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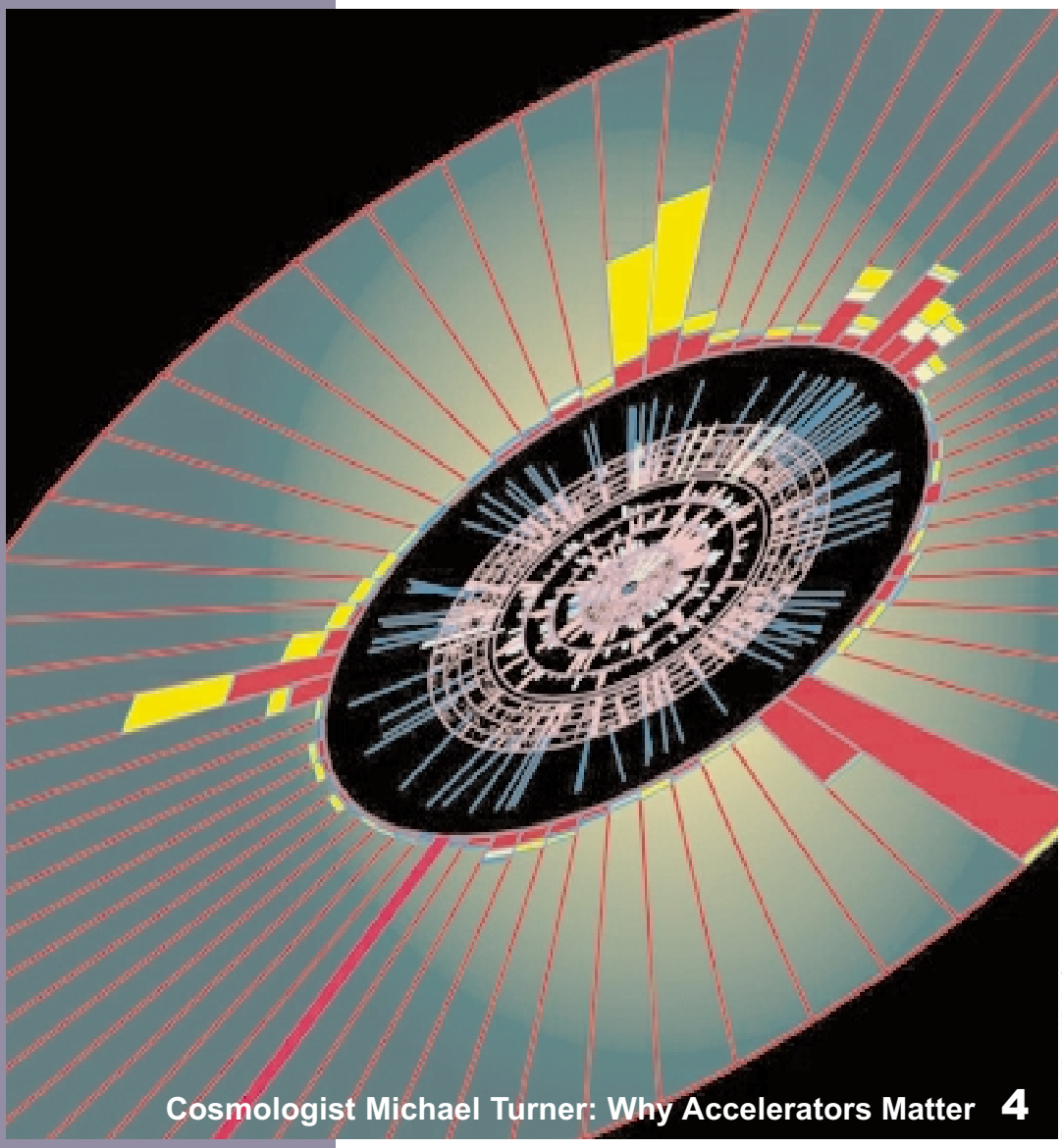

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Cosmologist Michael Turner: Why Accelerators Matter 4

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INSIDE:

Run II STATUS AND PROSPECTS

by Michael Witherell

In mid-August, just a few weeks from now, CDF and DZero experimenters will present the first full round of Run II physics results at the Lepton-Photon Symposium at Fermilab. So far in Run II, we have delivered nearly twice the integrated luminosity of Run I, extending the physics reach of the experiments. Nonetheless, at this point, despite the very hard work and dedication of many talented people, the luminosity delivered to CDF and DZero has fallen below our initial plans and predictions for Run II.

Improving Reliability and Quality

To maximize the Tevatron luminosity and hence the scientific potential of Run II, earlier this month Fermilab completed an accelerator plan for Run II through mid-2009. It will be reviewed by a Department of Energy panel on July 21-23. This is a good time to summarize where we are and where we are going with Run II at the Fermilab Tevatron.

At the start of FY2003, we estimated that the integrated luminosity for the year, that is, the total number of particle collisions delivered to the detectors, would reach a level between 200 and 320 inverse picobarns (pb^{-1}). We set a performance goal at 225 pb^{-1}. Meeting our performance goal by the August 25 start of the summer shutdown requires an average of 6.3 pb^{-1} per week in integrated luminosity. We are working very hard to achieve this goal, but it will be a challenge. Over the course of the year, some weeks of operation were lost due to unscheduled shutdowns for various reasons, such as magnet failures and power pole replacement. In a record week in May, the accelerators delivered initial peak luminosities as high as 4.5×10^{31} cm^{-2} sec^{-1}, but the peak luminosity has been well off the record for many of the accelerator stores. All of these factors have limited the integrated luminosity.

We can and we will improve the reliability and quality of accelerator operations. I am making changes in our organization to focus effort more effectively on improving the luminosity delivered every week, to quickly identify and remove limitations to increasing the luminosity, and to react faster to operational problems that develop. Starting immediately the Associate Director of Accelerators will hold a daily morning meeting with the Beams Division Head, the Head of Operations, the Run Coordinator, and the heads of the accelerator systems departments. They will assess the previous day's performance and react immediately to optimize the next day's performance. I will announce other changes as they are put in place. I will also call in additional effort from the entire laboratory to improve accelerator performance.

ON THE WEB:

Run II Luminosity Upgrade Plan:

www.fnal.gov/pub/now/upgradeplan

The Near Future

To optimize the scientific results in the next two years, we need to increase the data samples of the two collider experiments as much as possible. Between now and early 2005, we will:

- make continuous operational improvements designed to increase the efficiencies for proton and antiproton beam transfers;
- attack a series of maintenance projects to improve reliability of operations;
- upgrade instrumentation throughout the accelerator complex;
- improve alignment of accelerator components;
- upgrade the Antiproton Source to increase antiproton production rate;
- complete new damper systems in the Main Injector and Tevatron;
- optimize the orbits of beams in the Tevatron;
- commission the Recycler Ring; and
- introduce slip-stacking, a new technique that will increase Main Injector beam intensity for antiproton production.

These steps will allow the experiments to double their data by mid-2004, with another doubling by late 2005.

The Longer Future

The longer-term goal is to maximize the opportunity for discovery throughout the period of Run II. The Beams Division has completed a new long-term luminosity upgrade plan based on bottoms-up numbers. It presents parameters supported by computer modeling of the Tevatron and the antiproton cooling and accumulation systems. The experience acquired during two years of operation has given us a better understanding of the accelerators, allowing us to benchmark the model we are now using as a planning tool. We are also better able to estimate the number of hours of accelerator operation we can normally expect to achieve each week. The resulting targets for Tevatron luminosity are lower than our previous estimates; they are also more realistic.

The luminosity estimates presented for the period beyond FY2005 assume successful integration of the Recycler with electron cooling. The R&D program for electron cooling is progressing well. However, at this point we do not yet have a good enough understanding of the Recycler to present a completely worked-out plan for its commissioning. By next winter, using knowledge gained during the summer shutdown, we will be in a position to update our plan with new information.

Photo by Reidar Hahn

Fermilab Director Michael Witherell: “It is critical… that we deliver as much luminosity as possible to the detectors next year and every year after that.”

At their June meeting, the Fermilab Physics Advisory Committee reviewed the status of upgrades to the CDF and DZero detectors in the light of the new accelerator plan. They conducted thoughtful and detailed discussions of this issue. They advised that I consult with the detector collaborations and with accelerator experts in reaching a decision on the scope of the detector upgrade projects. Of course, I will also consider |the results of the upcoming DOE review. Our goal remains the optimization of the potential for scientific discovery in Run II.

Focus and Dedication

The physics program of the CDF and DZero experiments at the Tevatron collider represents the most important physics program now operating in particle physics. It is critical to the scientific success of the Tevatron Collider Run II and to the future of our laboratory that we deliver as much luminosity as possible to the detectors next year and every year after that. This will require an additional increase in the level of effort on the accelerator complex. It will require focusing that effort toward improved reliability and higher luminosity. Most important, it will require that all of us at Fermilab pull together to reach our goal.

INTERACTIONS
Communicating particle physics in the 21st century

Why Accelerators Matter

A cosmologist's assessment:

The universe is not enough

by Michael S. Turner
University of Chicago and Fermilab

For two decades, I have been an advocate for using the universe as a heavenly laboratory to extend our experimental reach in addressing some of the most exciting questions in science. Indeed, experiments using beams of neutrinos from the sun, a distant supernova and cosmic-ray collisions in Earth's atmosphere have taught us much about the properties of neutrinos, including the first solid evidence for neutrino mass.

Yet, in making the case for nonaccelerator physics, I (and others) may have been too successful.

Accelerators *are also crucial* to realizing the opportunities to dramatically advance our understanding of the universe and the laws that govern it. Not only can accelerators reveal much about the fundamental particles and forces, but also they can make discoveries that are critical to understanding the cosmos.

While the heavenly lab offers enormous dynamical range in energy, density and other parameters, accelerators offer well-planned experiments under carefully controlled conditions. The first evidence for neutrino mass came by way of beams of heavenly neutrinos; but only by using accelerator neutrino beams of well-determined energy, flux and flavor content will we be able to sort out the pattern of neutrino masses and get at the question of CP violation. In addition to the clues that this knowledge will give us about the unification of the forces, we all have a more personal interest: It now seems quite possible that neutrino mass and CP violation played a role in creating the excess of quarks over antiquarks that led to stars, and ultimately, to the stuff like us that came from them.

SAKHAROV, DARK MATTER AND PARTICLE SOUP

In 1967, Andrei Sakharov gave a seminar that left his colleagues scratching their heads. He explained how CP violation, baryon number nonconservation and the early rapid expansion of the universe could conspire to produce an excess of baryons over antibaryons, leaving the baryons we are made of when the universe cooled and all the antimatter and most of the matter annihilated. Today, Sakharov's crazy idea is the working hypothesis for why our baryons exist in the here and now, and it has evolved to include a role for neutrinos! Only accelerator experiments will shed light on the CP violation piece of his recipe.

Respond online at
www.fnal.gov/pub/ferminews/interactions/index.html
or send email to
ferminews@fnal.gov

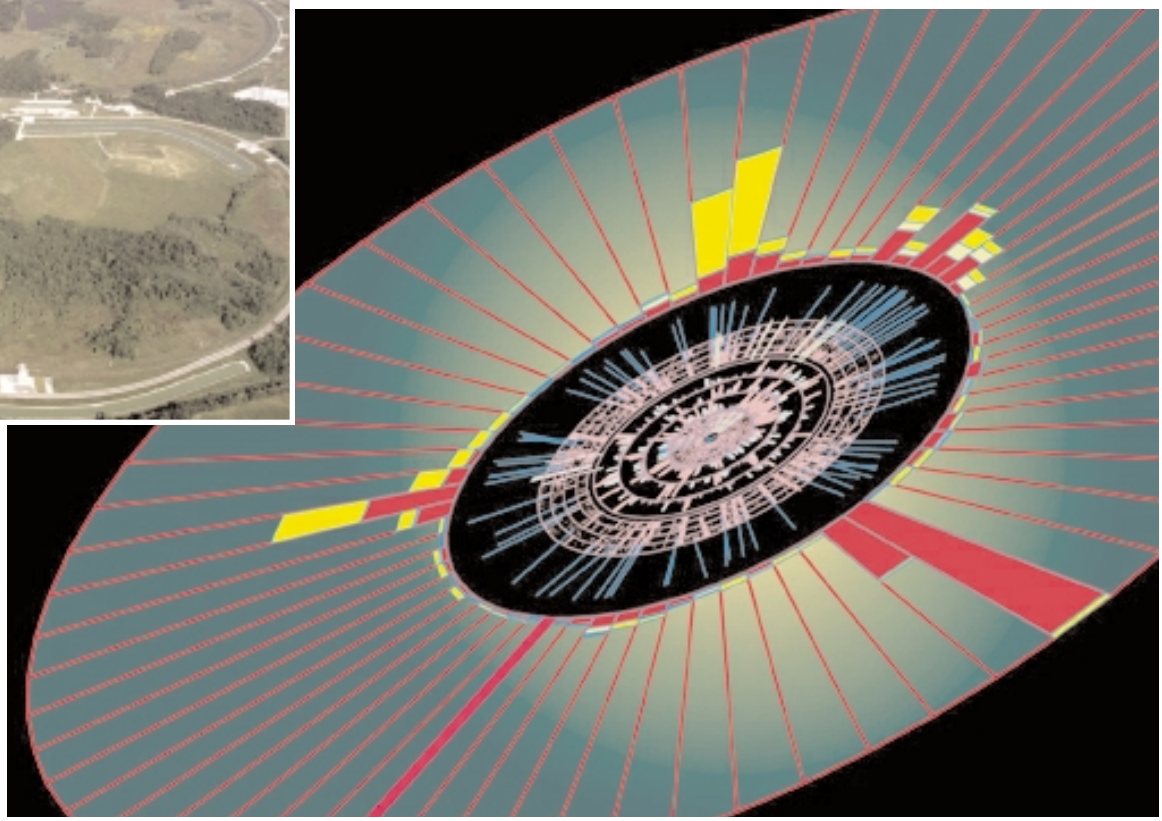
"Cosmology and particle physics are now joined at the hip by a new set of profound questions," says Michael Turner, "whose asking and answering cannot be neatly partitioned into physics and astronomy."

- What is Dark Energy?
- Are our quarks here because of neutrino mass and CP violation?
- Is the dark matter a new form of stable matter?
- How will the universe end?
- How did the universe begin?
- Is Nature supersymmetric?
- How are the forces and particles unified?
- What powered inflation?
- How much does nothing weigh?
- How many spacetime dimensions are there?
- Did Einstein have the last word on gravity?
- Why do some particles have mass?

INTERACTIONS

Communicating particle physics in the 21st century

Looking out and looking in: The Hubble Space Telescope (opposite page) offers new views of the universe, such as this image of the unique pair NGC 3314—a face-on spiral galaxy lying precisely in front of another larger spiral. Fermilab's accelerator complex (left) offers insights into the origins of matter, such as this visualization of a top quark event.



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On to darker matters. Cosmologists have put forth a compelling case for a remarkable idea: the dark matter whose gravity holds together all structures in the universe, from our own galaxy to distant superclusters, is composed of elementary particles left over from the earliest moments. The lightest supersymmetric particle—the neutralino, whose mass is supposed to be a hundred times that of a proton—is the prime dark-matter suspect. (Neutrinos are a part of the cosmic mix, but account for at most 10 percent of the dark matter.)

Before the neutralino is discovered at the Tevatron or LHC, I am rooting for a cryogenic dark-matter detector (like Fermilab's CDMS II operating in the Soudan Mine) to announce that a swarm of neutralinos holds the Milky Way together. But I also know that producing and studying neutralinos with accelerators is an indispensable part of the plan if we are to truly understand how neutralinos fit into the grander scheme of things.

In 1970, when cosmology was stalled, discoveries made at accelerators propelled it into the current renaissance. The discovery of the cosmic microwave background radiation in 1965 told us the universe began as a hot particle soup; however, our then ignorance of quarks and gluons erected a brick wall at 10 microseconds. If the fundamental particles are the finite-sized neutrons, protons and other hadrons, the universe had a confusing beginning with overlapping particles and a maximum temperature of only 100 MeV (due to the exponentially rising number of hadron states).

The emergence of the standard model of particle physics in the late 1970s opened the door to the study of the earliest moments of the universe, when temperatures reached as high as 10^{19} GeV. Almost immediately, the driving ideas in cosmology today—inflation, dark matter, and Sakharov's "baryogenesis"—came to be. If quarks, leptons and gauge bosons are point-like and weakly

Image Credit: NASA and The Hubble Heritage Team (STScI/AURA)

interacting, the early universe is then no harder to understand than a dilute, hot plasma–provided, of course, that you have in hand all the hard-won knowledge about quarks, leptons and gluons that has come from accelerator experiments.

ACCELERATORS AND TELESCOPES

It is easy to predict that further progress in understanding the universe's origin, its evolution to its present state, and its ultimate destiny, will involve accelerator experiments that teach us more about nature's deepest inner workings. Consider just a few of the questions that accelerators are poised to answer, which are also central to cosmology:

- Higgs or no Higgs? (inflation is based upon a scalar-field cousin of the Higgs)
- SUSY or not? (superpartners, superstrings, and SUSY-breaking all have important cosmological implications)
- Large extra dimensions or not? (more cosmic dimensions to play with)
- CP violation: how far and wide? (the origin of us)

I would not even rule out accelerators teaching us something profound about dark energy, that diffuse, mysterious stuff whose only known effects are to: (a) cause the speed-up of the expansion of the universe; and (b) keep me awake at night trying to figure out what it is.

The fields of cosmology and particle physics have been drawn together by advances in both, made possible by telescopes and accelerators. Cosmology and particle physics are now joined at the hip by a new set of profound questions, whose asking and answering cannot be neatly partitioned into physics and astronomy. Answering these questions will lead to a quantum leap in our understanding of the universe, of the laws that govern it and even of our place within it. To realize this opportunity of a lifetime, we will need both accelerators and telescopes, and that's why accelerators matter.

Particle Physics

MADE PAINLESS

Corked bats probably make no difference, but physicists will argue the point *(gladly)*

Put a CORK in it

by Mike Perricone

Sammy Sosa says he picked up his corked bat by mistake. To physicist Alan Nathan, the real mistake was thinking cork would make a difference in the first place.

Nathan, a baseball lifer (Boston Red Sox) and professor of physics at the University of Illinois at Urbana-Champaign, delivers the message in his widely-cited writing and lecturing on the physics of baseball: the reason to cork a bat is to lighten it, so you can swing it faster; but making it lighter by reducing the mass in the barrel wipes out any benefit from increased bat speed.

“In the absence of some trampoline-type effect from either the cavity in the bat or from the filler material,” Nathan said, “my conclusion is that there is no substantial effect from corking the bat with regards to a long fly ball, where one of the goals is to have as high a batted-ball speed as possible. That is, the beneficial effect of having a lighter bat (which can give higher bat speed) is essentially canceled by the reduced mass of the bat in the vicinity of the impact point, which is then less effective at transferring energy to the ball.”

If anyone stands to benefit from corking, it could be the singles hitter, not the slugger.

“If you are a ‘contact’ hitter who doesn’t swing the bat as hard as you can,” Nathan said, “then the beneficial effect of a lighter bat gives more bat control and probably leads to a higher batting average.”

Hitters have gone so far as to jam compressed high-bounce “superballs” into the barrel of a bat, looking for a trampoline effect—but then watched with chagrin when the bat split and the superballs spilled out. Nathan said a trampoline effect needs more study, but he’s never found one.

“I have done measurements on a hollowed wood bat without the filler and have concluded that there is no trampoline effect, nor did I expect any,” Nathan said. “To get a trampoline effect, you need to have energy stored in the compression of the bat and effectively returned to the ball. Even the hollowed-out bat is far too stiff to store any appreciable energy, so there is no trampoline effect there. Cork is highly unlikely to produce any trampoline effect because it is at the other extreme—too compressible. Although it can store elastic energy, it has much too long a time constant to ‘spring back’ at the right time to return that energy to the ball. So the stored energy gets lost. Again, no trampoline effect.”

ON THE WEB:

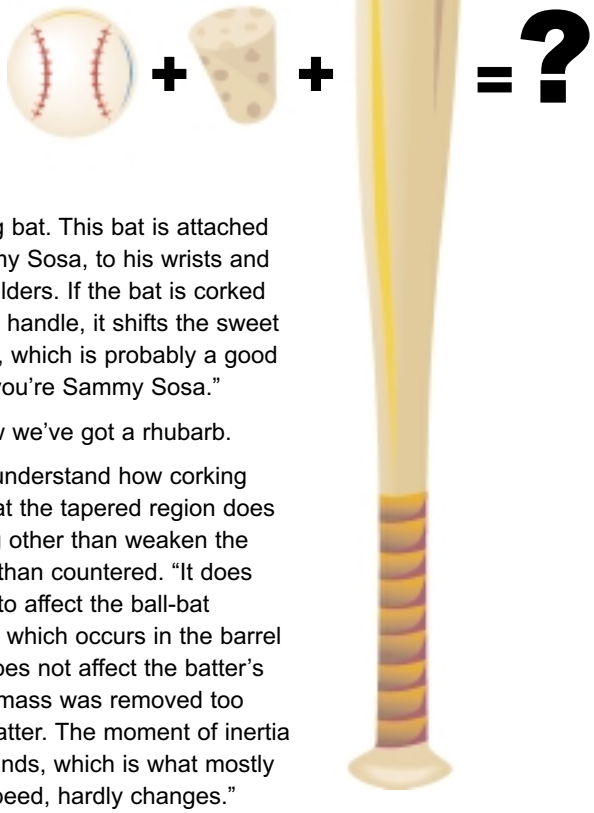
Alan Nathan,
The Physics of Baseball:
http://www.npl.uiuc.edu/~a-nathan/pob/

Fermilab Colloquium—Baseball:
It’s Not Nuclear Physics (or is it?):
http://www.npl.uiuc.edu/~a-nathan/pob/fnal/index.htm

(Photo courtesy Alan Nathan)

Alan Nathan demonstrates the sweet spot of a bat at Wrigley Field — in a Red Sox cap

> ***"Just one extra hit a week... a flare, a Texas Leaguer, a ground ball with eyes... one more hit a week, and you're in Yankee Stadium."***
>
> ***—Crash Davis, "Bull Durham"***



Since the bat-ball impact lasts about 1/1000th of a second, "you would need a material with a spring constant a lot less than that of the bat but a bit more than that of the ball," Nathan said. "I don't know where superballs fall on this scale. I am having some bats specially made so I can investigate this experimentally. There are labs where one can go to test bats under high-speed conditions. I hope to have all the answers then. Meanwhile, I can't see any advantage to Sosa in using a corked bat."

But what if the cork is not placed in the barrel, but is inserted down near where the bat begins to taper toward the handle? That's the hiding place revealed when Sosa's bat split open.

"A lighter bat moves faster," said Fermilab's Peter Limon, former Technical Division head and another long suffering Bosox lifer. "This gives the batter a few more milliseconds to count the stitches on a fastball. It may also help transfer energy to the ball. Remember, the problem is not defined by a free-swinging bat. This bat is attached to Sammy Sosa, to his wrists and his shoulders. If the bat is corked near the handle, it shifts the sweet spot out, which is probably a good thing if you're Sammy Sosa."

And now we've got a rhubarb.

"I can't understand how corking the bat at the tapered region does anything other than weaken the bat," Nathan countered. "It does nothing to affect the ball-bat collision, which occurs in the barrel of the bat. It probably does not affect the batter's swing speed, since the mass was removed too close to the hands to matter. The moment of inertia of the bat around the hands, which is what mostly determines the swing speed, hardly changes."

But Limon wondered about the possible cumulative effect of an ounce here, an ounce there over the long haul of a six-month season-and that difference can be physical or psychological.

"You don't need much of an edge," Limon said. "As Crash Davis put it so clearly, one more hit a week will turn a .250 hitter into a star and a .300 hitter into a superstar. Plus, even a psychological advantage can make a difference when you're facing a major league pitcher throwing 98 miles an hour. "

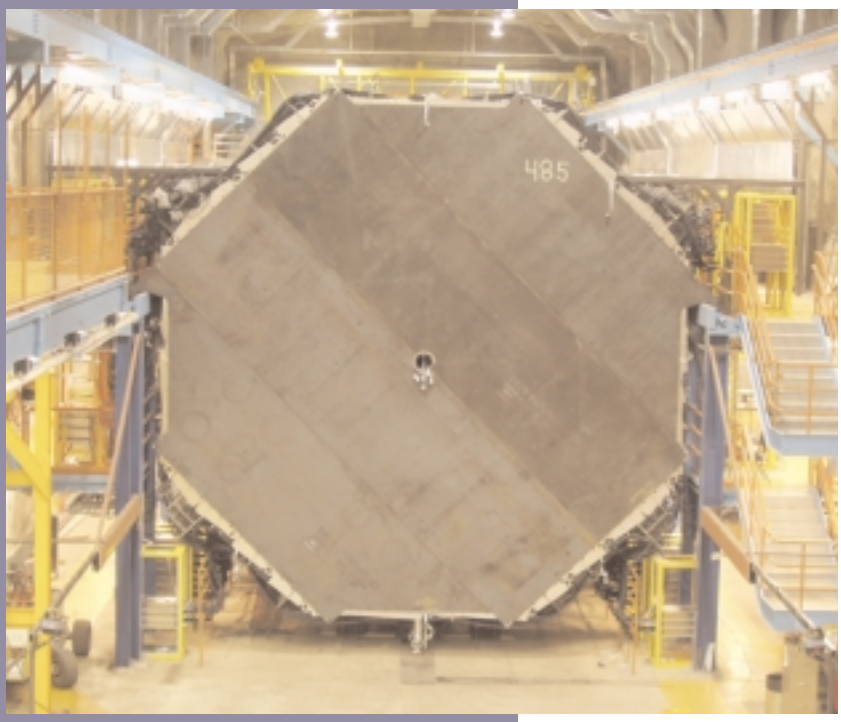
Either way, since perception usually strikes out reality, cork is here to stay.

"I guess I don't buy it," Nathan said. "But it is fun to argue about these things."

MINOS: LAST PLANE at Soudan

by Kurt Riesselmann

On June 5, technicians hung the last of 485 detector planes, each about two inches thick, of the 6,000-ton MINOS detector in the Soudan Underground Laboratory. Scientists expect the full detector to be operational this summer. Scientists already use half of the detector to record data on atmospheric neutrinos.



After four years of work in a former iron mine a half-mile underground, the Main Injector Neutrino Oscillation Search collaboration celebrated a milestone for the ambitious MINOS particle physics experiment. On June 5, technicians erected the last of 485 house-high detector planes of steel and plastic in the Soudan Underground Laboratory in Soudan, Minnesota.

"The technicians carried out the work faster and less expensively than estimated," said Bill Miller, responsible for hiring and supervising the technicians at the lab. "We used six people less than the original labor estimate, and yet we ended up installing six planes per week, more than the original projection. We had a really excellent crew of workers. That was the key to our success."

Overall, the four-year project finished on schedule and on budget. The faster-than-expected installation made up for time lost during the excavation of the cavern that hosts the experiment.

The whole detector is about 100 feet long and consists of massive planes that are lined up like the slices in a loaf of bread. Each plane consists of a sheet of steel, about 25 feet high and one inch thick, covered on one side with a half-inch layer of scintillating plastic. Because all material had to enter the cavern through an old narrow shaft, the 6,000-ton detector arrived in pieces not more than seven feet in width.

"It was like building a ship in a bottle," said MINOS spokesperson Stanley Wojcicki, physics professor at Stanford University. "We needed to bring all the material underground and assemble it right there. It was a real challenge to coordinate the logistics."

The project began in July 1999, with the groundbreaking for the cavern that now hosts the detector. The installation of the first plane occurred in August of 2001. Because of limited storage space in the underground area, the work crew relied on continuous delivery of steel sections through the shaft.

"Because the transportation cage was used during the day for tourists visiting the old iron mine, we lowered the pieces underground during the second shift at night," said Fermilab physicist Jeff Nelson, who explained that the Soudan mine is a State Park with 30,000 visitors per year. "We had a crew of three on the surface, working year-around. Over the two years, only three shifts were canceled due to weather."

ON THE WEB:

MINOS homepage:
www-numi.fnal.gov

Photos of the MINOS far detector construction:
www.sudan.umn.edu/Albums/MINOS/Weekly_Photos/

Soudan Underground Laboratory:
www.sudan.umn.edu

To carry out the two-year project, the Soudan laboratory hired about 30 technicians, many of whom it recruited from among the 1,300 people that were laid off when a steel company stopped mining in Soudan in 2001. Now, with the detector installation almost complete, workers are again forced to change jobs.

"It was a rather anticlimactic end of the project. When the last plane went up we laid off 17 people," said Miller, who has worked at the underground lab for 17 years. Many of the laid-off technicians have been able to secure summer jobs, but with another mine shutting down and laying off 600 people the prospects are less than rosy.

During the installation, technicians worked in two ten-hour shifts and accounted for about 75 percent of the total manpower. A mix of graduate students, postdocs and senior scientists from many of the 32 MINOS institutions from six countries—Brazil, France, Greece, Russia, United Kingdom and the United States—significantly contributed to the work at Soudan as well, with a special emphasis on the installation of the electronics and the commissioning of detector planes within days of their installation.

Work on the detector, however, was not limited to the Soudan mine. A number of university and laboratory groups in the U.S., UK, and Greece worked at their home institutions on the production of detector components, representing more than half the cost of the detector. In a carefully coordinated effort, the groups built and tested the pieces of the plastic scintillator system and then shipped them to the Soudan mine for installation.

In about a month, the whole detector will be ready to observe cosmic rays and atmospheric neutrinos, which easily penetrate the surface of the earth and reach the MINOS detector deep underground. For the last nine months, scientists have already used half of the detector to record particle interactions. In April, the MINOS collaboration reported its first scientific results, the identification of twelve atmospheric neutrino events.

Over the next two years MINOS scientists will focus on the so-called CPT test of atmospheric neutrino interactions, looking for differences in the interactions of matter and antimatter. Unlike earlier neutrino experiments such as Super-Kamiokande, MACRO and Soudan 2, the MINOS detector features a 1.5-Tesla magnet that allows scientists to distinguish between signals caused by neutrinos and antineutrinos.

Photos courtesy MINOS collaboration

The MINOS cavern before the first detector plane was installed.

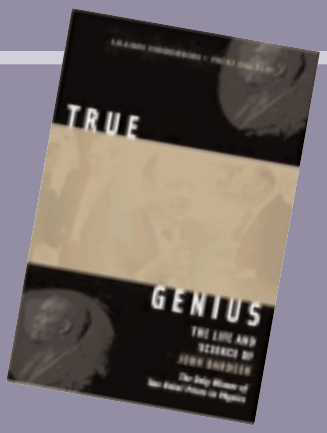
MINOS will enter its next stage in 2005, when scientists will use the detector to "catch" neutrinos created 450 miles away at Fermilab in Batavia, Illinois. The beam line creating the neutrinos is under construction. When ready, about five trillion muon neutrinos per year will travel straight through rock and traverse the detector in Soudan, but only about 1,500 of the rarely-interacting particles are predicted to leave a trace inside the detector. Scientists will use the long-distance experiment to study the oscillation of muon neutrinos into electron neutrinos or tau neutrinos under laboratory conditions.

"We really appreciate the work the technicians did for us," said Nelson, who has spent most of his last two years in Minnesota. "Now it has gone from beehive activity to taking care of the last details."

He and his colleagues will make sure that physics data will keep the lab abuzz.

THE MAKING OF GENIUS

NATURE AND NURTURE TOOK TURNS IN FORMING TWO-TIME NOBEL WINNER JOHN BARDEEN



by Sena Desai

He is the only two-time physics Nobel laureate, but few people know of John Bardeen.

True Genius: The Life and Science of John Bardeen, by Lillian Hoddeson and Vicki Daitch, offers insight into the complex personality of a remarkable physicist who differed from the stereotypical image of a genius. Hoddeson distinguishes Bardeen as "true genius," because he was not just born with talent, but worked to cultivate it throughout his life. Hoddeson draws on a wealth of experience and knowledge of the history of the field as a physics historian at the University of Illinois. She has also archived Fermilab's historical records since 1977.

A question plagued Hoddeson while she researched the book: "Why was a genius like John Bardeen so little known?" The answer, she said, was that he differed from the stereotypical image of genius, that of the exceptionally-talented but exceptionally-eccentric "mad scientist."

Bardeen did not act outrageous or flamboyant. In fact, he was at the other extreme, speaking in a soft warble that many people found difficult to understand, earning him the nickname "Whispering John." He did not court the media, sending two of his graduate students—Leon Cooper and Robert Schrieffer—to make the first announcement of his superconductivity theory at an American Physical Society meeting. The theory won Bardeen a second Nobel Prize in 1972; the first, in 1956, was for the discovery of the transistor effect, with William Shockley and Walter Brattain.

Bardeen's gifts were apparent at an early age. Letters that his mother, Althea, wrote her father-in-law, Charles William Bardeen, say that John "stood out" in most subjects from the day he started school, and that he "demonstrated a concentrated essence of brain." By the time he was nine, he had skipped enough grades to be in the same class as his brother, William, who was two years older than John and was ahead of his own age-group. In the summer after third grade, John mastered the mathematics of the fourth and fifth grades; in the fall, he mastered sixth, seventh, and eighth grade math.

ON THE WEB:

The Official Web Site of The Nobel Foundation:

www.nobel.se/

The Nobel Prize in Physics 1972

"for their jointly developed theory of superconductivity, usually called the BCS-theory"

John Bardeen

Leon Neil Cooper

John Robert Schrieffer

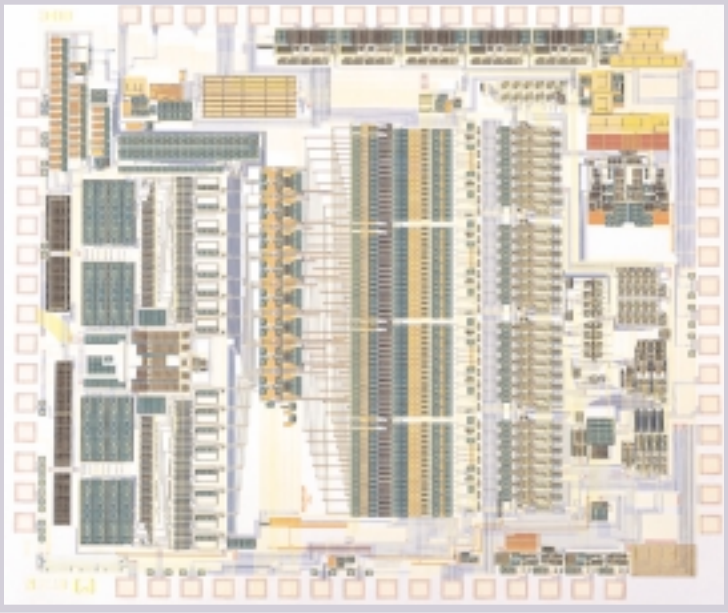
The Nobel Prize in Physics 1956

"for their researches on semiconductors and their discovery of the transistor effect"

William Bradford Shockley

John Bardeen

Walter Houser Brattain



His exceptional mind isolated him from his classmates, probably helping him to further cultivate his genius. His classmates considered him too young for their games, leaving John with even more time to study. He was always far ahead of his class, throughout school and college. Even after taking a year off, he graduated with a bachelor's degree in electrical engineering from the University of Wisconsin at the age of twenty. A year later he obtained a master's degree in electrical engineering.

Early family influences molded Bardeen's outlook. His mother taught her children to define their own problems and seek creative answers, a tool that John used in later years. His paternal grandfather, Charles William, stressed that the greatest opportunity was to serve. Bardeen sought out physics problems, such as the transistor, that he believed would directly benefit society. Few technological advances have so transformed society.

Bardeen's work methods played an equal role in winning Nobel Prizes in two widely-varying different fields—the engineering-based invention of the transistor, and the physics-based explanation of superconductivity. During graduate studies in math at Princeton University, Bardeen learned from professor Eugene Wigner to break down problems into smaller pieces that were easier to handle. Wigner taught Bardeen to "reduce the problem to its bare essentials, so that it contains just as much physics as is necessary," Hoddeson tells us.

Bardeen, it developed, was even more persistent than his mentors in tackling problems. He "bullied" through difficulties, seeking alternatives if one method failed, until he found the answer. He also had an encyclopedic knowledge of physics, which his colleagues found invaluable as a resource. Bardeen spent hours working and reading in the library, but preferred not to work in isolation. He enjoyed working in collaboration, drawing on the expertise and knowledge of others.

Bardeen's son Bill, a theorist at Fermilab, said he learned much about his father's working methods and his early life from Hoddeson's book.

THE MAKING OF GENIUS

"I knew that the transistor was important, but not how it happened," Bill Bardeen said. "I was just eight years old at the time and [my father] spoke very little at home. We knew he was there if we needed him, but he never forced anything on us."

John had a strong presence as a father even if it was a quiet presence, according to both Bill and the book. When Bill pitched in Little League, John coached him. John influenced his children's lives and career choices by holding up physics as a high calling. Bill always wanted to study physics, though he said his father would have preferred that he become an experimentalist rather than a theorist.

Hoddeson's book, even with its many insights, has not dealt with every aspect of John Bardeen's complex personality. "There was more to him than what is in the book," said Bill. "This book is a great start, but there will be more biographies."

Both authors, Hoddeson and Daitch, concur. In the book's preface, they write, "We are painfully aware that this book merely scratches the surface of the subject." Hoddeson said the book would have benefited had she begun it while Bardeen was alive, and had a chance to question him about his thoughts on his life and science. Hoddeson says most of her research was conducted through interviews with Bardeen's family, friends, and colleagues, and through family letters. The letters are in the basement of the home of Bill and his wife Marge, who is head of the Education Office at Fermilab.

But Hoddeson does know that John Bardeen would have picked her to write his biography. In the course of her research she came upon some correspondence between Bardeen and one Mr. Jefferson Bushman, who asked if he could write a biography. Bardeen replied that if anyone were to write his biography, it would be Lillian Hoddeson.

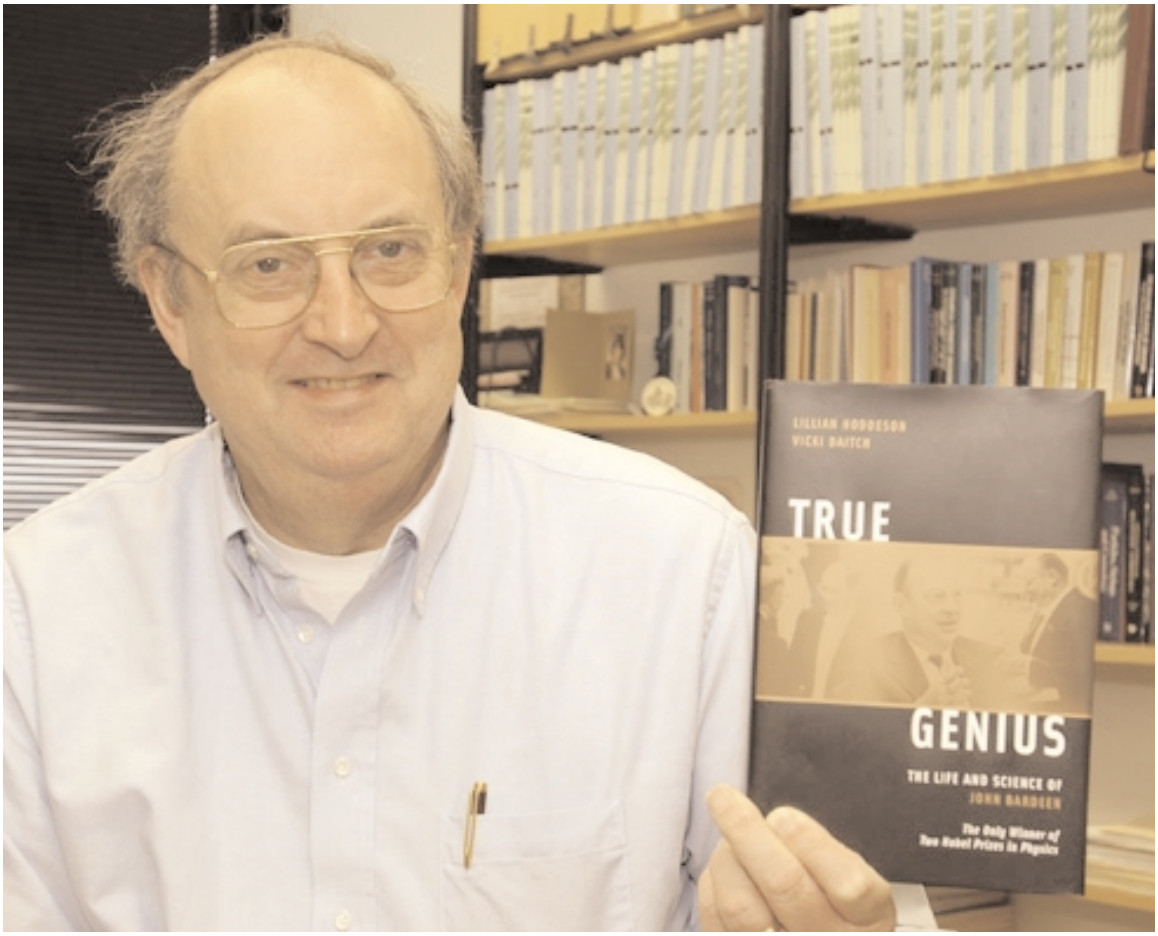


Photo by Reidar Hahn

Fermilab theorist Bill Bardeen with a copy of the new biography of his father. John Bardeen is the only two-time winner of the Nobel Prize in Physics, sharing the 1956 and 1972 awards.

FERMILAB ARTS SERIES SUMMER SEASON

To purchase tickets for Arts and Lecture Series events, or for further information or telephone reservations, **call 630-840-ARTS** weekdays between 9 a.m. and 4 p.m. Phone reservations are held for five working days, but will be released for sale if not paid for within that time. Will-Call tickets may be picked up, or available tickets purchased, at the lobby box office on the night of the performance beginning at 7 p.m. When coming to this event, only the Pine Street entrance to Fermilab will be open. *For more information, check out our web page at* **www.fnal.gov/culture.**

APRIL VERCH

July 19, 2003; $18 ($9 ages 18 and under)

"It's always a good thing for a performer to leave an audience howling for more. But she is such a startlingly brilliant player/performer you have to wonder whether even too much would be enough." – Halifax Herald

Emerging from the thick of the traditional music scene, the fiddling and step dance vitality of an April Verch concert is a breath of fresh air. Though she has deep roots in the fiddling of her native Ottawa Valley in Canada, April's broad repertoire features traditional and contemporary tunes ranging from French Canadian to Appalachian, from Bluegrass to Celtic, and Brazilian to Old Time, not to mention her own colorful compositions. No matter what you call it, April's music is beguiling in the way it brilliantly balances contemporary élan and traditional resonance. This young musician is highly sought-after, not only for her master fiddling, but also for her virtuoso Ottawa Valley step dancing. April's award-winning performances of this dynamic, high-energy form of dancing never fail to bring the house down.

CORKY SIEGEL'S CHAMBER BLUES WITH BONNIE KOLOC

August 23, 2003; $20 ($10 ages 18 and under)

"Corky Siegel's Chamber Blues – Classical Music, elegant and precise, marries the loose and passionate blues in this utterly winning musical program." – The Austin Chronicle

For almost four decades the defining cultural arts critics from Rolling Stone, Stereophile, Down Beat, Billboard, Jazziz, New York Times, and Washington Post have all recognized Corky Siegel as a "phenomenal virtuoso on harmonica... a deftly accomplished genius of the Blues" and a pioneer who brings his original award-winning benchmark compositions to delighted audiences globally. New fans and longtime followers of Corky's blues career have been quick to embrace his freshly innovative, genre-busting Chamber Blues.

Chicago singer/songwriter Bonnie Koloc joins Chamber Blues for a multi-media event titled "Bestiary" which features some of Bonnie's original artwork and songs. Koloc is often considered, along with John Prine and Steve Goodman, as one of Chicago's top three singer/songwriters.

Lunch served from 11:30 a.m. to 1 p.m. $10/person

Dinner served at 7 p.m. $23/person

Chez Léon MENU

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

Lunch
Wednesday, July 2
Salad Niciose
with Grilled Tuna
Trio Sorbet
with Cookies

Dinner
Thursday, July 3
Roasted Marinated Red Peppers
Scampi
Sauteed Spinach
Orange Almond Cake

Lunch
Wednesday, July 9
Grilled Chicken and Pineapple on Sticks
Curried Vegetables
Cold Rum Souffle

Dinner
Thursday, July 10
Shrimp Salad
Stuffed Flank
Risotto
Almond Chocolate Semi Freddo

Lunch
Wednesday, July 16
Pork Satay
with Peanut Basmatic Rice Sauce
Pineapple Coconut Parfait

Dinner
Thursday, July 17
Gueyere and Smoked Ham Souffle
Stuffed Fillet of Sole
with Crabmeat
Steamed Asparagus
Blueberry Shortcake

Lunch
Wednesday, July 23
Poached Salmon
with Watercress Sauce
Steamed Summer Vegetables
Vanilla Flan
with Raspberry Sauce

Dinner
Thursday, July 24
Salad of Field greens, Pears & Parmesan
Pork Tenderloins
with Marsala Sauce
Yam Puree
with Pecans & Bourbon
Peach Melba

FERMI NEWS

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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 Chevrolet Corvette Torch-red Coupe, 98K miles, asking $22,000. Contact Joe 630-840-2894 or home 630-898-3465.

■ '95 Nissan Sentra, 53K, AC, power steering/ brakes, locks, windows, cruise, AM/FM cassette, tilt wheel, air bags, economical and comfortable teal green. $3,800. Contact Ron 630-840-3839.

■ '95 Ford F150 XLT Pickup, extended cab, 5.8L V8, auto., air, cruise, PW, PL, lockable hard shell tonneau cover, spray in liner, and more. No winters and only 67K miles. Excellent condition $9,000 o.b.o. Contact Mike at 630-840-4663 or 630-513-7939.

■ '95 Ford Escort LX sedan, 4D, 102K miles, AC, power steering, AM/FM/cass, auto., dark green. Runs great, good condition, $2,000 o.b.o. Contact Edivaldo Santos at 630-840-4812 or 630-840-3831, or esantos@fnal.gov.

■ Motorcycle: 1998 Yamaha YZF600R, all black, excellent condition, with Yamaha service manual, 10K miles, $4,200 o.b.o. Contact Matt 630-267-2436 Mike 630-840-6124.

■ Foosball table. Old collectible professional foosball table from bar, was coin operated, with balls. $70. Contact Matt 630-267-2436 or Mike 630-840-6124.

■ Electric Guitar-BC Rich NJ Series Warlock. One year old, pristine condition. Hardshell case included. $400 o.b.o. Contact 630-840-2661 or jaysonh@fnal.gov.

■ Restored 1937 wood and canvas Old Town 16-foot (model: OTCA 16) sailing canoe, $2,500. Contact 630-840-6416.

■ Hardly used 12 CD JVC Disc Changer, model CHX350 with y-cable, in good condition, without magazine, retail value $149, Asking $75. Contact 630-840-3698.

■ Pair of JBL 4691B studio/stage speakers, 15″ woofer, horn tweeter. $400. Contact Angela at 630-840-3013 or email alp@fnal.gov

■ Schwin bicycle, men's style, 27″ tires, 12 speed, good condition, ready to ride, $25. Westinghouse window A/C, 9000 BTU, 230V, 7A. Older unit, aluminum case, works great except for thermostat, $25. Contact Ken 630-840-2083 or sievert@fnal.gov.

■ Furniture refinishing and restoration. Pick-up and delivery service available. Contact 630-554-3853.

■ 4 PCW Rims with tires, polished aluminum, size 17x7.5 5-115, fits all GM cars with particular bolt pattern, tires are BF Goodrich Competition T/A size P245/45R 17. Asking $600. Contact 630-840-3698

FOR RENT

■ 3 story, English-style home in River Forest; great condition, 4 BR, 4 bath, gourmet kitchen, walkout deck and large yard, completely furnished, C/A, lots of closets, sprinkler system, Grand piano. Walking distance to great elementary and middle schools. Convenient to both airports, Metra train and Pace bus. Available for 1 year beginning mid-August 03, $4,000/month (includes weekly cleaning) plus utilities. Call 708-488-9884 or kaplan@fnal.gov.

■ Lakefront home in Northern Wisconsin, close to Minocqua available to rent weekly or for the weekend. 4 bedrooms, 2 baths, sleeps 8-10 people, perfect for large family vacations. Contact dkeiner@fnal.gov or 630-907-2565.

HOUSE FOR SALE

■ Warrenville, two-story with basement, 3 bedrooms, 1.5 baths, 2 car garage. WSH, DR, AC, new carpet. 5 to 7 minutes away from Fermilab. $214,900. Contact Claudio 630-840-8035 or rivetta@fnal.gov.

HUNTING/FISHING/DREAMHOME SITE:

■ Approx. 22 secluded acres of land with frontage on the Beachfork River in Kentucky. Very scenic, with lots of wildlife, many trees, rock cliffs, and a waterfall. County water available, you'll have a hard time choosing where to build your dream home. Less than 2 miles from historic Bardstown, Kentucky. Asking $120,000. Will build to suit. Contact Edie at 859-336-0919 or email pacord@kyol.net.

HOUSING ASSIGNMENTS – FALL 2003/SPRING 2004

■ The Fermilab Housing Office is now taking requests from Users for houses, apartments and dormitory rooms for the Fall of 2003 and Spring of 2004. Since there will be a large influx of experiments during the fall/spring, and requests are anticipated to be in excess of our available facilities, you are urged to submit your request for reservations to the Housing Office by Monday, July 14, 2003. Requests can be made for any period and need not commence on any particular date. For further information, please contact the Housing Office, telephone: 630-840-3777, fax: 630-840-2823, email:housing@fnal.gov.

BIBLE EXPLORATION FOR LUNCH

Would you like to be a happier person? Interested in what the Bible has to say about happiness? Want to explore this on your own terms, devoid of outside pressure or obligation? Then join us noon - 12:35 p.m. every Wednesday in the Small Dining Room of Wilson Hall (WH-1SW). The current study is entitled 'Journey into Happiness' and no preparation is necessary. Info at 630-840-3607 or dykhuis@fnal.gov.

MILESTONES

RETIRING

■ George Wayne Smith BS-SU-Dist./Rec./Shipping #00841 June 20th, 2003

CORRECTION

■ In Milestones (*FERMINEWS*, vol. 26, no. 10, June 13, 2003), the name of retiree Jim Ellermeier was misspelled. *FERMINEWS* regrets the error.

NETTED:

■ Big fish (photos at right), by the Fermilab day-care center, for display on the Batavia River Walk.

FERMILAB
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