

# F E R M I N E W S

F E R M I L A B

A U.S. DEPARTMENT OF ENERGY LABORATORY



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Photo by Fred Ullrich

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# HEPAP Unveils 20-Year Plan for U.S. High Energy Physics

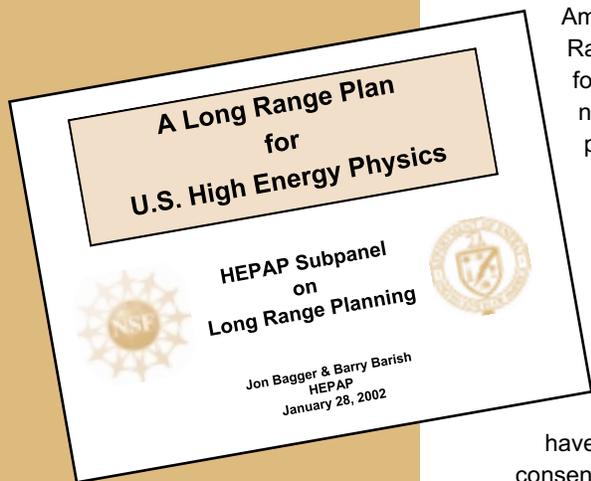
By Judy Jackson

**O**n an unusually balmy winter day in Washington late last month, the High Energy Physics Advisory Panel officially launched the plan that they hope will lead to a new era of opportunity for particle physics in the United States. Among its recommendations, the “Report of the Subpanel on the Long-Range Future of U.S. High-Energy Physics” calls for creating a system for prioritizing particle physics projects and, eventually, for building a new international particle accelerator “somewhere in the world”—preferably somewhere nearby.

The new plan is the product of a 22-member HEPAP Subpanel, charged by the Department of Energy and the National Science Foundation with the daunting task of consulting with the U.S. particle physics community to produce a plan for the future of a field that, in recent years, has been hard pressed to maintain its leading edge. Straitened federal funding for U.S. particle physics, and indeed for all of the physical sciences, has left cash-strapped physicists struggling to maintain momentum in a science where Americans have traditionally led the field. The Subpanel’s report represents, if not a consensus on the best way forward, at least as close to consensus as they are likely to get in a community where strongly held opinions are as divergent as particles in a high-energy collision. The Subpanel, chaired by physicists Jonathan Bagger, of The Johns Hopkins University, and Barry Barish, of Caltech, listened to hundreds of U.S. particle physicists from across the nation, as well as foreign colleagues, before presenting the draft of their report to HEPAP on October 29, 2001.

“We kept the process as open and interactive as we possibly could,” Barish said. “We set up a website, held open meetings and even shared a set of questions with the community. We invited input in the form of letters or face-to-face conversations with the Subpanel. The response was overwhelming! We received about 100 letters, we had many talks with our colleagues, and we heard reports from Snowmass working groups. We could not hope to satisfy all of the diverse opinions that we heard, but they were very influential in determining our recommendations.”

At the January 30 HEPAP meeting, held at Georgetown’s Latham Hotel, HEPAP Chair Fred Gilman, of Carnegie Mellon University, called for a vote





Jonathan Bagger, left, co-chair of the Subpanel on the Long-Range Future of High-Energy Physics and HEPAP Chair Fred Gilman, in Washington, DC, where HEPAP voted to transmit the subpanel's report to DOE and NSF.

Photo by Fred Ullrich

## “High-energy physics is entering an EXTRAORDINARY PERIOD of DISCOVERY”

of acceptance from the panel before transmitting the Subpanel's report to DOE and NSF, the federal agencies that fund high-energy physics in the United States. The "ayes" had it, unanimously.

Not all U.S. physicists had endorsed the initial October 29 draft with such unanimity, however. In particular, members of Fermilab's BTeV collaboration interpreted its recommendations to mean the demise of their 4-year effort to bring to reality their proposal to study the physics of the B meson at Fermilab's Tevatron. But changes to the draft left BTeV collaborators at least cautiously satisfied with the final plan. In remarks delivered at the meeting, co-spokesman Joel Butler spoke for the BTeV collaboration.

“After the October 29 release of the draft report,” Butler said, “there were several developments. The subpanel chairs, Jon and Barry, assured us that the subpanel did not intend that BTeV be killed, explained to us what they did mean, and said that they would change the words to make their intent more clear.”

The clarification process, while painful, Butler said, brought out the best in the tradition of vigorous discourse in the field.

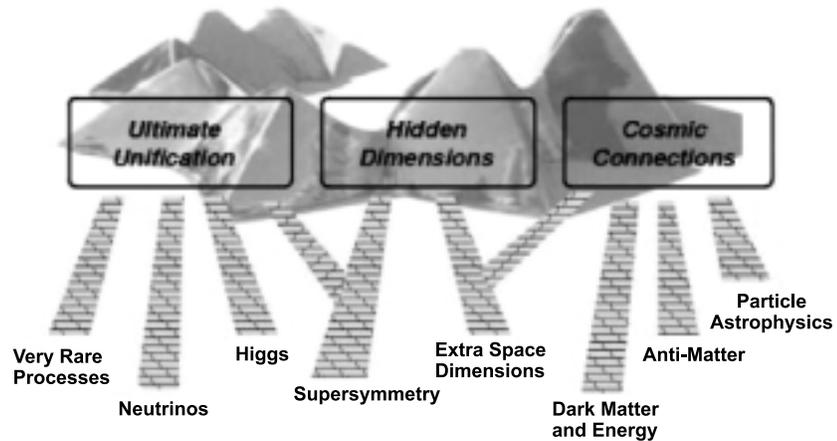
“I want to comment on the process we have all just been through,” he said. “It has been difficult, sometimes tense, frequently vocal, and quite public. In its odd way, however, it has accomplished much.... It has, in my judgment, led to a better report for those who are concerned about the diversity in the field, especially in the neutrino and heavy quark sectors of our community. This kind of discourse requires much patience and mutual good will and respect and is in our best tradition.”

While discourse within the field may be flourishing, particle physicists recognize that they have just begun the discourse with the rest of the world that will determine whether the new plan leads to anything resembling reality. For starters, particle physicists face a difficult task in communicating the revolutionary potential of a field often viewed as either impossibly esoteric or devoted merely to ever-more-refined riffs on the Standard Model of particle interactions, the reigning theory of the structure of matter. In transmitting the plan to the funding agencies, Gilman focused on the scientific opportunities now emerging for the field of particle physics.

# What is Particle Physics?

## *Our Definition*

### The Science of Matter, Energy, Space and Time



### The Paths and Goals of Particle Physics

It's more than particles: the HEPAP Subpanel Report defines particle physics as the science of matter, energy, space and time.

"High-energy physics is entering an extraordinary period of discovery," Gilman said. "Are there extra dimensions of space? What is the dark matter that makes up the majority of our universe? What unknown mechanism gives mass to particles? Solving these mysteries will be an epochal chapter in the history of science. Physicists now have within reach the technology and understanding to find the answers."

That technology doesn't come cheap, however. In a field where the price tags of the tools of the trade quickly mount into the billions of dollars, particle physicists must make clear not only the compelling nature of the discoveries they seek, but also their willingness to choose the best of the best experiments among the many paths to discovery. To this end, the Subpanel recommends something new for high-energy physics, a formal continuing mechanism for setting priorities. It proposes the creation of a Particle Physics Project Prioritization Panel, dubbed "P5," to assess and prioritize proposed experiments and other research initiatives to ensure the highest scientific return on public funding for particle physics. The report does not spell out the exact makeup and functioning of P5, a question that is likely to form the subject of ongoing discussion over coming months.

At the heart of the report, and what makes it more than a mere exercise in prioritization, is the recommendation that a high-energy, high-luminosity, linear particle accelerator should be designed, built and operated as a fully international collaboration, somewhere, sometime soon.

"The world particle physics community agrees that a linear collider is the right choice for the next major physics facility," Barish said recently. "There are initial proposals to build such a collider in Germany, Japan and in the United States. Although there are many steps to be taken to decide design, funding and collaboration issues before such a project can go forward, our sub-panel strongly recommends that U.S. scientists participate in this initiative wherever it is built."

The panel then takes a step further and recommends that the United States "prepare to bid to host" the initiative.

Bagger enunciated the benefits of building the world's next accelerator on the home turf.

"Building the linear collider would bring one of the great scientific projects of our time to the United States," Bagger said, "together with its associated intellectual, educational, technological and economic benefits."

# HEPAP Unveils 20-Year Plan

The panel estimates that the cost of constructing the 30-km (18-mile) long collider in the United States would be \$5 to \$7 billion, with one-third of the financing coming from international contributions and a further \$1 to \$2 billion from realignment in the current U.S. particle physics program.

Although reluctant to predict exactly when the new accelerator might be built, the Subpanel proposed that a steering group be set up immediately to coordinate U.S. participation in a linear collider. Much subsequent discussion at the meeting centered around the makeup and responsibilities of the Linear Collider Steering Committee.

Besides the linear collider, the new HEPAP roadmap reflects the need for a variety of techniques and experimental approaches to achieve scientific goals, physicists familiar with the plan said.

"Particle physics requires forefront accelerators at the energy and luminosity frontiers," said University of Oregon physicist Jim Brau, an experimenter at the Stanford Linear Accelerator Center, in a prepared statement. "However, the plan also recognizes the need for innovative experiments in space and deep underground. A balanced approach that strengthens the increasingly important links to astrophysics, cosmology and nuclear physics is the foundation for a future of scientific discovery in our field."

The HEPAP report presents a focused way forward for U.S. particle physics, members of the Subpanel said. They emphasized that its recommendations are long term, underlining the need for careful coordination and planning in a field characterized by global partnerships and in which most experiments begin taking data years after they were originally conceived.

Officials from both DOE and NSF thanked the Subpanel for their efforts but largely refrained from comment on the report itself, noting that they were only now receiving the plan. Acting DOE Office of Science Director James Decker did say that the Department would take the report "very, very seriously." At a meeting of the Universities Research Association's Council of Presidents two days later, DOE Under Secretary Robert Card called the linear collider "an interesting project," but said its future would depend on physicists'

success in making the case for its scientific value to the country.

In an accompanying letter to DOE and NSF, HEPAP Chair Gilman stressed the importance of basic science for national security and economic strength, but acknowledged the stiff challenges that particle physicists will face in carrying out their plan at a time when national resources are focused on the struggle against global terrorism, and the national economy is faltering.

"Responding to this plan will take resources, creativity and determination, together with the commitment of the American people and the government," Gilman wrote. "But this is not the time to shy away from challenges, especially when the benefits from success are clear. By making a renewed commitment to our scientific and technical base, we will be repaid by strengthened international cooperation and a new level of U.S. leadership and achievement in science and technology, together with the benefits that flow from them." ❏



Photo by Fred Ullrich

HEPAP Chair Fred Gilman: "This is not the time to shy away from challenges."

## On the Web

The Report of the DOE/NSF High-Energy Physics Advisory Panel Subpanel on Long Range Planning for U.S. High-Energy Physics, and the accompanying letter from HEPAP Chair Fred Gilman, are available online at <http://bohr.pha.jhu.edu/~bagger/report.pdf>

# URA Council of PRESIDENTS



Congressman Rush Holt (D-NJ) urged HEPAP to make collaboration with scientists from developing nations a priority in particle physics projects.

## HEARS FROM Science Policymakers

By Judy Jackson

**U**niversities Research Association President Fred Bernthal led off URA's 37th annual Council of Presidents meeting in Washington, DC last month with some tongue-in-cheek advice for job seekers.

"It seems that the surest way to higher office in this town," Bernthal jokingly told the assembled representatives of URA member universities, "is to serve on a URA governing board."

As evidence, Bernthal cited President George W. Bush's recent nomination of URA Trustee Ray Orbach to be director of the Department of Energy's Office of Science; the appointment of Fermilab Overseer Arden Bement as Director of the National Institute of Standards and Technology; and the appointment of former long-time URA Trustees Chairman Jack Marburger as chief science advisor to the President and Director of the Office of Science and Technology Policy. As a steppingstone to positions of influence in national science policy, it's not a bad record.

One of URA's illustrious old grads, OSTP's Marburger, returned to address the annual gathering he had so often attended in the past. Besides serving as the URA "stockholders meeting," the annual Council meeting, traditionally held in the Lecture Room of the National Academy of Sciences, has become a Washington science policy forum with addresses from legislators and Administration officials. Besides Marburger, speakers at this year's meeting included Rep. Rush Holt (D-NJ), one of the two physicists in Congress; National Science Foundation Director Rita Colwell; and DOE Under Secretary Robert Card.

"I well remember sitting in this room year after year," Marburger told the university representatives. "It was here, in 1991, that the late Representative George Brown, former chair of the House Science Committee, made clear that with the end of the Cold War the world was reassessing the relationship between science and society. There had been an implicit link between



URA President Fred Bernthal addressed university representatives gathered at the National Academy of Sciences.



Office of Science and Technology Policy Director John Marburger: "Discovery is important to this administration."

support for the physical sciences and national security. Brown foresaw that especially high-energy physics would come under scrutiny because it was seen as no longer necessary for national security, and he was concerned about the mood in Congress to expect science funding to drop."

Marburger noted that the end of the Cold War also coincided with a sharp rise in the capability for research, citing increases in computing power and visualization technology that opened up new vistas in science.

"It was a time of emerging possibilities on the one hand and scrutiny and skepticism on the other," Marburger said. "It made things a little complicated for the national laboratories."

In most cases, Marburger told the audience, he believes that the DOE laboratories have done their best to adapt to user demands and to clarify their missions in response to post-Cold War changes.

"These labs are catalysts and focal points for user communities," Marburger said. "The investments that the federal government makes in the national labs generate the capability for national security, for addressing energy and environmental issues, and also provide access to the tools to conduct science. I believe that society is ready to support science at these labs, but the whole picture is so complicated that it will take more than we have done in the past to explain why they are an essential part of the nation's science apparatus."

Marburger echoed a question on the minds of many physicists, namely how to communicate

the insight that much of the science that ultimately produces high-profile (and well-funded) biomedical advances comes initially from physics. While basic science is a DOE mission, he said, other DOE missions compete for funding.

"There are many obscuring features in the way of a clear picture of science at DOE," Marburger said. "There is competition within DOE to the disadvantage of the science mission."

Marburger assured the audience of the support of the Bush administration for basic science.

"Discovery is important to this administration," he said. "There is an emphasis on long-range, high-risk research. It is the administration's great desire to see industry take up applied research. So there is a natural inclination to support basic science. The president believes that the opportunities for society from increased investment in medical research are vast. Now the trick is to get a balance, to make sure that physical science gets funded to maintain the pace of discovery. Here in Washington, I am trying to help. I hope you will continue to call on me."

Representative Rush Holt, former assistant director of Princeton Plasma Physics Laboratory, is another Washington champion of basic science. His opening statement that he had reviewed the



Photos by Fred Ullrich

Department of Energy Under Secretary Robert Card: "We don't want to compete for missions with other agencies. We build big machines. We do a good job."

# URA

High Energy Physics Advisory Panel's Plan for the Long-Term Future of U.S. High-Energy Physics, released two days earlier, elicited pleased exclamations from the audience.

Holt said that reading the report reminded him of what "good citizens" the scientists of the high-energy physics community are.

"I was very pleased to have an opportunity to look at the report's recommendations," he said, "and I generally endorse them. High-energy physics has a great tradition. Eleven of the twelve fundamental constituents of matter were discovered in the United States. High-energy physics is one of the hallmarks of a civilized society, and we must strive to maintain leadership at all levels."

The New Jersey Congressman suggested that plans for the future of high-energy physics would benefit from more emphasis on collaboration with developing nations. Besides an increased understanding of the physical world, he said, international projects like the new linear collider proposed by the HEPAP report bring direct benefits in international cooperation.

"I would extend the HEPAP recommendations," Holt said. "There is not enough attention paid to reaching out to the developing world, not just to Japan and CERN. Just as education of our children should be part of the structure of scientific projects, so should outreach to the developing world."

Under Secretary Card also commented on the HEPAP recommendations to build a linear collider.

"A linear collider seems like an interesting project," Card said. "But it will depend on making the case for its value to the nation. HEPAP has done a good job of convincing the physics community, but there is still a long way to go to convince others."

Responding to a question from the audience, he referred to remarks made last fall by Energy Secretary Spencer Abraham on DOE's mission and priorities. Card explained that the remarks had been "widely misinterpreted" to mean that the Secretary saw no place for basic science, such as high-energy physics, in the DOE mission. On the contrary, he said, DOE remains committed to its role in building and operating large scientific facilities.

"We don't want to compete for missions with other agencies," Card said. "We build and operate big machines. We do a good job. We have a core competence to protect, and when we have a problem with a big scientific project, it cuts at the core competence of DOE."

For her part, the National Science Foundation's Rita Colwell embraced the concept of science as patriotism. Firefighters and soldiers are patriots and heroes, Colwell said, but a re-examination of personal and national goals since the terrorist attack of September 11 has convinced her that scientists and engineers are patriots as well. Through their contributions to national security and to economic well-being and education, scientists have the opportunity for "global patriotism" by improving the lot of humankind.

In other business, the Council elected URA's ninetieth member, the Illinois Institute of Technology; heard an appeal from President Bernthal for increased support for the DOE Office of Science, and elected new officers of the URA Board.

Based on their predecessors' experiences, they may want to begin preparing for higher office. 🗳️



Fermilab Director Michael Witherell reported to URA "stockholders" on the state

# MEMBERS OF UNIVERSITIES RESEARCH ASSOCIATION, INC.

## On the Web:

**Universities Research Association, Inc.**  
[www.ura-hq.org](http://www.ura-hq.org)

## HEPAP

[http://doe-hep.hep.net/hepap\\_general.html](http://doe-hep.hep.net/hepap_general.html)



National Science Foundation Director Rita Colwell discussed science and patriotism.



Photos by Fred Ullrich

ce of the Laboratory.

## Alabama

University of Alabama-Tuscaloosa

## Arizona

Arizona State University  
University of Arizona

## California

California Institute of Technology  
University of California-Berkeley  
University of California-Davis  
University of California-Irvine  
University of California-Los Angeles  
University of California-Riverside  
University of California-San Diego  
University of California-Santa Barbara  
San Francisco State University\*  
Stanford University

## Colorado

University of Colorado-Boulder

## Connecticut

Yale University

## Florida

Florida State University  
University of Florida

## Hawaii

University of Hawaii-Manoa

## Illinois

University of Chicago  
Illinois Institute of Technology  
University of Illinois-  
Champaign/Urbana  
Northern Illinois University  
Northwestern University

## Indiana

Indiana University  
University of Notre Dame  
Purdue University

## Iowa

Iowa State University  
University of Iowa

## Kansas

Kansas State University

## Louisiana

Louisiana State University  
Tulane University

## Maryland

Johns Hopkins University  
University of Maryland, College Park

## Massachusetts

Boston University  
Harvard University  
Massachusetts Institute  
of Technology  
University of Massachusetts at Amherst  
Northeastern University  
Tufts University

## Michigan

Michigan State University  
University of Michigan  
Wayne State University

## Minnesota

University of Minnesota

## Missouri

Washington University

## Nebraska

University of Nebraska-Lincoln

## New Jersey

Princeton University  
Rutgers University

## New Mexico

New Mexico State University  
University of New Mexico

## New York

Columbia University  
Cornell University  
University of Rochester  
Rockefeller University  
State University of New York-Buffalo  
State University of New York-Stony Brook  
Syracuse University

## North Carolina

Duke University  
University of North Carolina  
at Chapel Hill

## Ohio

Case Western Reserve University  
Ohio State University

## Oklahoma

University of Oklahoma

## Oregon

University of Oregon

## Pennsylvania

Carnegie Mellon University  
Pennsylvania State University  
University of Pennsylvania  
University of Pittsburgh

## Rhode Island

Brown University

## South Carolina

University of South Carolina

## Tennessee

University of Tennessee-Knoxville  
Vanderbilt University

## Texas

University of Houston  
University of North Texas  
Prairie View A&M University\*  
Rice University  
Southern Methodist University\*  
Texas A&M University  
Texas Tech University  
University of Texas-Arlington  
University of Texas-Austin  
University of Texas-Dallas

## Utah

University of Utah

## Virginia

Virginia Polytechnic Institute  
University of Virginia  
College of William and Mary

## Washington

University of Washington

## Wisconsin

University of Wisconsin-Madison

## Canada

McGill University  
University of Toronto

## Italy

University of Pisa

## Japan

Waseda University

\*Associate member institution

# IIT

## FROM A MILLION-DOLLAR WISH *to Invaluable Reality*



by Mike Perricone

**W**hat would you do with a million dollars?

Frank Gunsaulus, minister of the Plymouth Church on 31st and State Streets in Chicago, put his million-dollar wish list into words in a sermon in 1890. He found that the right words, at the right time and place, can change the future.



Rev. Frank Gunsaulus

Gunsaulus envisioned building a school open to anyone wishing a technical education, in an America facing a new century exploding with technology. Church member Philip D. Armour, of the Chicago meat-packing and grain-trading family, took Gunsaulus at his word. He pledged the necessary funds, and founded the Armour Institute with Gunsaulus as its first president.

The Armour Institute opened in 1893, already boasting a backlog of applicants. More than a century of evolution has brought mergers and partnerships with the Art Institute of Chicago, the Lewis Institute of Humanities, the Institute of Design and the Chicago-Kent College of Law—the latter establishing one of the nation's few technological universities with its own law school.

The modern Illinois Institute of Technology, renamed in 1940, has an enrollment of more than 6,000 students representing 89 countries, distributed among five campuses in the city and suburbs. It recently received a \$1 million grant from the Whitaker Foundation to create an undergraduate degree program in biomedical engineering. The university and its contract research affiliate, IIT Research Institute, have \$130 million in annual research volume. IIT has a long history of involvement in improvements for Chicago's south side, and was an original member of both the South Side Partnership and the South Side Planning Board, whose accomplishments include the McCormick Center on Chicago's lakefront.



Rep. Bobby Rush  
(D-Illinois, 1st District)

Congressman Bobby L. Rush, of the 1st District in Illinois, expressed high regard for IIT and its longstanding research contribution to Fermilab.

"Throughout a distinguished history spanning more than a century, IIT has represented the highest ideals in education and research," said Rep. Rush, who serves on the House Energy and Commerce Committee. "It has also demonstrated a firm and continuing commitment to the city and community."

ILLINOIS INSTITUTE  
OF TECHNOLOGY

Armour Institute opened in 1893 in this classic building, which today houses IIT administration offices.

### On the Web:

**Illinois Institute of Technology**

<http://www.iit.edu/>

**Center for Accelerator and Particle Physics**

<http://www.capp.iit.edu/>

**Illinois Consortium for Accelerator Research**

<http://www.capp.iit.edu/~icar/>



Photos courtesy IIT

The 120-acre Main Campus at 33rd and State in Chicago and many individual buildings were designed by Ludwig Mies van der Rohe, one of the 20th century's most influential architects, who directed the architecture program at IIT from 1938 to 1958. In 1976, the American Institute of Architects recognized the campus as one of the 200 most significant works of architecture in the U.S. The McCormick Tribune Campus Center, currently under construction, is the latest architectural innovation on campus. Dutch architect Rem Koolhaas' design solution to intrusive "EL" noise is to encase the elevated train in a steel-and-concrete tube where it passes over the single-story building. The campus center is the first new building on the main campus in 25 years.

The bond between IIT and Fermilab surely guarantees a bright future for both."

A longstanding contributor to Fermilab research, IIT further strengthened the bond on January 30 by becoming a full member of Universities Research Association, Inc., the consortium of 90 universities which operates the lab under contract with the U.S. Department of Energy.

"We are delighted to join with the other members of URA in support of these extraordinary research facilities that are so important to this nation's future," said IIT president Lew Collens.

IIT's support has often come from a leadership position. In addition to creating its own Center for Accelerator and Particle Physics, IIT was the founding member through CAPP of the Illinois Consortium for Accelerator Research, initially funded in 2000 by the State of Illinois to advance future site-specific Fermilab projects. To Fermilab Director Michael Witherell, IIT's official membership in URA comes at a critical time for the future of accelerator physics—and physicists.

"We need to renew the close connection between accelerator physics and university physics departments," Witherell said. "The supply of accelerator physicists is not able to keep up with the growing demand, and we need to train many more. IIT is one of the universities that has responded to this need and is committing itself to an accelerator physics program. I think this is a great move for IIT and we are working with them to make it a success for them and for us."

Dan Kaplan, director of CAPP and principal investigator of ICAR, emphasized IIT's history of experimental high-energy physics established by Ray Burnstein and Howard Rubin in the 1960s, with bubble-chamber physics at Brookhaven, Argonne and later, Fermilab. The two collaborated with Fermilab's Jeff Appel on E791 which achieved a breakthrough with 250,000 charm decays. After Leon Lederman joined IIT in 1992-93, Kaplan switched from Northern Illinois University. Kaplan had been a grad student on the Fermilab experiment, led by Lederman, that discovered the bottom quark in 1977.

"The four of us agreed that we would join forces to form a single strong group," Kaplan said, "initially to work on the new HyperCP experiment."

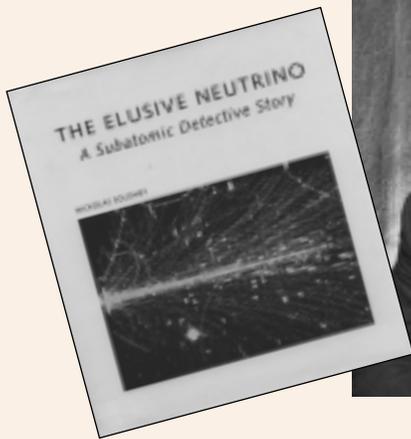
And so they got to work. At Fermilab, CAPP physicists now participate in the HyperCP, BTeV and MINOS experiments, and in the MuCool project. HyperCP (E871) is searching for CP violation in Lambda and Xi hyperon decays, as well as in charged kaon decays. All are important tests for the Standard Model of elementary particles and forces. CP violation is the asymmetry between matter and antimatter, the apparent reason that the universe exists as matter with virtually no antimatter. HyperCP has accumulated the world's largest sample of decays of hyperons, which include one or more strange quarks in their three-quark makeup. The second run of HyperCP took place in 1999, and data analysis is now in progress.



Dan Kaplan

Photo by Reidar Hahn

## The Math-less Neutrino



Nickolas Solomey, author of *“The Elusive Neutrino: A Subatomic Detective Story,”* aims at explanation with a minimum of mathematics because, he says wryly, “each equation you add diminishes sales—except I’m told  $e=mc^2$  actually boosts sales.”

But he’s serious about communicating science: “The public has paid for most of the research in elementary particle physics and we have the responsibility to tell them why it is important to continue. Also, for example, we tend to remember Newton’s laws and forget the experimental proof behind them. In my book, I explain the reasons why we know the neutrino exists, and how we know that it has certain special properties. This story is not done yet, and I suspect the neutrino still holds some surprises for us.”

Solomey is at work on a new book about the photon.



Photo courtesy of CAPP

The CAPP group at IIT—Faculty: Ray Burnstein, Professor Emeritus of Physics; Dan Kaplan, Professor of Physics and Director, Center for Accelerator and Particle Physics; Leon Lederman, 1988 Nobel Laureate in Physics and Pritzker Professor of Science; Howard Rubin, Professor of Physics and Associate Chair of the Physics Division; Chris White, Assistant Professor of Physics; Nickolas Solomey, Research Associate Professor of Physics. Postdocs: Alak Chakravorty, Xiaonan Li, Haibo Li, Yagmur Torun; technician: Bill Luebke; graduate student, Durga Rajaram; undergraduate student, Nathan Stobie. Members of the group not shown in this photo: Linda Klamp Spentzouris, Assistant Professor of Physics, and Project Manager Engineer Edgar Black.

BTeV will also search for CP Violation in the “b system,” hadrons containing bottom quarks. With the Main Injector in operation, the Tevatron will produce more than 400 billion b-flavored hadrons per year and 10 times as many c-flavored hadrons (containing charm quarks) per year.

“BTeV is well positioned to answer the most crucial questions in heavy flavor physics,” Kaplan said.

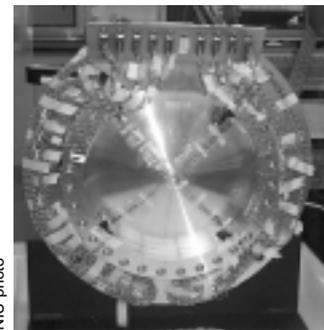
MINOS is the long-baseline neutrino experiment designed to detect neutrino oscillations. It uses two detectors 400 miles apart: one at Fermilab, and the other at the Soudan Underground Mine State Park in Soudan, Minnesota. IIT’s Chris White is the Level 3 Manager for MINOS Near Detector Plane Assembly, responsible for coordinating physicists’ efforts on the assembly and checkout in the New Muon Lab.

MuCool, a major ICAR effort, centers on developing techniques for cooling muon beams, critical to the operation of a future accelerator that would collide oppositely-charged muons. Heavier cousins of electrons, muons are produced in a range of energies and angles. The process of cooling reduces the spread of energy and angles, focusing the muons to make them useful as colliding beams.

Muon beams are also an effective means of producing neutrinos, and a muon accelerator could serve as a “neutrino factory.” Project Manager Engineer Edgar Black explained that IIT is leading the design of the cooling channel hardware in MuCool.

“This effort requires assembling all the components of the channel contained and supported by cryogenic and vacuum vessels,” Black continued. “The vessels are designed for fit and maintenance in small quarters, like in a tunnel. We are also trying new methods of photogrammetry, where we can measure the displacement of a pressure-stressed window without physically touching its delicate surface.”

ICAR grew from the concept of the muon accelerator as neutrino factory, proposed by Fermilab’s Steve Geer. IIT Physics Department head Tim Morrison suggested to Kaplan that a consortium for research at Fermilab could be an attractive proposition for a state grant aimed at insuring the lab’s long-term future. The group



NIU photo

Test of thin window for Muon Cooling energy absorber, being conducted by IIT, NIU and U of I at Urbana-Champaign.

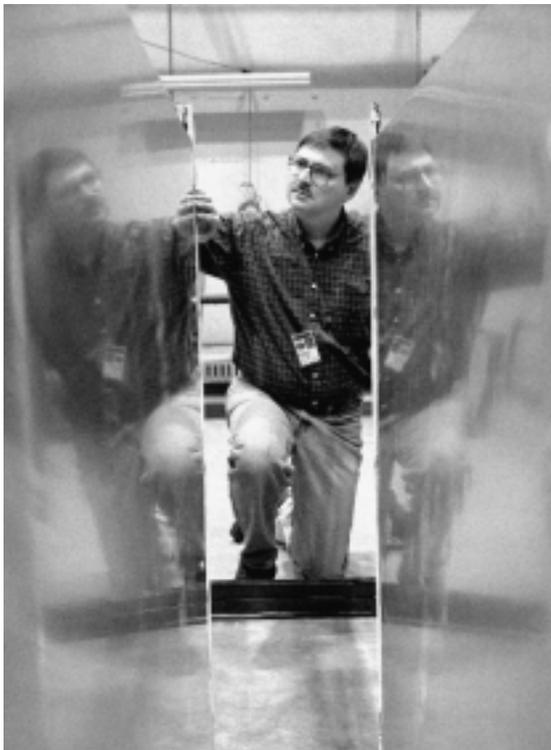


Photo by Reidar Hahn

Chris White is the Level 3 Manager for MINOS Near Detector Plane Assembly, responsible for coordinating physicists' efforts on the assembly and checkout in the New Muon Lab. He also coordinates integration of electronics and DAQ system with the Near Detector Hall infrastructure, and is responsible for designing and producing a component of the near detector electronics.

drafted a white paper in 1998, and Gov. George Ryan announced a \$600,000 planning grant at the 1999 dedication ceremonies of the Main Injector; the funds arrived about a year later.

Also in 2000, ICAR received a \$2.5 million grant from the Higher Education Consortium Agreement of the Illinois Board of Higher Education. And ICAR member Northern Illinois University received federal funds to establish the Northern Illinois Center for Accelerator and Detector Development. ICAR also has also mounted a substantial effort in Linear Collider research and development, especially important in light of the High-Energy Physics Advisory Panel recommendation of a Linear Collider as the next major machine.

"ICAR is really unique," Kaplan said. "I especially want to recognize the inspiration provided by Fermilab's Allen Tollestrup, whose vision has always encompassed the collaboration of high-energy particle physicists and accelerator physicists to help set the direction of the future."

True to its origins, IIT will have a large say in forming the vision of the high-energy physics future. 🌟

## PRIMARY SCHOOL PROGRAM LINKED LEDERMAN TO IIT



Fermilab photos

Fermilab's first three directors at the ribbon-cutting for the Lederman Science Education Center (from left): John Peoples, Leon Lederman, Robert Rathbun Wilson. Lederman (right) on the day of the announcement of the 1988 Nobel Prize for Physics, which he shared with Mel Schwartz and Jack Steinberger.

Ask Nickolas Solomey what drew him to the Illinois Institute of Technology, and he answers succinctly: "Leon Lederman."

Ask Lederman, Nobel Prize winner and Fermilab Director emeritus, what drew him to IIT a decade ago, and his answer is rooted in his concerns for science education.

"I was spending a lot of time on the IIT campus in 1990-92 while teaching at the University of Chicago," says Lederman, the Pritzker Professor of Science at IIT. "The Teachers Academy for Math and Science (TAMS) was headquartered at IIT. We were developing a program for teaching science and math to primary school teachers, and (IIT's) near south side location was ideal for the disadvantaged schools in the Chicago Public School system. I was also increasingly drawn by what I saw as a strong interest by the university in the problems of the city. So I transferred to IIT in 1993."

Lederman also points to the importance of Dan Kaplan joining the faculty and helping to create the Center for Accelerator and Particle Physics.

"That group has since demonstrated leadership in several Fermilab experiments," Lederman says, "including E871 (CP Violation in Hyperon decay), BTeV and others, as well as leading a consortium of Illinois institutions in obtaining support from the state for assisting Fermilab in accelerator R&D."

The Illinois Consortium for Accelerator Research (ICAR) was established through a \$600,000 grant from the State of Illinois to IIT, as part of a \$2.4 million Technology Challenge Grant program announced by Gov. George Ryan.

ICAR now includes five member universities: IIT, Northern Illinois University, Northwestern University, the University of Chicago and the University of Illinois at Urbana-Champaign. The language of the grant outlined "a five-year program to participate in technical investigations and site-specific planning for future Fermilab projects."

## Father of the Idea

Father Thomas Wickliff Ockham, Jesuit priest and particle physicist, is the author of *"The Mechanics of Grace"* and *"Superstrings and Salvation."* His favorite comfort clothes are jeans and a Fermilab sweatshirt.



Tim Toohig

Father Tom Ockham could be mistaken for the late Father Tim Toohig (1928-2001), a Jesuit priest, particle physicist, and cornerstone of Fermilab from its founding days (*FERMINEWS*, vol. 24, no. 17, October 19, 2001). But the resemblance, as the standard disclaimer puts it, is unintentional and coincidental.

"It's just serendipity, as far as I can tell," says James Morrow, author of the novel *"Towing Jehovah,"* in which Father Tom Ockham plays a major role.

"He [Toohig] was obviously a remarkable man: more than remarkable—transcendent—so I'm delighted if I paid him some sort of oblique homage. If I had anybody consciously in mind for my Thomas Ockham character, it was probably the Benedictine priest Rev. Stanley Jaki of Seton Hall University (who is both a theologian and a physicist). Plus dashes of Thomas Merton and Teilhard de Chardin. But Tim Toohig actually sounds much closer



"Towing Jehovah,"  
by James Morrow

to my vision of Father Ockham than any of those other three. I did tour Fermilab a year or so before I started writing *'Towing Jehovah,'* during a World Science Fiction Convention in Chicago in the 1980s, so possibly I picked up whisperings and intimations of Father Tim Toohig."

Ockham, named for the 14<sup>th</sup>-century English philosopher William of Ockham, of "Ockham's razor" fame, represents the Vatican in the most awesome salvage job in history. In *"Towing Jehovah,"* God has died, and his two-mile-long corpse has descended to rest in the Atlantic Ocean. Ockham directs the funeral procession: using an oil supertanker to tow the corpse to a sepulcher carved into an iceberg in the Arctic.

Morrow, winner of the World Fantasy Award, is at work on another novel with an even closer focus on physics.

"It's called *'The Last Witchfinder,'* he says, "and it's about the meeting that almost took place in 1725 between Benjamin Franklin and Isaac Newton. In my novel, they really do meet. The narrator is Newton's *'Principia'*—yes, this is a book written by a book—which enables me to talk about Heisenberg and Einstein and other post-Enlightenment scientists."

And as for those scientists' work attire...

"Do you really have Fermilab sweatshirts?" Morrow asks. "I was just making that up."

## Beyond Newton?

Benjamin Franklin was, indeed, tantalized by the prospect of meeting Sir Isaac Newton during his first sojourn in London from 1724 to 1726.

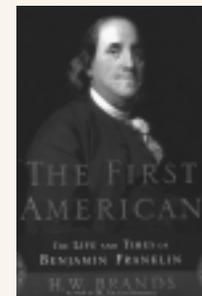
Franklin, barely into his 20s, wrote and printed an essay called "A Dissertation on Liberty and Necessity, Pleasure and Pain." As biographer H.W. Brands relates in *"The First American: The Life and Times of Benjamin Franklin,"* the essay brought Franklin to the attention of London surgeon William Lyons and his intellectual circle, including "...Henry Pemberton, a friend of Isaac Newton. Pemberton delighted Franklin by promising to introduce him to the great scientist; he disappointed Franklin by failing to fulfill his promise."

In his later years, Franklin thought and wrote of the physical sciences in ways that resonate in the 21<sup>st</sup> century. Brands examines Franklin's theories:

"'Universal space, as far as we know of it, seems to be filled with a subtle fluid, whose motion, or vibration, is called light,' Franklin wrote in a letter to the American Philosophical Society. The vibrations of light—sunlight, for example—heated objects on which the light fell by causing the particles of those objects to vibrate in turn.

Franklin used the word 'fire' to denote a combination of electromagnetic, kinetic and chemical energy—a combination about which he was rather vague (and, in fact, confused). He was not sure whether this 'fire' was something material or immaterial (although in this he unknowingly anticipated the Einsteinian equivalence of mass and energy). But he hit on a fundamental law of conservation of mass-energy: 'Thus, if fire be an original element, or kind of matter, its quantity is fixed and permanent in the world. We cannot destroy any part of it, or make addition to it; we can only separate it from that which confines it...'

He was called "Dr. Franklin" in his time, and he might have been called the same by Newton.



"The First American: The Life and Times of Benjamin Franklin,"  
by H.W. Brands

## CALENDAR

### FERMILAB LECTURE SERIES PRESENTS

#### Neutrinos Get Under Your Skin

Dr. Boris Kayser, Fermilab Theory Group  
Friday, March 1, 2002 at 8:00 p.m.  
Ramsey Auditorium, Wilson Hall

Admission: \$5 (tickets non-refundable)

Boris Kayser, who was raised on a chicken farm, earned his Ph.D. in Physics from Caltech. He served as Program Director for Theoretical Physics at the National Science Foundation for nearly 30 years before joining Fermilab last November

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

as Fermilab Distinguished Scientist. Kayser loves to understand the basic physics of a phenomenon and find ways to explain it in simple terms. He will describe the neutrinos' strange behavior, the role of neutrinos in shaping the universe, and the questions that Fermilab's neutrino research program will be trying to answer.

For 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. The box office opens at 7 p.m.

the night of the event for will-call pick-up and sale of available tickets. Please note that at this time only the Pine Street entrance to Fermilab is open, on the west side of the lab off Kirk Road. Check our web page at [www.fnal.gov/culture](http://www.fnal.gov/culture).

### 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.

## LETTERS TO THE EDITOR

### TO FERMINES:

I wanted to let everyone know how much I appreciated the very rapid and professional response of the lab's Environment, Safety and Health department when I fell and broke my leg in front of Wilson Hall on Jan. 7. Security was there and directing traffic in what seemed like a matter of seconds after Leo Bellantoni called from his cell phone. The Fire Department was right behind them, and it was obvious everyone was well trained and rehearsed in emergency response. The medical attention from the EMT's was very thorough, and I really appreciated the obvious concern everyone had to keep me as calm and comfortable as possible under the circumstances, especially

Billy Clayton, who rode the back of the ambulance with me to Mercy Hospital; and Mae Stroebel, who came up from Medical to be sure I had a blanket (and also kept the EMT's from slipping on the ice patch). The fall broke both bones in my lower left leg, and also dislocated the ankle. I spent half a day in surgery, and expect a long period of rehabilitation ahead of me. Now that I know how severe the injury really was, I especially appreciate the excellent attention I got "up front." And it reminded me again that one of the under-valued benefits of working at Fermilab is that people actually care about each other. My thanks to everyone!

— Mark Kaletka, Computing Division

### TO FERMINES:

The recent article "Recycling Antimatter" (*FERMINES*, vol. 25, no. 2, Feb. 1, 2002) may have given a misleading impression to your readers. As the head of the Alignment Group at Fermilab, I am writing to clarify.

There was no misalignment. When magnets are constructed, there are a series of measurements relating the internal workings of the magnets to marks on the outside called "fiducials." Those fiducials are then supplied to the alignment group. Unfortunately, there were small errors made in the original determinations of those fiducials, which were outside the exacting tolerances of the Recycler. Those errors ended up telling us to install the magnets in incorrect positions. To us, a misalignment means that we put it in the wrong place and I think that would also be the common inference.

Our group discovered the problems when the magnets were installed. We kept finding odd rotations and offsets which we decided could only arise if the magnets were not configured as described. We decided on our own to check.

The very first magnet we examined had a 0.2-inch discrepancy—20 times the allowed deviation. After that, we made a major effort to find and fix the remaining problems, which led to the success of the Recycler. I am proud of the perseverance and dedication that everyone showed. Our entire group worked very long hours to correctly measure the internal workings of the magnets, then to reanalyze and decide on new positions, and finally to reinstall the magnets correctly. These technicians and staff members worked for weeks and weeks, as hard as any graduate student I've met. However, they don't receive the kind of reward and recognition that a grad student can expect from being invited to a conference and giving a presentation. A little credit can go a long way.

So our professional pride was wounded, and I hope this letter sets the record straight. We feel as though we made the major breakthrough that led to successful Recycler operations. *FERMINES* is read worldwide by our peers at other accelerator laboratories, so we care deeply what is said.

— Bob Bernstein, AMG Group Leader

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11:30 A.M. TO 1 P.M.

\$10/PERSON

DINNER SERVED AT 7 P.M.

\$23/PERSON

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### LUNCH

#### WEDNESDAY, FEBRUARY 20

Three Cheese, Cabbage  
and Bacon Calzone  
Romaine, Radicchio  
and Arugula Salad  
Hazelnut Tart With Angelico  
Creme Anglaises

### DINNER

#### THURSDAY, FEBRUARY 21

Lentil Soup  
Grilled Rack of Lamb  
With White Beans and Spinach  
Fennel, Red Onion and  
Orange Salad  
Banana Chocolate Napoleans

### LUNCH

#### WEDNESDAY, FEBRUARY 27

Grilled Flank Steak  
With Rice Noodles and Vegetables  
Coconut Cake

### DINNER

#### THURSDAY, FEBRUARY 28

Sancocho con Postelotas  
Roast Suckling Pig  
Moro de Guandules  
Chayote Guisado  
Ensalada de Fruta  
Flan de Pina

## F E R M I N E W S

F E R M I L A B  
A U . S . D E P A R T M E N T O F E N E R G Y L A B O R A T O R Y

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Please include your name and daytime  
phone number.

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## CLASSIFIEDS

### FOR SALE

- '98 Jeep Grand Cherokee Ltd., silver, 4WD, 6 cyl, 56K, ac, ps, pb, pl, pw, pds, sunroof, AM/FM/cassette/CD, tint, alloy, luggage rack, and more! \$14,500. Tamara 630-579-4036, or Sergey x8313, los@fnal.gov
- '98 Dodge Dakota club cab SLT truck. Black with gray cloth interior, 3.9L V-6 engine, automatic 4-speed, PS, PB, AC, intermittent wipers, AM/FM cassette, tilt wheel, power locks, and windows, sliding rear window, rear cap and much more, 45K, 6 year/60,000 warranty. \$13,500, 630-505-0276.
- '95 Chevy Geo Metro LS: 5 speed, 4 door, <84k miles. New tires, muffler, clutch. 4 speaker AM/FM/cassette. Incredibly economical (mileage and insurance). \$1,800 obo. axel@fnal.gov, x8595.
- '94 Honda Accord EX, original owner, 79K miles. Very clean, features: 2.2 L VTEC engine, 30 hwy/23 city, 4 spd. auto, 4-wheel disc ABS, front & rear stabilizer bars, 6-speaker 20-watt anti-theft stereo, moon roof with sliding shade, power windows, locks & driver's seat w/ lumbar, tilt wheel, folding rear seat, color matched trim, front tires new in Dec. '01, complete exhaust new in Nov. '01, battery new in May '01, front and rear brakes replaced Aug. '99 (@56K miles), maintenance conducted as per warranty, all receipts available. Asking: \$7,700. Contact: Bill at 630-235-6952 or bscully@flash.net.
- '89 Toyota Celica GT Liftback, 2-door, 5-speed stick, cruise control, all power, excellent engine & gas mileage. Some rust. Must sell at the end of the month for departure. 119K mi, \$1,000 o.b.o.! tourneur@fnal.gov or x6849.

- 1973 Crestliner 14' boat with Sea Bird trailer. 5-1/2 HP Johnson Seahorse motor, 2-electric trolling motors, Garmin Fish Finder, dual anchors with cranks, miscellaneous fishing poles, tackle, vests, etc. \$3,800. Call 630-505-0276.
- 3.5 HP B&S gasoline powered teal water pump. Pump comes with approx 25' each of 2" dia suction & discharge hoses less than 10 running hours on unit. \$225.00 Mike Van Densen, x 4054 MVD@FNAL.GOV
- 1 set of 33\* 12.5 BF Goodrich tires on 15\* 10 Eagle polished aluminum rims \$800, 1 Draw-Tite Class 3 hide-a-hitch W/2" receiver for S10 or S10 Blazer, \$150, 1 Snowmobile steel trailer with tilt, spare tire. Set up for quads. \$400, 1 fiberglass Century truck cap. Black. For short bed. For S10, sliding window in front. Sliding side windows with screens. \$500. Call x 3691.
- Viking 1+ sewing machine with embroidery unit. 8 years old, excellent condition. Includes 4 embroidery cards (#1, #4 - Holidays, +12 - Flowers, card of crests and shields from embroidery library): stitch cassettes A, B, D, F, L: extra feet - ruffler, walking foot, 1/4" piecing foot, bias-binder application foot, open-toe applique foot, edge-stitching foot, piping foot: instruction manuals: binder of embroidery designs available from Viking. \$1,400. Contact Liz Buckley-Geer x8650, buckley@fnal.gov.
- PDA - Handspring Visor Platinum. Palm OS, 8MB RAM, 33MHz processor, expansion port. With USB synch cradle, cover, case, screen protectors, all software and packaging. Includes Date Book, Address Book, To Do List, Memo Pad, Fast Lookup, Advanced Calculator, World clock, Handwriting software, E-Mail, Expense, and more. \$175. Matt 630-674-7448.

- Antique drop-leaf table on rollers, excellent condition. \$200 firm. Call Arlene Carey at 630-264-7981.
- Quart storage jars with snap lids \$1 each, double Co<sub>2</sub> regulator \$70, 2.5 lb. Co<sub>2</sub> bottle new \$60, Mich bar light \$10, large cooler \$10. x4604 or 630-557-2523 Greg.
- Furniture refinishing and restoration. Pick-up and delivery services available. Call x3762 or 815-695-5460.
- Twin-size couch that opens to a bed, floral pattern, asking \$75.00. Call Ed. 630-879-9404.

### ROOMS FOR RENT

- Two rooms available for rent immediately in 4 bedroom apartment in West Chicago. Large kitchen, 2 bathrooms, close to Metrail stop \$243/month plus utilities. x8413 or bolshov@fnal.gov

### CALICO CAT AVAILABLE

- Tiger, a 2-yr-old female calico, has been fixed & declawed (front only) by her previous owner. She is a very friendly housecat, but can no longer stay with us due to increasing severity of children's allergies & asthma. If interested, call Bill at x2689, or email barker@fnal.gov.

### NOON BIBLE CLASS

- Each Wednesday at noon, in the Huddle off the Cross Gallery. The 1-year study will end soon. Our next topic is Heaven—How to Get There. You are invited. Jeff Ruffin x4432, ruffin@fnal.gov.

## MILESTONE

### AWARDED

To Nicole Bell (ID 13376N), postdoctoral researcher in the Theoretical Astrophysics Group: the Bragg Medal of the Australian Institute of Physics. The

medal is given each year to the author of the best Ph.D. thesis in all areas of physics throughout Australia.

## LAB NOTES

### BLOOD DRIVE, MARCH 19

Fermilab's blood drive will be held on March 19, 2002 9am to 2pm at WH Ground floor EOC room and the NE ES&H Training Room. Due to the overwhelming turnout we had last summer, we are expanding our efforts to have more Heartland Blood Center staff on hand to shorten the waiting time. Please call Lori Limberg at ext 6615 or email LLimberg@fnal.gov to schedule an appointment. Walk-ins are welcome (we will try to work everyone in), but scheduled appointments will take priority.

### URA SCHOLARSHIPS REQUIRE SAT TEST SCORES

Universities Research Association (URA) awards a number of scholarships to children of regular, full-time Fermilab employees. URA scholarships are awarded on the basis of SAT (Scholastic Aptitude Test) scores. Scholarship candidates must be high school seniors who will begin a four year college degree program next fall. The maximum amount of the scholarship is \$3,500 for tuition and fees, and is renewable for four years for students in good academic standing. Applications are available January 1 through March 1. Scholarships will be awarded in early April. Questions about the program may be directed to Jeannelle Smith of Human Resources, Mail Station 124, x4367.

### HOUSING ASSIGNMENTS – SUMMER 2002

The Fermilab Housing Office is now taking requests from Users for houses, apartments, and dormitory rooms for the Summer of 2002. Since there will be a large influx of experimenters during the summer, 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 March 1, 2002. Requests can be made for any period and need not commence on any particular date. For further information, please contact the Housing Office at: Telephone: 630-840-3777 Fax: 630-840-2823 Email: housing@fnal.gov

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