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Lab Partners: NSF and DOE

by Leila Belkora, Office of Public Affairs

On a spring day in Chicago, if you long for the crack of the bat and the scent of mustard on hotdogs, head to Wrigley Field. In the seventh inning stretch you'll sing a chorus of "Take Me Out to the Ball Game," along with announcer Harry Caray; baseball at Wrigley just wouldn't be the same without it. After the game, should you travel about 40 miles west to Fermilab, you'd find another essential pairing: Fermilab depends on funding from the Department of Energy, but high-energy physics here would be incomplete without the support of the National Science Foundation, as well.

NSF's largest contribution at Fermilab is to the collider program. At DZero, seven NSF-supported groups built the central drift chamber, the trigger system, the calorimeter electronics, and other components of the detector. At CDF, NSF-supported groups contributed heavily to the vertex detector and trigger. A report recently drafted by a special panel at the funding agency states that the 12 universities with NSF-funded groups on the collider experiments—Arizona, Columbia, Illinois at Chicago, Michigan State, Northern Illinois, Notre Dame, NYU, and Stony Brook at DZero, and Chicago, Johns Hopkins, Rochester and Rutgers at CDF—together received $4.86 M from NSF in 1995. An indication of NSF's high visibility in the collider program is that both experiments have had co-spokesmen from NSF-funded university groups.

NSF also funds fixed-target experiments and special projects at Fermilab. The agency supports groups at KTeV and NuTeV, where experimenters hope to shed light on CP violation and neutrino-nucleon scattering, respectively. Two experiments related to charm quarks, E831 and E835, are supported in part by NSF. This year, approximately 70 graduate students are receiving their training in NSF-funded research groups both at collider and fixed-target experiments. On a smaller scale, NSF grants to Fermilab augment research in cosmology and facilitate international collaborations in particle physics with India and Korea.

In dollars, NSF's contribution to the national high-energy physics program is about 10 percent that of DOE. Fermilab physicist Joel Butler, who heads the Computing Division, cautions, however, that the numbers don't tell the whole story. "NSF's importance is larger than its fraction of the budget," he says. "There are serious problems for the field [of high-energy physics] when the NSF has problems." Butler served on the NSF Special Emphasis Panel that reported to the High Energy Physics Advisory Panel in February 1996. The Special Emphasis Panel reviewed NSF's priorities and strategies for coping with the current squeeze on the federal budget.

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Inside

A PARTICLE PHYSICS TRAILBLAZER

Wonyong Lee receives Korea's most prestigious award and inspires a new generation of particle physics research by Korean groups at Fermilab

by Donald Sena, Office of Public Affairs

Wonyong Lee, a professor at Columbia University and mentor to two generations of physicists at Fermilab and beyond, recently won Korea's prestigious Ho-Am Prize for his significant contributions to the field of high-energy physics.

The Ho-Am prize, awarded by the Samsung Welfare Foundation, carries a $60,000 award for Dr. Lee and another $50,000 to support his research. The Foundation announced the award on February 7, and the Columbia physicist received it at a March 22 ceremony in Seoul. The Ho-Am prizes are awarded each year to people born in Korea but living anywhere in the world and working in one of six fields: basic science, engineering, medicine, arts, communication and social service.

Besides his own contribution to particle physics, Lee has had a significant effect on many scientists at Fermilab. John Peoples, Fermilab's director; Associate Director Tom Nash; Jeff Appel, head of the Physics Section; the late Mike Gormley and Main Injector project manager Steve Holmes are all former students, postdocs or colleagues of Lee. The Columbia physicist was also instrumental in opening opportunities for Korean groups and universities to perform research at Fermilab, as well as persuading the Korean Ministry of Science to support the endeavor.

Photo by JOE PINEIRO of Columbia University

Wonyong Lee recently won Korea's most prestigious award, the Ho–Am Prize, for his work in particle physics.

In a letter congratulating Lee on his award, Peoples said, "I am delighted at this recognition of your many achievements in our field throughout a distinguished career over many years. In addition to the profound effect you had on my own career, I want to also note your important and successful efforts to help establish high energy physics research in Korea; Korean scientists are now playing a significant part in the Fermilab program."

LEE'S RESEARCH HISTORY

As an assistant professor at Columbia in 1965, Lee teamed up with Leon Lederman, now director emeritus of Fermilab, and Samuel C.C. Ting, among others, to investigate antimatter. The Columbia group, working at Brookhaven National Laboratory on Long Island, produced the antideuteron. "The discovery was the first observation of the strong force that holds nuclei of atoms together acting in an anti-nucleus, which told physicists that antimatter obeys at least some of the same laws as matter does," according to a Columbia University release announcing Lee's award.

Soon after that experiment, Lee headed a study at Brookhaven, the "eta experiment," which researched C violation in electromagnetic interactions. Peoples was an assistant professor at Columbia and Nash was a graduate student on that study.

"We grew up with that experiment," said Lee.

Nash said the eta study was significant not just for the physics, but because it was one of the first on-line experiments. He added that the experiment used some of the first automatic tracking systems—techniques considered very difficult at the time. He said this study and other work with Lee prepared him for his future as a researcher.

"He trained you to have an extremely thorough analytical view of what you were doing, both in terms of designing an experiment and analyzing it," said Nash.

In the 1970s, a collaboration of researchers from several universities, including Columbia, did a series of experiments in Fermilab's wideband photon beam. The study was the first to observe the photoproduction of the J/psi meson, and the collaboration reported the first observation of a charmed baryon. The team also observed and measured more photo-produced charmed particles. The experiment, known as E87, ran until 1978, according to Holmes, who was a Columbia postdoc at the time. Among the people working with Lee were Peoples and Joel Butler, now head of Fermilab's Computing Division.

"We have a lot of students from E87 who are very successful and doing great things at Fermilab," said Lee, the study's spokesman.

Collaborators on that experiment cite Lee's leadership as one of the reasons for its success.

"I regarded Wonyong as the intellectual leader of the E87 effort," said Holmes. "Wonyong is among the most imaginative physicists I have worked with."

E87 laid the groundwork for future experiments with similar themes, including E687 and E831. Currently, the professor is involved in a number of studies, including a cosmic ray experiment.

Wonyong Lee, John Peoples and Leon Lederman at a 1972 experiment.

The type of research that Lee has done over his career receives recognition from many quarters. Jim Griffin, legislative aide for Rep. Charles Rangel (D–NY), said the Congressman, who represents the district that includes Columbia University, supports government-sponsored science and research. Noting that a balance must be struck between applied and basic research, Griffin added that the search for and study of the most basic constituents of matter is "kind of a divine question; it's inspiring and compelling on a lot of different levels."

RETURNING TO FERMILAB

After a bit of a hiatus from Fermilab, Dr. Lee will return for the NuMi project—the search for neutrino mass. Scientists hope to conduct two experiments that will take advantage of the Laboratory's newest accelerator, the Main Injector, now being built. Experimenters will direct a particle beam of pure muon neutrinos toward a nearby detector (COSMOS) on Fermilab's campus and toward a far-off detector (MINOS) in Minnesota. If either detector finds another flavor of neutrino besides muon, then neutrinos must have oscillated, and hence must have mass. Lee and Yunsil Ho, also from Columbia, are working to design beams with well-understood systematics and electronics for the long-baseline experiment. Ho has also played a key role in the narrow-band beam analysis. Former collaborators said they look forward to Lee's presence at Fermilab again.

"For one reason or another, Wonyong's interests turned to different places, but now he is engaged in MINOS, so it will be good to have him back," said Peoples.

KOREAN INFLUENCE

Peoples said Lee helped begin a tradition of Korean physicists engaging in research at Fermilab. At first, according to Lee, Korean professors and students came here with the help of Fermilab funds, but more recently the Korean government has contributed increased support to the research effort.

Many Korean institutions currently engage in research at Fermilab or have worked here in the recent past, including Korea U., Kyungsung U., Seoul National U., Gyeongsang National U. and Chonnam National U. Presently, the team from Korea University, led by Joo Sang Kang, is working primarily on analysis for E687 and preparing for E831, two descendants of E87.

Kang recently had two students receive Ph.D.s for work at Fermilab. Byung Gu Cheon earned his degree for work on E687 and C.L. Kim for his studies as part of the DZero collaboration, one of Fermilab's collider experiments.

In addition, Seoul National University has a few people at Fermilab working on fiber tracking upgrades for the DZero detector and analyzing data from the recently completed Run Ib.

Lee said he hopes that the Korean groups will continue their work at Fermilab, stressing that international collaborations in high-energy physics will ensure a rich future of research and, hopefully, discoveries. He added that the scientific community cannot afford "redundancy" in worldwide particle physics research and must work together to plan the future.

"There are so many important questions to be answered. If we physicists get together and identify our priorities—and pursue them—we will continue to be successful," said Lee. ❑

Photo by REIDAR HAHN

Scientists and students from Korea University at their experiment on the Fermilab campus.

Awards Honor Fermilab Inventors

by Judy Jackson, Office of Public Affairs

Sixteen Fermilab employees received Records of Invention awards at a ceremony on the Wilson Hall crossover on March 20, 1996. Certificates and cash awards honored staff members who made inventions at the Laboratory during 1995. John Venard, of the Office of Research and Technology Applications, who presented the awards, thanked the inventors and called the Records of Invention process an important step in transferring technology developed at Fermilab to potential applications beyond high-energy physics research.

FermiNews profiles one of the inventions from this year's list of ROIs on page 5. Future issues will examine more of these good ideas from people at Fermilab.

Photo by REIDAR HAHN

Bob Angstadt (right) co-inventor of manufacturing process software, talks with John Venard of the Office of Research Technology Application, and Regenia Richardson, co-inventor of a portable system for purifying neon gas.

INVENTIONS OF THE YEAR

The ceremony recognized: Muzaffer Atac, of the Research Division, and Timothy McKay, of the Physics Section, for a high resolution mammography device for detecting malignant tumors at an early stage .

Cary Kendziora, of the Research Division and John Anderson, Jr., of the Accelerator Division, for a visual robotic welding process that resembles arthroscopic surgery for leaky pipes. The device allows a remote operator to operate a welding arm inside a pipe, using an electronic monitor to control and operate the device in areas inaccessible to a welder .

Carol Johnstone, of the Accelerator Division, for a multipurpose facility design for a linear accelerator that relies on charge-changing an H-beam to manipulate intensity and individual beam characteristics, without generating radioactive areas and waste, as is the case when collimators are used.

Hans Jostlein, of the Physics Section, for a ball pyramid for the quick calibration of coordinate measuring machines. The Ball Pyramid software checks a set of test data to identify most CMM problems.

Carl Lindenmeyer, of the Physics Section, for a self-constrained mandrel that provides an alternative to usual methods for fabricating composite tubes. Lindenmeyer received a second award for a sandwich panel hole-reinforcement system for facilitating the process of making the holes to attach honeycomb or similar lightweight core panels.

Richard Bossert, of the Accelerator Division, for a high-voltage resonant frequency amplifier for driving the accelerating D's of a small cyclotron used for gas analysis. The amplifier's operating principle takes advantage of the high voltage developed in a series LC circuit at resonance.

Robert Angstadt, Alan Bross and Marvin Johnson, all of the Research Division, for a dual-axis micrometer, generalized software that allows use of an available commercial instrument for recording, monitoring, and controlling manufacturing processes based on measuring the vertical and horizontal diameters of an object.

Angstadt and Johnson were also recognized for BIT3.DLL, software to access VME memory. The software "BIT3.DLL," is a Microsoft Windows Dynamic Link Library that allows a user to access VME directly from an Excel cell.

Robert Sanders, Michael McGee and Roger Rabehl, all of the Research Division, for a weir flow meter for measuring the liquid flow rate of a saturated liquid in two-phase flow in a closed piping system.

Regenia Richardson and Richard Schmitt, of the Research Division, for a portable neon purification system that purifies neon gas by purging air with carbon dioxide, freezing the carbon dioxide, then cryoadsorbing the remaining contaminants.

Alan Bross, of the Research Division, for triangular scintillating strips that use geometry and the properties of plastic scintillator to track the paths of charge particles. The DZero detector upgrade will incorporate this technology in its preshower detector. ❑

Profile of a Good Idea:

Flashing Triangles for DZero's Upgrade

FermiNews examines one of the dozen Fermilab inventions that won Records of Invention awards on March 20. Future issues will profile other good ideas from the list on page 4.

by Don Lincoln, Research Fellow, University of Michigan, DZero Collaboration

An invention by Fermilab physicist Alan Bross that uses high-school geometry and off-the-shelf plastic scintillator will help DZero's collider detector track particles from proton-antiproton collisions in the era of Main Injector physics at Fermilab. To make a device that works this well using conventional technologies would require twice as many electronic channels. Electronics are often the most expensive component of a detector, so the triangular scintillator offers the potential for substantial cost savings.

A detector made of interlocking triangular scintillating strips works on the principle that the amount of signal seen in a strip varies with the amount of material through which a charged particle passes.

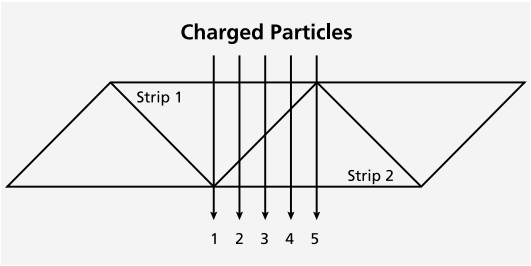


Figure 1

For example, in Figure 1 (above), charged particle #1 passes through a lot of material in strip 1 and no material in strip 2. Therefore, if a particle generates a large signal in strip 1 and little in strip 2, then we can locate the particle's position near the center of strip 1. Charged particle #5, would generate a large signal in strip 2, but little in strip 1. For charged particles #2, 3, and 4, where the particles cross two strips, a simple equation gives the position in terms of the signals in each of the strips. Tests of this idea show that one can pinpoint the position of a charged particle with a precision at least 15 times smaller than the base of the triangle. For instance, in this test the base of the triangle is 9 mm and the precision of the measurement is 0.56 mm, about the thickness of a sewing needle. ❑

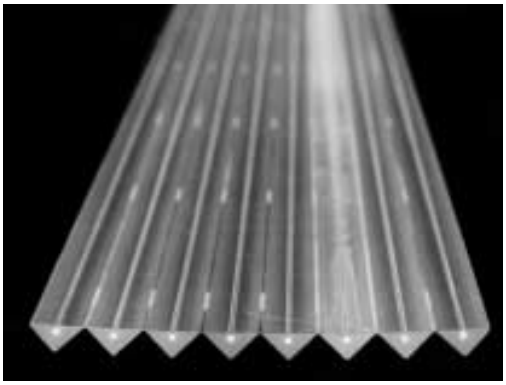


Figure 2

Figure 2. End view of a prototype tile of triangular cylindrical grooved strips of plastic scintillator. The device starts with a sheet of plastic scintillator. First, parallel grooves are milled into one side. Then triangle cross-section strips are milled into the other side. The result is a tile of straight, parallel, triangular strips. Wavelength-shifting fibers are then slid into the grooves. A second identical tile is interlocked with the first, as in the cross section. When a charged particle crosses the strips, it generates blue scintillator light. This light bounces into the optical fiber, which converts it to green light and guides the green light out to a photodetector for electronic readout.

In the actual detector, the triangular strips will be formed by extruding the scintillator and gluing the strips to a sheet of metal to make a tile.

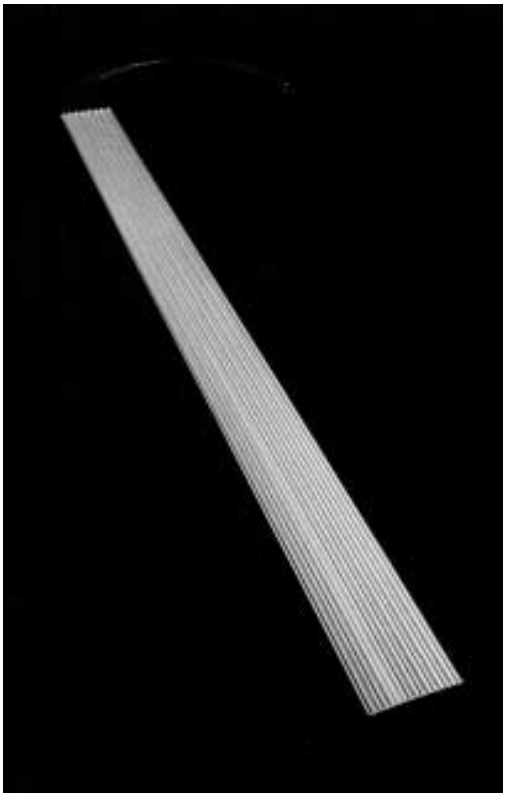


Figure 3

Figure 3. Lengthwise view of a single tile of triangular scintillating strips. The tile is 39" long, and about 3.25" wide. At the far end, wavelength-shifting fibers emerge from the strips. They transport light from the scintillator to photodetectors.

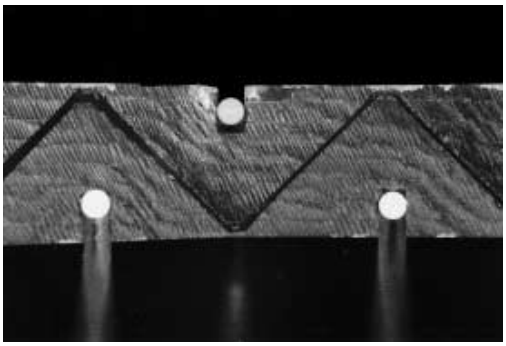


Figure 4

Figure 4. Cross-section of two interlocking tiles configured as they will be used. Triangles will be wrapped in mylar to keep light from passing between adjacent strips.

Michigan's Full Court Press on Fermilab

Its football and basketball teams get much of the attention on campus, but the University of Michigan's high-energy physics program fields a talented group as well.

by Donald Sena, Office of Public Affairs

For 25 years, the high-energy physics group from the University of Michigan has taken advantage of Fermilab's ever-progressing physics tools, from early bubble chambers to the Tevatron, the world's highest energy particle accelerator. And as the Laboratory prepares to "up" the stakes with its newest accelerator, the Main Injector, the Michigan staff has positioned itself once again at the frontiers of particle physics research.

Building upon a deep history of experimentation, the University of Michigan has a team working on upgrades for the Collider Detector at Fermilab (CDF) experiment and a separate group for the DZero experiment—the Laboratory's two collider collaborations. The university will also participate in fixed-target experiments set to begin this summer, as well as in the future NuMI (Neutrinos at the Main Injector) project, the search for neutrino mass. J. Chapman, physics professor at UM, said this array of work is indicative of the broad range of interests and expertise within the large high-energy physics group at the school. Dan Amidei, another Michigan professor, added that the university's proximity to Batavia, Ill. fosters the close relationship between Michigan and Fermilab.

"There is the ability to sit on the cutting edge [of physics] only 270 miles away...," said Amidei.

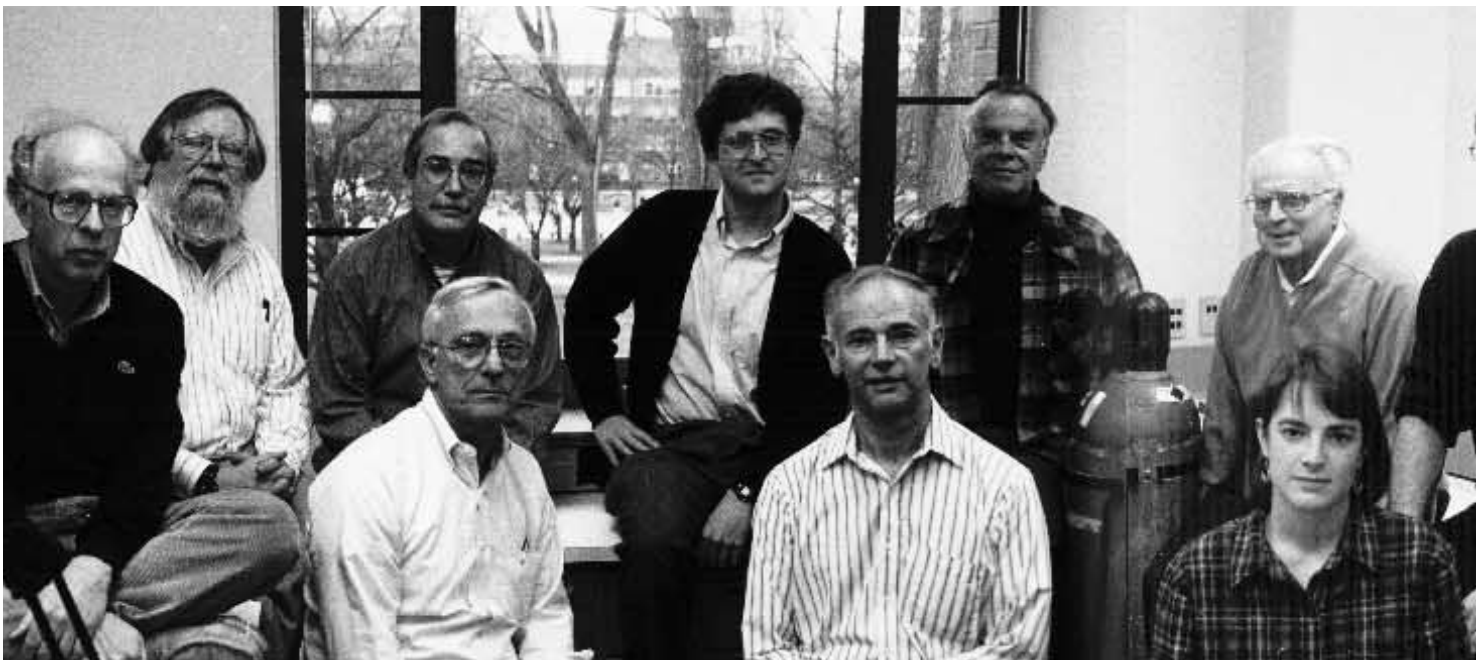
A LONG HISTORY

From Fermilab's infancy, Michigan has had several groups at the Laboratory. A bubble chamber team, led by Jack Vandervelde, Dan Sinclair, Byron Roe and Chapman, performed experiments with the 30-inch chamber in 1971, sending protons into liquid hydrogen to study particle multiplicity. The same group did several experiments with the 15-foot chamber. Another team, led by Donald Meyer and Carl Akerlof, performed "counter" experiments in the Meson line.

Progressing with the Laboratory's advancements over the years, Michigan participated in more than 20 fixed-target experiments in the 1970s, 1980s and early 1990s. For example, a team collaborated in the search for charm particle production in hadron collisions in 1975–76. In the early 1980s, another Michigan team experimented with a "beam dump" to look for prompt neutrinos as a signature of charm particle production.

PROGRESSION TO THE PRESENT

In 1984, as postdocs at the University of Chicago, Amidei and Myron Campbell worked



The Michigan team: (Front row, left to right) Carl Akerlof, J. W. Chapman, Mike Longo, Colleen Murphy, Bob Ball.

(Back row, left to right) Dave Nitz, Jim Matthews, Keith Riles, Larry Jones, Don Meyer, Dante Amidei, Byron Roe, Jianming Qian, Homer Neal, Myron Campbell.

on the original construction of CDF. A few years later, Amidei joined the Fermilab staff where he was the co-project leader on the silicon vertex detector development. By 1990, both Campbell and Amidei were at Michigan.

As Amidei continued his silicon detector work, Campbell and Chapman, along with other collaborators, developed a trigger system for CDF. In colliding beam physics, the proton beam and antiproton beam "cross" every 3.5 microseconds, and each "crossing" has one or more interactions. However, an "interesting," or potentially meaningful, event occurs about once every second. The triggering system selects only the meaningful interactions for physicists to analyze later. When the trigger system chooses an event to record, it omits others—a necessary sacrifice, according to Amidei. Thus, the trigger system must be carefully designed or experimenters will miss important data.

As the Run I data set accumulated, the Michigan group turned its focus to the hunt for the top quark with important contributions from postdocs David Gerdes, Soo-Bong Kim and Steve Vejcik. The entire team is also working on the critical upgrades for the detector, including more trigger system development.

DZERO

Along with CDF, Michigan also covers Fermilab's other collider experiment, DZero. Homer Neal and Jianming Qian are Michigan's lead staff on the experiment. A group of collaborators, led by Neal, built the Inter Cryostat Detector for Run I, which is a scintillating fiber-based detector. The ICD has been an effective tool in determining jet energies in the region between the endcap and central calorimeters, according to Qian. For the detector upgrade, the UM collaboration's main responsibility is developing the central preshower detector, whose main purpose is electron triggering and identification. The Michigan DZero team is also working on analysis of Run I data for top physics; Sailesh Chopra, Frank Hsieh and Norm Amos have been key players in this project.

Chapman says he likes the fact that Michigan has teams at each of the competing collider detectors.

"It's nice to have seminars and colloquia [on the UM campus] that have representatives from the two hottest things around," Chapman said.

Moreover, knowledge of Michigan's high-energy physics research is not confined to Fermilab or the university. Rep. Lynn Rivers (D–Mich.) and her staff have also followed their work. Rivers is a member of both the Basic Research and Energy and Environment subcommittees of the House Science Committee.

"You don't even have to look at the [university] to know what they are doing. Any time you look at high-energy research, the University of Michigan's name will come up," said Tony Gibson, the Congresswoman's legislative assistant for science issues. For example, "With the top quark and the competing research teams [DZero and CDF]—the University of Michigan was only one of a small handful [of institutions] that had researchers on both teams. That's exciting."

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PHYSICISTS CONTEMPLATE NEW DIRECTIONS FOR HEP

Butler, Ron Ray of the Research Division, and other physicists at Fermilab agree that budget austerity in Washington D.C. is putting pressure on research in high-energy physics and influencing the relationship between universities and the national labs. "They need each other," says Butler, of DOE and NSF-funded institutions and groups, "but there are also tensions." Ray asserts, "There's a danger to high-energy physics if university groups become weak."

One troublesome issue concerns the ability of university groups to contribute to the building of detector elements and electronics. Ray believes that the funding agencies are concerned about the duplication of resources such as machine shops at universities and at the labs. Butler sees the "center of gravity" of detector-building activity moving to the labs, which means that students and professors will increasingly reside at the labs and maintain less of a presence at their home institutions. Universities are understandably concerned about this erosion of their research infrastructure. The reason for this, Butler says, is that the national labs can provide more continuous support for engineers and machinists. In a small university group, Butler explains, "each person brings a unique capability; if you have to let an engineer go [because a project has come to an end], you may completely lose some capability....At the lab, there's always something on the table so that you can productively swing someone to a new project."

"DOE and NSF should together develop an overall rogram that provides the est scientific pportunities for the U.S. in LHC."

NSF Special Emphasis Panel

Concerns about the health of high-energy physics research in times of lean budgets have prompted NSF leaders to re-examine the research program as a whole. "NSF is in danger of spreading itself too thin," says Fermilab user Nick Hadley, a member of the Special Emphasis Panel and professor at the University of Maryland. The panel recommends that NSF review not only individual proposals, but large collaborative projects as well. The new strategy is "an attempt to add a 'big picture' element to the [high-energy physics] program," explains Hadley. "It's an attempt to prioritize, but it also means you look to see that the program as a whole makes sense, and allows for new initiatives." The Special Emphasis Panel calls for assessments of collaborative programs, reviews of mature programs about two years prior to their nominal termination to determine their impact on the field, and provision of resources for initiatives such as U.S. involvement in the Large Hadron Collider in Europe.

BALANCING LARGE AND SMALL EXPERIMENTAL EFFORTS

It's too early to know what changes the current programmatic review will bring to the field of high-energy physics, but researchers at Fermilab and at universities with strong HEP programs expect the impact of the reviews to be significant. Hadley predicts "the big departure will come the first time a review panel says no" to a project as a whole.

The attempt to prioritize goals in high-energy physics will certainly require more communication between DOE and NSF. A specific recommendation of the Special Emphasis Panel, in its report to HEPAP, is that "DOE and NSF should together develop an overall program that provides the best scientific opportunities for the U.S. in LHC."

For his part, Butler worries about the "intellectual diversity" issue of balancing large, high-priority efforts with smaller, higher-risk experiments that he says have sometimes, in the past, come up with important new results. "Lots of us are rooting for small experiments like that of Kam-Biu Luk," he says. Luk is a spokesperson for E871, the search for direct CP violation in hyperon decays. Butler, who adds parenthetically that he tries to run the Computing Division the way Red Auerbach managed the Celtics, explains his support for small experimental programs this way: "It's like rooting for the Cubs," he says. "It's sort of a long shot, but maybe someday they'll win." ❑

Photo courtesy of NSF

he National Science Foundation building in Arlington, Virginia.

Paint Marks Magnet Milestone

by Judy Jackson, Office of Public Affairs

Urged on by his colleagues in the Permanent Magnet Group, technician Billy Jones of the Technical Support Section rolled a coat of blue paint onto the steel case of the first permanent magnet of the 8 GeV transfer line that will take protons from the Fermilab Booster to the new Main Injector accelerator. The March 21 event marked one more Fermilab milestone in accelerator history.

The use of the magnets in the 8 GeV line will represent the first large-scale use of permanent magnets in a particle accelerator. Advances in permanent magnet technology, including the use of new materials, make the magnets an attractive choice for some accelerator applications.

Permanent magnets offer particular advantages over electromagnets, such as those in the Main Ring and the Tevatron, in transfer lines and storage rings that use low-field magnets and where ramping, or varying the magnetic field, is not required. Because permanent magnets use magnetic materials instead of electric current to create a magnetic field, they are reliable and economical. Permanent magnets also offer high precision, with the capability of achieving specified magnetic field strength to an accuracy of one part in ten thousand.

Physicist Bill Foster and engineer Mike May, both of Fermilab's Accelerator Division, designed the new magnets, taking the technology from prototype to first production magnet in about 12 months. Members of the Technical Support Section, under the leadership of Project Manager Hank Glass and Project Engineer Tom Nicol, will build the 41 dipole magnets and 67 combined-function, or gradient, magnets for the 8 GeV line. The group expects that magnet installation will begin in October, 1996, with beam in the beamline by February, 1997.

The permanent magnets use 4" x 6" x 1" bricks of magnetized strontium ferrite, stacked around the beam pipe inside the steel case of the magnet. "It's a simple and forgiving design," said Foster. "Since there are no coils, if you make a mistake you take the magnet apart and put it back together again. If you make a mistake in winding a Tevatron magnet, you have to start over."

A Department of Energy review in September, 1995, approved the use of permanent magnets for the 8 GeV transfer line. Original plans had called for reusing electromagnets from the Main Ring accelerator, which the Main Injector will replace. Using the permanent magnets instead will minimize accelerator shutdown time and spread the work of installing the 8 GeV line over a longer and more manageable period. Substituting permanent magnets will also save an estimated $25,000 in annual power costs when operations begin.

Fermilab plans to use permanent magnets in another accelerator in the near future—the new Recycler Ring that will take the antiprotons left at the end of a Tevatron store and recycle them, yielding increases in Tevatron luminosity beyond those achievable with the Main Injector alone. "In a sense, the 8 GeV magnets are a trial run for the Recycler," Foster said. "We're cranking up to build a giant antimatter bottle at Fermilab." ❑

Photo by REIDAR HAHN

Technician Billy Jones of the Technical Support Section paints the first permanent magnet of the 8 GeV line that will transfer protons from the Fermilab Booster to the new Main Injector accelerator. Physicists Bill Foster and Hank Glass, technicians Lee Benson and Glenn Smith, and engineer Tom Nicol join in marking the milestone event.

FERMILAB CALENDAR

APRIL 6

Fermilab will host a "Family Challenge" 5K Run and and one mile and one-half mile fun run to benefit Drug Abuse Resistance Education (D.A.R.E.). T-shirts for all, prizes for winners in several categories. Prepaid registration $14 adult, $8 under 15, $30 family. Call Officer Karen Miller of the Addison Police Department (708) 543-4100 x238.

APRIL 12

The Fermilab International Film Society will show BROTHER'S KEEPER at 8 p.m. in Ramsey Auditorium. A documentary about an illiterate dairy farmer accused of murdering one of his three brothers. Filmed as the story unfolded, this film has the drama and tension of a big-budget Hollywood thriller. Limited distribution, so don't miss it here! Dir: Joe Berlinger, Bruce Sinofsky, USA (1993). Admission $4.

APRIL 13

The Fermilab Arts Series presents a choreographer's showcase - Jellyeye Drum Theater, Jan Erkert & Dancers. These artists from Ballet Chicago feature a diverse mix of some of the best dance Chicago has to offer. The company of five dancers will perform Whole Fragments, a multimedia work created in 1995 set to John Adams' "Shaker Loops."

The showcase will include a performance of Blood Lotus, a compositionally and choreographically complex work that challenges the physical limits of the performers as it spirals through an ever-changing field of rhythm and motion. Tickets $15. 8 p.m., Ramsey Auditorium. Call (708) 840-ARTS for information and reservations.

APRIL 14

Arianna Quartet. Fermilab's quartet in residence performs its final concert of the season. Tickets $5 at the door. Call Janet McKay at x2059 for more information.

APRIL 15 - JUNE 24

Step Aerobics classes Monday & Wednesday from 5:45 - 6:45 p.m. in the exercise room of the Recreation Facility. $50.00 for each 10-week session, paid prior to start of the session. Call x2548 or mail your name, class name and check, payable to Bod Squad, to M.S. 126. You must be a current facility member. Contact: Jean Guyer, X2548 or email jeanm@fnal.gov

APRIL16

Blood Pressure Screening. User's Office, 11:30 a.m. -1p.m.

APRIL 16 - JUNE 20

Muscle Toning classes, Tuesday & Thursday, 5:30 - 6:30 p.m. in the exercise room of the Recreation Facility. $50 per 10-week session, paid prior to start of the session. Call X2548 or mail your name, class name and check, payable to Bod Squad, to M.S. 126. You must be a current facility member. Contact Jean Guyer, x2548 or email jeanm@fnal.gov

APRIL 18

The Wellness Works Committee presents a lecture, "Recognizing and Treating Depression" by R. Leider, MD & J. Schneider, MD. Noon-1 p.m., One West.

APRIL 24

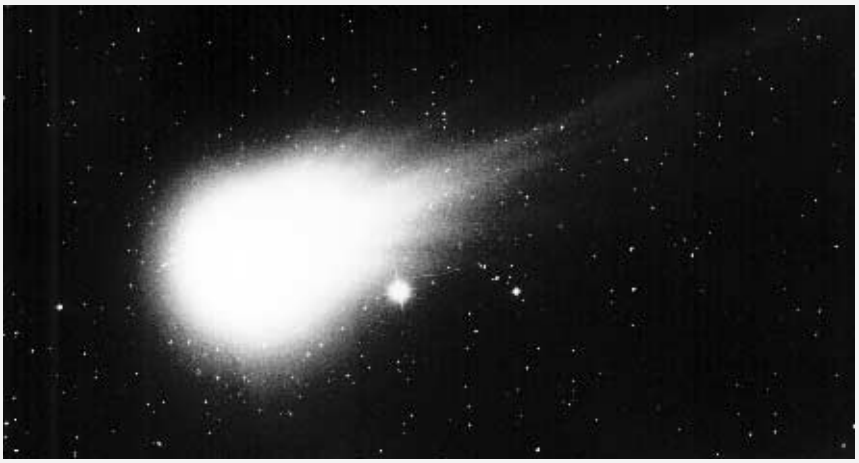
The Wellness Works Committee presents "Count Down Cholesterol and Heart Health." Noon-1 p.m., One West.

APRIL 26

The Fermilab International Film Society will show THE CITY OF LOST CHILDREN at 8 p.m. in Ramsey Auditorium. Comic fantasy about a horrible scientist named Krank who is aging prematurely because he lacks the ability to dream, so he kidnaps young children to steal theirs. Prestigious opening night film at Cannes in 1995. Dazzling special effects. Dir: Marc Caro, Jean-Pierre Jeunet, France (1995) 112 min. Admission is $4.

APRIL 26-27

Workshop on solar neutrino experiments, aimed at those familiar with the basic issues. The workshop will focus on options for both near-term and long-term future experiments. Curia II, 10 a.m. to 6 p.m. on Friday, 9:30 a.m. to 1 p.m. on Saturday. Consult http://fnas08.fnal.gov/ or email solarnus@fnas08.fnal.gov for further information.



Physicist Pat Colestock of the Accelerator Division took this photo of Comet Hyakutake in his backyard in St. Charles at about 3:00 on the cold morning of March 23. Division Head Dave Finley stood by to count during the exposures.

1996 SUMMER DAY CAMP

Fermilab will sponsor three supervised day camp sessions for children of employees, visitors, and Fermilab contractors. Session dates are June 17-July 5, July 8-July 26, and July 29-August 16. Fee is $225 per child, per session. Admission by lottery drawing April 1. Contact Jean Guyer at x2548 for more information and for a registration form.

PRESTBURY GOLF LEAGUE

Hey Duffers! The Fermilab Tuesday night Prestbury Golf League has an opening for a four - person team for the coming season. Or sign up for a regular or sub spot on an existing team. Greens fees $9, fun and camaraderie are FREE. Contact Bob Andree at x3703 or Rod Klein, x4682.

STOCKROOMS TO CLOSE FOR INVENTORY

The Fermilab stockrooms will be closed for annual inventory as follows: Wilson Hall stockroom, closed Friday, May 17 at 12:00 pm, will re-open Monday, May 20 at 12:30 pm; Site 38 stockroom: closed Monday, May 20 and Tuesday, May 21, all day both days. Please plan accordingly. Questions? Call the supply office at x3808.

FERMILAB STAIR CLIMBERS

Merle Haldeman, x3958 or email Haldeman@fnal.gov is assembling a Fermilab team to "Tackle the Tower" in Oakbrook the morning of April 20, 1996. This event is sponsored by the American Lung Association as a fundraiser. The event consists of climbing the stairs of "Oakbrook Terrace Tower" from the first floor to the thirty-second floor, once. Registration is $20. Team members receive a t-shirt, healthy food and beverages, great music and a complimentary muscle massage.

NALWO'S PRESCHOOL COOPERATIVE

NALWO's preschool cooperative for children aged 18 months to 5 years is re-forming and will meet in a new location in the Fermilab Village. The new location is in the shelter area of Dorm 3. The playgroup, which meets Mondays and Wednesdays and requires each parent to work one day a week, costs $24 for three weeks. NALWO urgently needs new members for the playgroup. Contact Mary Brandt at (708) 961-5194 for more information.

FILE SHARING CHANGES FOR RECREATION AND WELLNESS

The "Recreation Events & Info" and "Wellness Works" folders will be moving to a new location. They will be removed from the Lab Services zone in about one week.

To access these files in their new home, go to:

- Zone: Main Ethernet
- Server: HRSERVER1
- Volume: "Wellness Works" or "Recreation Events & Info"

University of Michigan
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COSMOS AND FIXED TARGETS

Michigan's future also involves neutrinos, as the university will be part of the Neutrinos at the Main Injector project, the search for neutrino mass.

Specifically, the Michigan team will work with a short-baseline experiment called COSMOS. The Main Injector is scheduled to begin operating in 1999. The university is helping to develop the muon system and EM calorimeter, as well as constructing data acquisition systems for NuMI.

Michigan will also have professors and students involved in some of the upcoming fixed-target experiments. H.R. Gustafson and Longo are collaborators on an experiment that will attempt to find CP violation in the decay of particles besides the kaon, in order to look for another way to explore this phenomenon.

One of the results of all this activity at Fermilab is an opportunity for students at Michigan to receive extensive physics training and hands-on experience in a variety of experiments. Chapman said the benefit is mutual because the collaborations get needed help from enthusiastic and talented students. ❑

Photo by REIDAR HAHN

Kevin Burkett (right) and Gene Guillian from the University of Michigan in the "trigger room" at the CDF experiment.

CLASSIFIEDS

FOR SALE

■ 1989 Toyota Corolla DX sedan, gold, 4-dr, auto., AC, power steering, AM/FM stereo, rear defogger, excell. cond. New muffler and exhaust. Oil changed every 3K-4K miles. 90K miles. Asking $5,200 o.b.o. Call Brajesh, x8596 or e-mail brajesh@fnal.gov.

■ 1985 Honda Accord 4 dr. auto., good tires, new brakes. Runs good no rust, high miles, asking $995. Call Don x8217 or (708) 557 2397

■ 1986 Isuzu Trooper II, 4WD, red, 5-sp., power steering and brakes, AC, AM/FM cassette, luggage rack, towing hitch, good cond. int. and ext., runs great, no rust, 92K miles. $ 4,500. Call Alex, x3873 or (708) 393-6774.

■ Simmons oak baby crib, high chair, conv. car seat, walker, baby toys, linens, etc. All in perfect condition, call Karen, (708) 897-8125.

■ Rollerblade Lightning rollerblades, black w/white letters, excell. cond., used one season. Cost $140 new, size: woman's 6, men's 4.5 or mondopoint 23, $65. call Merle, x3958.

■ 4 tickets for 1996 Indianapolis 500. Seats numbered 1 thru 4 (first 4 seats off an aisle). High, SW vista, excellent seats. $260 for all four; will NOT separate. (708) 232-8344.

■ Fuji 12 sp. touring bike, 26" alloy frame and wheels, $150. Exercise bike, DP brand, air resistance, smooth, quiet, $90. Radial Arm Saw, Dewalt 10", 2HP motor w/ table and stand, $200. Calculator, HP48SX expandable scientific calculator, $100. Personal Information Manager card for HP48SX calculator $35. Call Steve at x4253

■ Golf clubs, Titleist DCI irons, 2 through SW. $300. Powerbilt persimmon woods 1,3,5 with graphite shaft $50. All excellent condition, call Jim at x4293 or (708) 416-0548.

The deadline for the Friday, April 19 issue of FermiNews is Tuesday, April 9.

Please send your article submissions, classified advertisements and ideas to the Office of Public Affairs, MS 206 or Email: ferminews@fnal.gov

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

FermiNews
Fermi National Accelerator Laboratory

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