openings for individuals or foursomes (but they're going fast). Golfers of all abilities are welcome. If interested, please contact Dean Sorensen (deans@fnal.gov, x8230), Pat Sorensen (psorensen@fnal.gov, x-3811) or Don Arnold (arnold@fnal.gov, x2871).

## NOON BIBLE CLASSES

■ Need wisdom, want understanding? Take a 1 year study of the scriptures. Wednesdays at 12 noon in the Huddle. For information call x4432, Jeff Ruffin.

## ATTENTION FERMILAB ARTISTS AND ARTISANS:

■ Now is the time to show us your artistic side! The Employee's Arts & Crafts Show will be taking place in the 2nd Floor Gallery of Wilson Hall from May 14 to June 15. All Fermilab employees, visiting scientists, retired employees, contractors and their immediate families are encouraged to enter the exhibit. The last exhibit featured and eclectic combination of photographs, prints, paintings, sculptures, weavings, quilts and jewelry. If you're interested in participating please pick up an application form from the Wilson Hall Atrium desk. Application deadline is April 26 and work must be dropped off on Wednesday May 4, 2001.

**Post-Doctoral Position in Experimental High-Energy Physics, Colorado State University, Fort Collins, Colorado, USA**

The High-Energy Physics Group at Colorado State University (CSU) invites applications for a post-doctoral research position. Opportunities are for work on the BABAR experiment at the Stanford Linear Accelerator Center and the Pierre Auger Cosmic ray observatory currently under construction in Argentina. The CSU group has worked on the BABAR drift chamber and the DIRC, and is presently involved in tau physics and analysis of charmonium final states. They are also involved in the design and construction of the Auger observatory ground array detectors. The group is building an analysis-computing farm (Sun and Linux platforms) at CSU. The successful candidate may spend time at both CSU and at SLAC or at the Auger site depending on qualifications and interest.

Applicants with a PhD in experimental particle physics or particle-astrophysics should send their CV and arrange for three letters of reference to be sent to: Prof. John Harton, Department of Physics, Colorado State University, Fort Collins, CO 80523 USA. Applications will be accepted until the position is filled, but should be received by 15 July 2001 to receive full consideration. CSU is an EEO/AA employer.



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