FERMI NEWS

FERMILAB A U.S. DEPARTMENT OF ENERGY LABORATORY

DASTOW '04: Wings and Wonders 8

Photo by Reidar Hahn

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INSIDE:

Just One More Time

FERMINEWS ends its run in June; new magazine follows in fall

by Mike Perricone

The one constant of science is change, and science communication must keep pace.

After serving its readers throughout the particle physics community since 1978, *FERMINEWS* will take a final bow with the June 2004 issue. A new publication, tentatively titled *SYMMETRY*, will begin publication in the fall as a joint venture between Fermilab and Stanford Linear Accelerator Center, the two largest laboratories in U.S. particle physics—and that unique collaboration is just the start of what the staff of the new magazine hopes will be a compelling and unconventional presence in science communication.

David Harris has joined SLAC to serve as managing editor of the new monthly publication, coordinating efforts at both labs to create a forum where issues of science policy and science in society will be as prominent as issues of science in thought and science in the laboratory, within and beyond the field of particle physics.

David Harris

Harris will be based at SLAC, but will spend considerable time at Fermilab overseeing the production of the magazine.

"Particle physics is entering a new area, where traditional accelerator physics is joining with cosmological physics, and that is changing the whole field," said Harris, who served recently as head of Media Relations for the American Physical

Stanford Linear Accelerator Center

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Society. “We also want to use the magazine as a way for policy leaders to communicate with the physics community.”

A theoretical physicist by training, studying at the Australian National University in Canberra and at the University of Queensland in Brisbane, Harris moved into science communication as a free-lance writer and radio broadcaster for the Australian Broadcasting Corporation and for Radio Australia, an international radio station. He joined APS in 2002.

Serving as publishers for the new publication will be Judy Jackson, head of the Office of Public Affairs at Fermilab, and Neil Calder, Director of Communications at SLAC. The new magazine will strive for an international base, with input from leading physicists and policy makers around the world.

Communications directors at the world’s particle physics laboratories will be invited to serve as contributing editors, emphasizing the magazine’s global reach.

The June/farewell issue of *FERMINEWS* will have special features from cover to cover, including a look back to its origins as *The Village Crier*. You won’t want to miss it.

Fermilab

The ***new magazine***, to be published jointly by **Fermilab** and **SLAC**, IS IN THE DESIGN STAGE with a debut projected in the fall.

Fermilab

by Kurt Riesselmann

It was an historic moment when several hundred physicists gathered in Fermilab's Ramsey Auditorium on March 11 to consider their response to a revolution. They had come to listen to strategies and recommendations. They asked questions and discussed answers. They weighed the merits of different time lines and the tools to be used. At times emotions were high, as were the stakes: the future scientific program of Fermilab.

In the last five years the worldwide physics community has found signs of revolutionary changes in our understanding of nature. Particle physicists have found that neutrinos have mass and oscillate, causing a huge crack in the 30-year-old "holy grail" of particle theory: the Standard Model of particles and interactions, which predicted massless neutrinos. The mechanism responsible for the masses of all particles is soon expected to make its appearance. Astrophysicists have discovered that 95 percent of the universe is made of dark matter and dark energy, stuff invisible to the naked eye—and physicists so far can only speculate about its origin.These and other observations indicate that there is much more to learn.

"What we see is a revolution," said Associate Director Hugh Montgomery addressing the crowd. "The Standard Model we feel is beginning to give way to something new. The Tevatron, and certainly the Large Hadron Collider, will pull back the curtain on the origin of mass and electroweak symmetry breaking."

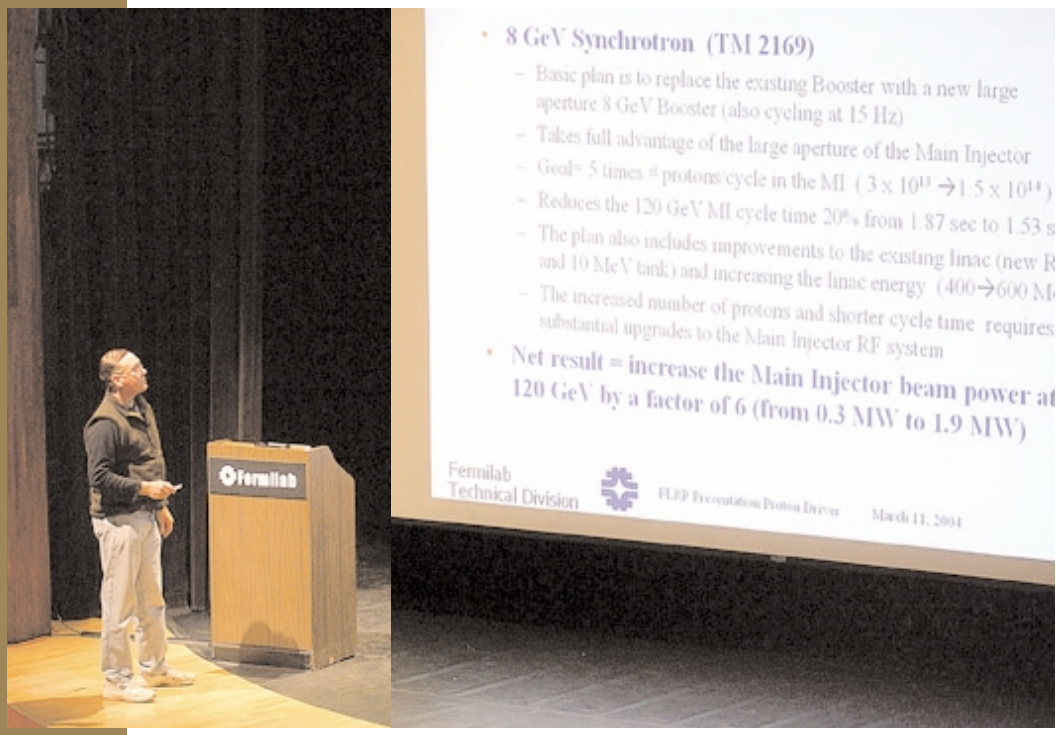


Photo by Reidar Hahn

Bob Kephart chaired the Proton Driver working group of the Long Range Planning Committee. He presented the preliminary results of the group in front of several hundred scientists in Fermilab's Ramsey Auditorium on March 11.

Members of the Fermilab Long Range Planning Committee:

Hugh Montgomery (Chair)
Fermilab Associate Director

Steve Holmes (Deputy)
Fermilab Associate Director

Joel Butler
Fermilab,
BTeV Collaboration

Marcela Carena
Fermilab,
Theory Department

Gary Feldman
Harvard University,
MINOS Collaboration

Josh Frieman
Fermilab,
Theoretical Astrophysics Department

Steve Geer
Fermilab,
Accelerator Division

Chris Hill
Fermilab,
Theory Department

Bob Kephart
Fermilab,
Technical Division

Young-Kee Kim
University of Chicago,
CDF Collaboration

Peter Meyers
Princeton University,
MiniBooNE Collaboration

Sergei Nagaitsev
Fermilab,
Recycler Department

Angela Olinto
University of Chicago,
Astrophysics and
Astronomy Department

Ritchie Patterson
Cornell University,
CLEO Collaboration

Jim Strait
Fermilab,
US LHC Accelerator Project

John Womersley
Fermilab,
DZero Collaboration

Prepares for its Future

"WHAT WE SEE IS A REVOLUTION"

Montgomery chaired the 15-member Fermilab Long Range Planning Committee that has been studying Fermilab's future beyond the LHC, which will begin operations at the European laboratory CERN in 2007. The LRPC, which began its work in the fall of 2003, has been charged by Fermilab Director Michael Witherell "to develop in detail a few realistically achievable options for the Fermilab program in the next decade under each possible outcome for the Linear Collider. The goal in developing each option should be to optimize the opportunities available at Fermilab in this period for high energy physicists to answer the most important questions in our field."

Fermilab is well suited to be a major player in advancing the revolution. While conducting Collider Run II at the Tevatron, Fermilab has been building the NuMI neutrino beam line and installing the MINOS neutrino detectors. Two months ago, the Office of Science of the Department of Energy gave Fermilab the first approval, Critical Decision Zero, of the BTeV experiment. Fermilab will also have a central role in an active U.S. research program at the LHC, participating in both the CMS experiment and the development of the LHC accelerator upgrades. In addition, Fermilab is involved in several smaller-scale projects in astrophysics. Altogether, the Laboratory is guaranteed a vibrant research program throughout the end of this decade.

But what will Fermilab be doing in the year 2015? Since it takes years to plan and construct large-scale science facilities, it is not too soon to ask the question. The physics revolution is provides plenty of research opportunities, but choosing—and funding—the right path is difficult.

"There are two visions of where the lab can be in 2015," said Associate Director Steve Holmes, deputy chair of the LRPC. "Either there'll be a Linear Collider within 20 miles of the lab, and it would be a big part of the lab's program; or the Linear Collider will not be near, and we would become a world center of excellence in neutrino physics with a high-luminosity proton program. The question is: Given that, what do we do now? The two facilities represent vastly different scales."

Hugh Montgomery, chair of the Fermilab Long Range Planning Committee

The LRPC formed 10 working groups to study the two scenarios and the future scientific program that would accompany these efforts. The sub-committees brought in experts, both from inside the lab and outside, to lay out the issues. After developing a thorough understanding of the issues, the working groups drafted "proto-recommendations," which they discussed with scientists from across the lab in a series of open sessions, each drawing more than 100 scientists, with Fermilab's directors listening to the discussions. In January 2004, the LRPC gathered for a 2-day retreat to develop a plan on how Fermilab should proceed in the near future to achieve its long-term goals. Since then the committee has worked on finalizing its report.

"The committee has served as a discussion group to go out and get the information," said Princeton University physicist Peter Meyers, a collaborator on the MiniBooNE experiment and member of the LRPC. "It was our charge to hash out the arguments that will shape Fermilab's future. However, obviously, this committee does not make the final decision."

Photos by Reidar Hahn

Steve Holmes, deputy chair of the Fermilab LRPC and convenor of the Linear Collider working group, at the LRPC presentation in Ramsey Auditorium

Photo by Reidar Hahn

R&D for a Linear Collider at the Large Vacuum Furnace in Technical Division building IB4. Shekhar Mishra (right) leads the LC R&D effort at Fermilab, with Technical Division head Bob Kephart (second from right). Tug Arkan (left) and Harry Carter are the lead engineers on x-band LC R&D.

The meeting on March 11 was the last open session before the committee publishes its final report in May. The key recommendations, presented by Montgomery at the meeting, are in place:

■ It is imperative that Fermilab prepare a bid to host the electron-positron linear collider, with broad U.S. linear collider accelerator collaboration. The Fermilab planning should be based upon the host laboratory/international project model.

■ Fermilab must prepare a conceptual design report for a facility (AKA Proton Driver) that creates high-luminosity proton beams for a Super Neutrino Beam. The goal is to establish mission need, obtaining Critical Decision Zero (CD-0) approval from the Office of Science.

The linear collider is a multi-billion-dollar accelerator for the next generation of precision measurements at the energy frontier. Over 2,600 physicists from around the world have signed a document supporting a high-energy electron-positron linear collider as the next major experimental facility for frontier particle physics research (see story at www.interactions.org/cms/?pid=1011605).

ON THE WEB:

Fermilab Long Range Planning Committee:
http://www.fnal.gov/directorate/Longrange/Long_range_planning.html

Proton Driver Project:
http://www-bd.fnal.gov/pdriver/

Linear Collider Project:
http://waldo.fnal.gov/NLC/

DOE 20-year Strategic Plan:
http://www.science.doe.gov/Sub/Facilities_for_future/facilities_future.htm

In its 20-year strategic plan of Facilities for the Future of Science, released in December 2003, the Office of Science of the Department of Energy has listed the linear collider as the highest midterm priority. Fermilab currently has a $3 million R&D program for LC technology, collaborating with other laboratories (see *FERMINEWS*, vol. 27, no. 3, March 2004).

The Super Neutrino Beam is also listed in the 20-year plan of the Office of Science. The beam, many times more intense than those available with current accelerators, would be powered by a megawatt proton driver, a project estimated at about an order of magnitude smaller than the LC. Several laboratories are interested in such a machine, which would allow scientists to begin precision measurements of neutrino measurements, comparable to measurements of corresponding properties of quarks over the last 40 years.

Some Fermilab scientists expressed concern that the decision-making process of the linear collider, a complex international project with stakeholders in many countries and laboratories, will take the entire Fermilab program "hostage to this process," as pointed out by Stanford University's Stan Wojcicki at the March meeting.

Ensuring that Fermilab remains a valid contender for both projects, the Fermilab Directorate took action with regard to the key recommendations of the LRPC after the March meeting.

"At this time we will pursue both projects, assuming that within a couple of years an assessment and a decision will be made," said Holmes. "The director has issued two charges. Bill Foster and Steve Geer are leading the Super Neutrino Beam efforts, aiming for CD-0 approval and preparing the ground work to go beyond. One aspect of the charge is to get better cost estimates, and understanding the scientific benefits, of implementations based on either a superconducting linac or a more traditional synchrotron. Shekhar Mishra now is coordinating our linear collider accelerator efforts at the lab. His charge is to maximize the possibility that the linear collider will be built with strong Fermilab participation, and preferably as host. The final decision where the linear collider will be built is beyond our control."

This approach allows Fermilab to pursue the timely construction of the proton driver if the linear collider should be built elsewhere or if no decision is in sight.

The Fermilab Directorate will present the Long Range Plan to the Director of the Office of Science, Raymond Orbach, when he visits Fermilab on May 6.

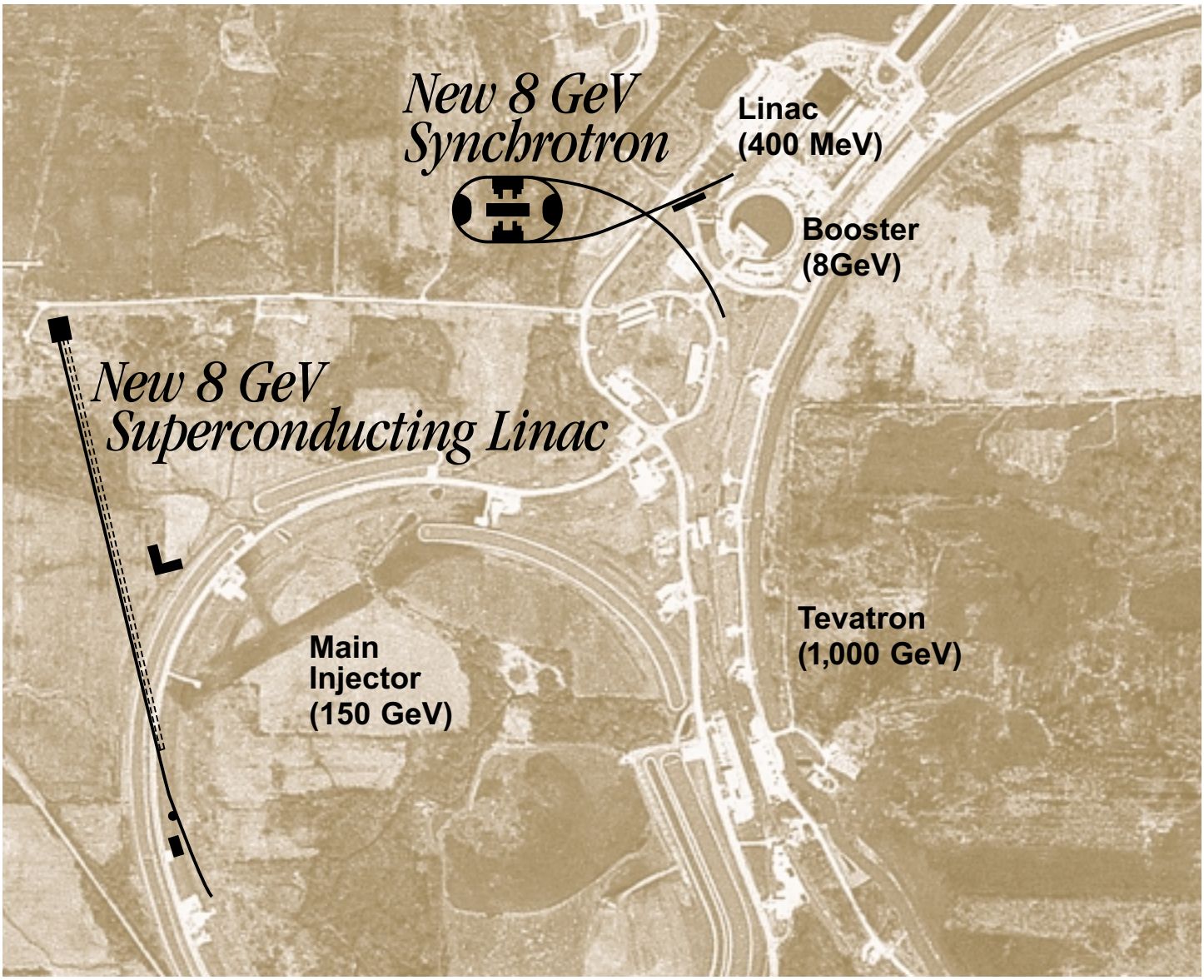
"We see an exciting future for Fermilab," said Montgomery. "If we work together we can make it happen."

Proton Driver for Super Neutrino Beam

The Proton Driver study group is examining two options for creating high-intensity proton beams for the next generation of neutrino and other fixed-target experiments. Fermilab could either replace the entire low-energy part of its present accelerator complex with a high-tech linear accelerator based on superconducting technology, or it could replace just the Booster with a new circular accelerator (synchrotron). Both options would produce an intense 8-GeV proton beam. The beam could be further accelerated in the Main Injector or used directly for lower-energy experiments.

Photo by Reidar Hahn

Bill Foster (left) and Steve Geer are in charge of the studies for the Proton Driver, which would replace the Fermilab 8-GeV Booster accelerator ring (background). The Booster is the bottleneck in the production of higher-intensity proton beams.



A record turnout of some 400 employees and family members gathered for the annual group portrait in front of Wilson Hall.

DASTOW '04:

Thursday, April 22, 2004: Daughters and Sons to Work Day at Fermilab took flight from its first moments and soared through the day. In a record turnout, some 400 employees and family members were charmed by an early bird walk with Peter Kasper; awed by the beauty of butterflies in Tom Peterson's presentation; thrilled by a simulated helicopter rescue, courtesy of the Fermilab Fire Department and LifeStar helicopter service of Loyola University Hospital; gratified by their work in planting trees in celebration of Earth Day; filled by a hot dog lunch; enlightened by demonstrations at the Leon Lederman Science Education Center; chilled by Jerry Zimmerman's super-cool Cryo Show, and transported back to prairie days by a visit to the buffalo pasture with veteran herdsman Don Hanson. Photos by Fermilab Visual Media Services.

The Early Bird Walk began the day.

Tom Peterson's "The Butterflies of Fermilab" showed that science is also about beauty and wonder.

Loyola University Hospital's LifeStar helicopter dropped in for a simulated rescue.

A crash dummy is transferred to the chopper.

Wings and Wonders

Michael Fox, 7, has all the hot dog he can handle.

Jerry Zimmerman was again Mr. Cool.

Catherine Jordan, 9, conducts a unique electricity experiment at the Lederman Science Education Center.

Daena Wallace, 12 (left), and Kariya Spillers, 10 (right) get planting tips from Roshanda Nowlin of Accelerator Division.

Melanie Groenwald, 5 (left), tries on a set of bison headphones, assisted by sister Caitlin, 7.

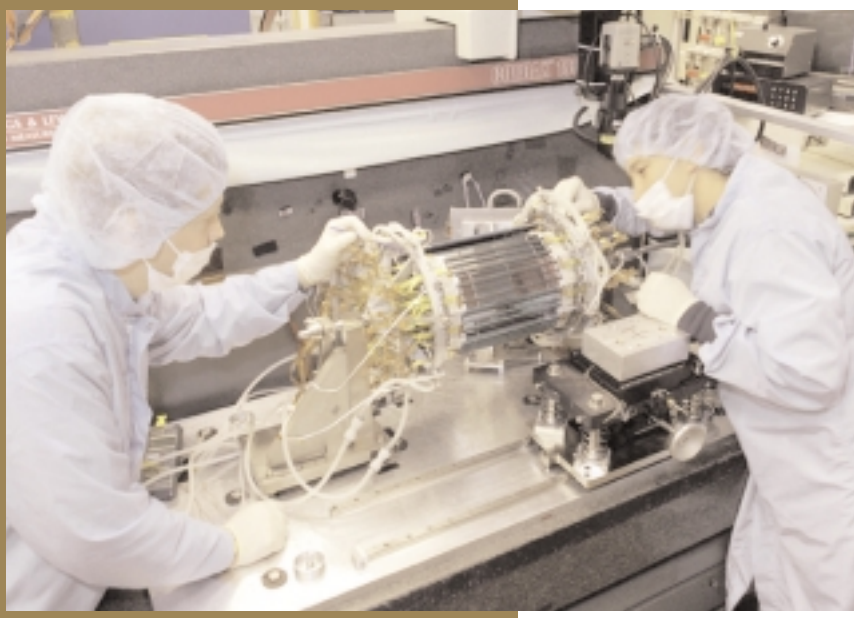
Time Exposure

With the world's biggest CCD camera, the Dark Energy Survey hopes to chronicle the expansion rate of the universe

by Katie Yurkewicz

Dark energy comprises about 70 percent of the universe and is responsible for the surprisingly accelerating expansion of the universe, yet it is one of the biggest mysteries facing science today.

Fermilab is part of a collaboration proposing an ambitious new experiment to measure the properties of dark energy. If approved, the Dark Energy Survey would measure the history of the expansion rate of the universe more precisely than ever before, using the largest camera ever built with Charge Coupled Devices (CCD). The 500 megapixel Dark Energy Camera would be placed on an existing 4-meter telescope located in north-central Chile at the National Optical Astronomy Observatory's Cerro Tololo Inter-American Observatory.



Harvard physicist Andy Foland (left) and Fermilab technician Bert Gonzalez (right) work on one of three barrels built at SiDet for the CDF Run IIa silicon vertex detector. The techniques used in building the barrels are similar to those needed to build the Dark Energy Camera.

"We don't know if the dark energy is some new kind of 'stuff,' and if so what kind it is, or if something strange is going on with gravity," said Josh Frieman of Fermilab and the University of Chicago's Astronomy Department, a collaborator on the proposed DES. "The only way we really have to probe the properties of the dark energy is to make much more precise measurements of the history of the expansion rate of the universe."

The DECam together with the CTIO 4-meter telescope will allow for a survey of 15 percent of the sky to light levels faint enough to measure the colors of galaxies at redshift one. The redshift of an astronomical object generally increases with distance. The farther the objects observed, the farther the look back in time. By surveying the sky out to redshifts of one, the DES will measure the expansion rate as it has evolved over two-thirds of the total age of the universe.

The DES would use four independent methods to probe dark energy:

- A galaxy cluster survey, where photometric redshifts will be measured for 30,000 galaxy clusters
- Weak gravitational lensing, which measures the effect of the universe's matter distribution on light from distant galaxies
- Measurements of 2,000 Type Ia supernovae, whose similar peak brightness allows for good estimates of distance
- A galaxy angular power spectrum study, whose angular size features allow for good estimates of distance.

Each method could stand alone as a probe of dark energy, and each will be by far the best in its class at the time of the DES. By combining the four results, collaborators hope to measure the properties of dark energy to five percent precision.

"This is really our strength," said Joe Mohr of the University of Illinois, DES project scientist for data management. "We'll have four different pieces of information about dark energy, and we can see if the answers are consistent."

Galaxy cluster counting is the primary goal. The DES and the South Pole Telescope will combine their galaxy cluster data to measure the universal expansion rate by determining the number and masses of galaxy clusters as a function of time.

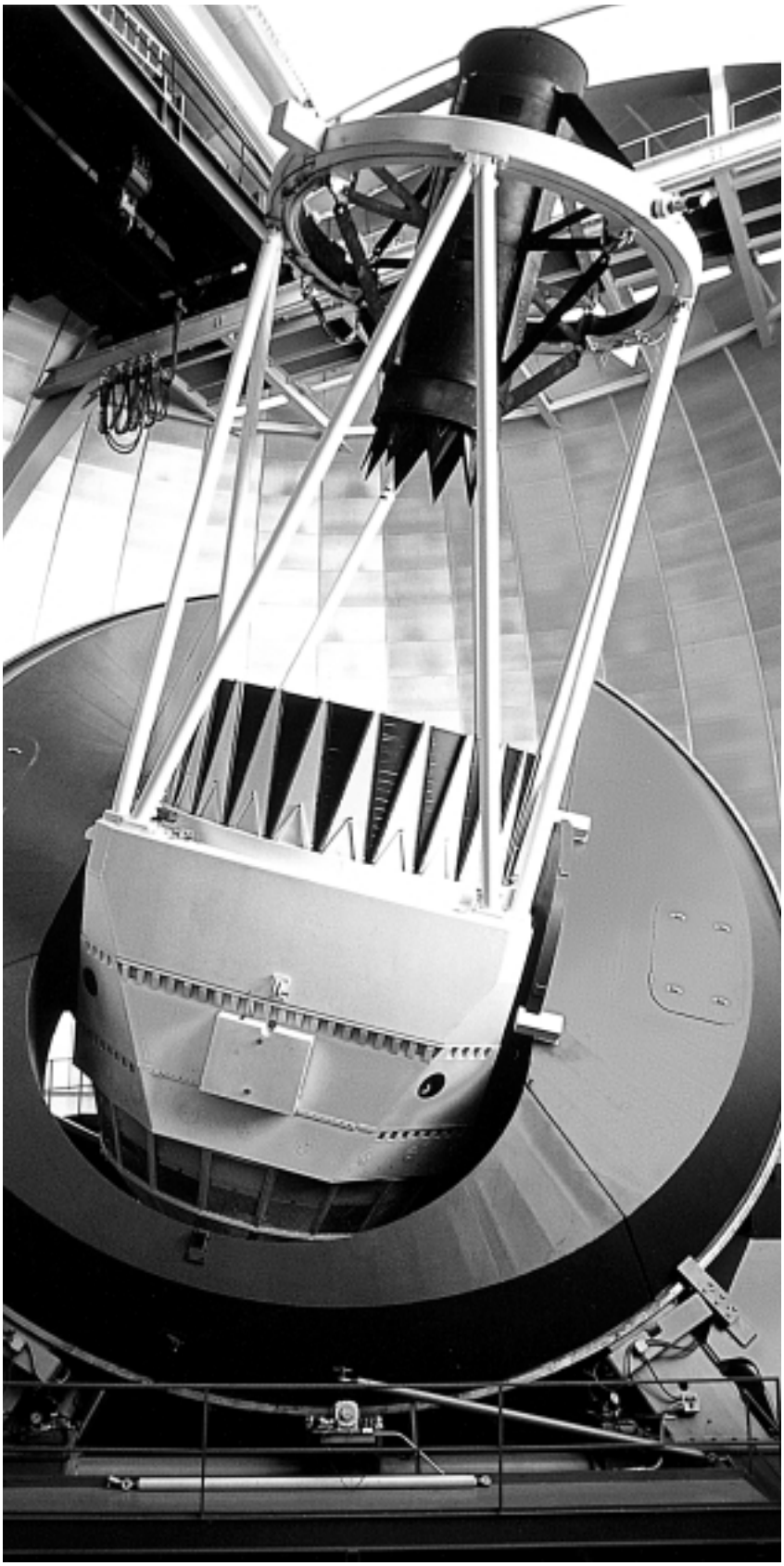
The DES would provide photometric redshifts for approximately 30,000 galaxy clusters. The photometric redshift of a cluster is determined by combining measurements taken through four different filters, each of which "sees" different ranges of wavelengths of light. The SPT survey will use a different technique to determine the masses of about 30,000 galaxy clusters—at least 20,000 of which will also be measured by the DES. SPT cluster masses and DES cluster redshifts together will provide a powerful probe of the universe's expansion rate.

"The DES is a very exciting instrument concept, and a very exciting, interesting and topical concept as well," said Alistair Walker, director of the CTIO. "It really sequences well with what's been going on now and what will happen later with the Large Synoptic Survey Telescope, and even later with the Supernova Acceleration Probe."

If approved and funded, the DES could begin collecting data in September 2008. The DES would run for five years, collecting the largest amount of information to date on the properties of dark energy. The next generation of experiments to probe the properties of dark energy and matter, the ground-based LSST and the space-based SNAP, will begin operating around 2012.

Fermilab is building on its experience in particle physics and in collaborating on the Sloan Digital Sky Survey in leading the effort to design and build the proposed instrument for the 4-meter telescope. The instrument includes the DECam, a series of focusing lenses, four wavelength filters and the mechanical and electrical interfaces to the telescope.

"It turns out that Fermilab particle physics expertise maps really well into CCD cameras for astronomy," said Fermilab's Jim Annis, DES survey strategy leader. "We know about cooling, precision positioning of silicon detectors and mounting of optics."



Photos credit NOAO/AURA/NSF

The 4 meter telescope located at the Cerro Tololo Inter-American Observatory will be used in conjunction with the Dark Energy Camera to measure the properties of dark energy. The Dark Energy Survey collaboration proposes to build a new instrument to replace the current prime focus cage, which would include the 500 megapixel, one-half-meter-diameter DECam, the largest CCD camera ever built.

Time Exposure

Photo by Deborah Guzman

The Fermilab Dark Energy Camera team (from left) John Peoples, Peter Limon, Brenna Flaugher, Greg Derylo, Del Allspach, Jim Annis, Huan Lin and William Wester in front of SiDet, where the 500 megapixel CCD camera will be packaged and assembled.

ON THE WEB:

Dark Energy Camera Project
http://home.fnal.gov/~annis/astrophys/deCam/

Cerro Tololo Inter-American Observatory
www.ctio.noao.edu/

National Optical Astronomy Observatory
www.noao.edu/

Lawrence Berkeley National Laboratory
www.lbl.gov/

Brenna Flaugher, deputy at Fermilab's Silicon Detector facility and Camera Project manager for the DES, emphasized that the DECam is a natural fit for Fermilab.

"Building a CCD camera is a lot like building a silicon vertex detector," she said. "They use the same machines and the same technology. We have the infrastructure set up at SiDet and we have a lot of experienced people."

At the heart of the DECam are 60 rectangular (2k x 4k) CCDs, each with 8 million 15-micron pixels. The CCDs, developed at Lawrence Berkeley National Laboratory, are over five times more sensitive at near-infrared wavelengths than conventional CCDs currently used for astronomy. The improved near-infrared sensitivity is critical for the science of the DES, as it allows the survey to obtain galaxy redshifts out to one. The one-half-meter-diameter DECam will be the first large-scale use of the LBNL CCDs.

Berkeley Lab will ship the CCD wafers to Fermilab, where they will be packaged and assembled in the camera housing. The University of Illinois' high-energy physics group will develop the data acquisition system for the camera. Once the DES instrument has been assembled and tested at Fermilab, it will be delivered to Chile, where CTIO will lead telescope operations and maintenance.

The five-year DES hopes to generate about 100 terabytes of data—over seven times more than current surveys. As the data will be relevant to a wide range of topics in astrophysics, cosmology and particle physics, it will be released to the public at regular intervals. The University of Illinois' high-energy physics and astronomy groups, in cooperation with the National Center for Supercomputing Applications and the University of Chicago, will lead the data processing and archiving effort. The NCSA and CTIO will work to make DES data easily accessible to all interested researchers.

"If we can make the data public in an accessible form, it will be very valuable to lots of other people," said Fermilab's John Peoples, collaborator on the DES.

Since their first collaboration meeting in December, DES researchers have been presenting their idea to laboratories and funding agencies in the hopes of receiving approval by the end of 2004.

"At Halloween last year, we had only an idea," said Annis. At that same time this year, DES collaborators hope to be well on their way to resolving one of the biggest mysteries of the universe.

EXTREME Sensitivity

CDMS II presents new results on Weakly Interacting Massive Particles that could make up most of the matter of our universe.

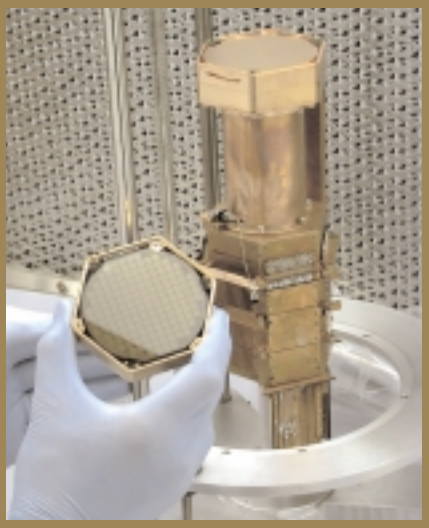
by Mike Perricone

With the first data from their underground observatory in Northern Minnesota, scientists of the Cryogenic Dark Matter Search have peered with greater sensitivity than ever before into the suspected realm of the WIMPS. The sighting of Weakly Interacting Massive Particles could solve the double mystery of dark matter on the cosmic scale and of supersymmetry on the subatomic scale.

The CDMS II result, described in a paper submitted to *Physical Review Letters*, shows with 90 percent certainty that the interaction rate of a WIMP with mass 60 GeV must be less than 4×10^{-43} cm^2 or about one interaction every 25 days per kilogram of germanium, the material in the experiment's detector. This result tells researchers more than they have ever known before about WIMPS, if they exist. The measurements from the CDMS II detectors are at least four times more sensitive than the best previous measurement offered by the EDELWEISS experiment, an underground European experiment near Grenoble, France.

"Think of this improved sensitivity like a new telescope with twice the diameter and thus four times the light collection of any that came before it," said CDMS II cospokesperson Blas Cabrera of Stanford University. "We are now able to look for a signal that is just one-fourth as bright as any we have seen before. Over the next few years, we expect to improve our sensitivity by a factor of 20 or more."

The results were presented at the April Meeting of the American Physical Society on May 3 in Denver by Harry Nelson and graduate student Joel Sanders, both of the University of California-Santa Barbara, and by Gensheng Wang and Sharmila Kamat of Case Western Reserve University.



Closeup of a detector in its mount. A detector of this kind, made of Silicon, was operated in the 1998 run. The photolithographically-fabricated thin film on the surface is the phonon sensor and represents a significant advance over the detectors used in the 1999 run. Silicon and germanium detectors, weighing 100g and 250g respectively, are used in CDMS II runs in the Soudan Mine.

ON THE WEB:

Cryogenic Dark Matter Search (CDMS II):
http://cdms.berkeley.edu/index.html

Photos:
http://www.fnal.gov/pub/presspass/press_releases/CDMS_Photos/index.html

Background information:
http://www.fnal.gov/pub/presspass/press_releases/CDMS_Background.html

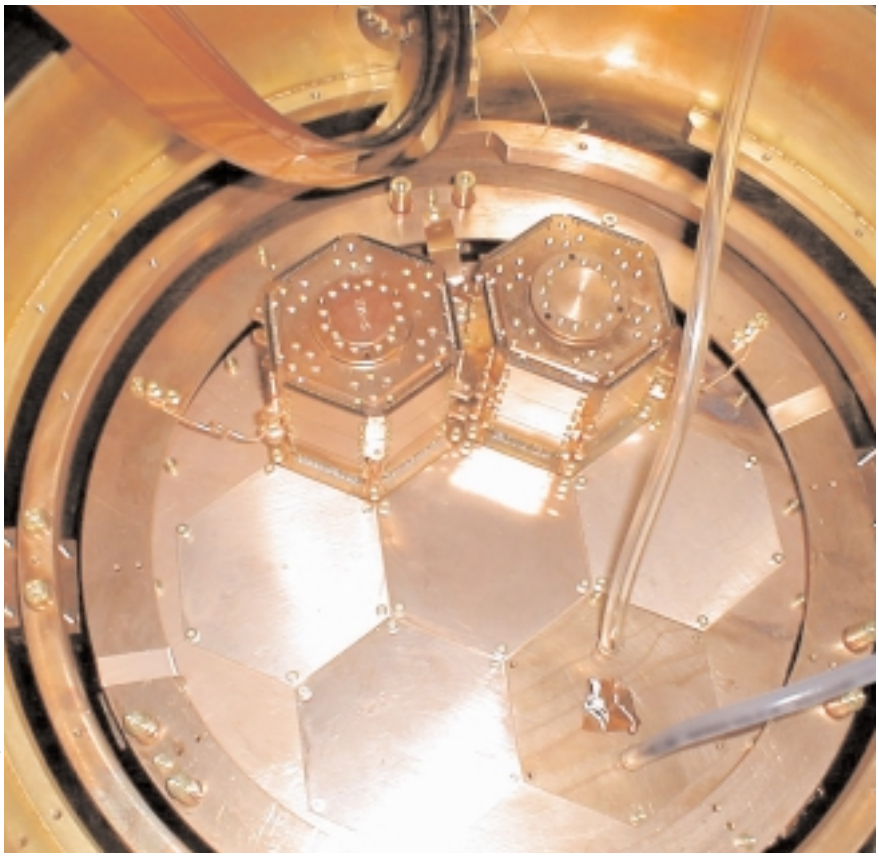


Photo courtesy CDMS II

A view of the inner layers of the cryostat with two towers installed. Detector towers are mounted in the holes covered by hexagonal plates. The coldest part of the cryostat stays at 10 mK (millikelvin, or thousandths of a degree above absolute zero) during operation. The surrounding layers are higher temperature stages of the cryostat. The cryostat is constructed using radiopure copper to provide a low-radioactivity environment for the extremely sensitive CDMS detectors.

"We know that neither our Standard Model of particle physics nor our model of the cosmos is complete," said CDMS II spokesperson Bernard Sadoulet of the University of California at Berkeley. "This particular missing piece seems to fit both puzzles. We are seeing the same shape from two different directions."

WIMPs, which carry no charge, are a study in contradictions. While physicists expect them to have about 100 times the mass of protons, their ghostly nature allows them to slip through ordinary matter leaving barely a trace. The term "weakly interacting" refers not to the amount of energy deposited when they interact with normal matter, but rather to the fact that they interact extremely infrequently. In fact, as many as a hundred billion WIMPs may have streamed through your body as you read these first few sentences.

"The nature of dark matter is fundamental to our understanding of the formation and evolution of the universe," said Dr. Raymond L. Orbach, Director of DOE's Office of Science. "This experiment could not have succeeded without the active collaboration of the DOE's Office of Science and the National Science Foundation."

Michael Turner, Assistant Director for Math and Physical Sciences at NSF, described identifying the constituent of the dark matter as one of the great challenges in both astrophysics and particle physics.

"Dark matter holds together all structures in the universe—including our own Milky Way—and we still do not know what the dark matter is made of," Turner said. "The working hypothesis is that it is a new form of matter—which, if correct will shed light on the inner workings of the elementary forces and particles. In pursuing the solution to this important puzzle, CDMS is now at the head of the pack, with another factor of 20 in sensitivity still to come."

Dark matter in the universe is detected through its gravitational effects on all cosmic scales, from the growth of structure in the early universe to the stability of galaxies today. Cosmological data from many sources confirm that this unseen dark matter totals more than seven times the amount of ordinary visible matter forming the stars, planets and other objects in the universe.

"Something out there formed the galaxies and holds them together today, and it neither emits nor absorbs light," said Cabrera. "The mass of the stars in a galaxy is only 10 percent of the mass of the entire galaxy, so the stars are like Christmas tree lights decorating the living room of a large dark house."

Physicists also believe WIMPs could be the as-yet unobserved subatomic particles called neutralinos. These would be evidence for the theory of supersymmetry, introducing intriguing new physics beyond today's Standard Model of fundamental particles and forces.

Supersymmetry predicts that every known particle has a supersymmetric partner with complementary properties, although none of these partners has yet been observed. However, many models of supersymmetry predict that the lightest super-symmetric particle, called the neutralino, has a mass about 100 times that of the proton.

"Theorists came up with all of these so-called 'supersymmetric partners' of the known particles to explain problems on the tiniest distance scales," said Dan Akerib of Case Western Reserve University. "In one of those fascinating connections of the very large and the very small, the lightest of these superpartners could be the missing piece of the puzzle for explaining what we observe on the very largest distance scales."

The CDMS II team practices "underground astronomy," with particle detectors located nearly a half-mile below the earth's surface in a former iron mine in Soudan, Minnesota. The 2,341 feet of the earth's crust shields out cosmic rays and the background particles they produce. The detectors are made of germanium and silicon, semiconductor crystals with similar properties. The detectors are chilled to within one-tenth of a degree of absolute zero, so cold that molecular motion becomes negligible. The detectors simultaneously measure the charge and vibration produced by particle interactions within the crystals. WIMPS will signal their presence by releasing less charge than other particles for the same amount of vibration.

"Our detectors act like a telescope equipped with filters that allow astronomers to distinguish one color of light from another," said CDMS II project manager Dan Bauer of Fermilab. "Only, in our case, we are trying to filter out conventional particles in favor of dark matter WIMPS."

Physicist Earl Peterson of the University Minnesota oversees the Soudan Underground Laboratory, also home to Fermilab's long-baseline neutrino experiment, the Main Injector Neutrino Oscillation Search.

"I'm excited about the significant new result from CDMS II, and I congratulate the collaboration," Peterson said. "I'm pleased that the facilities of the Soudan Laboratory contributed to the success of CDMS II. And I'm especially pleased that the work of Fermilab and the University of Minnesota in expanding the Soudan Laboratory has resulted in superb new physics."

As CDSMII searches for WIMPs over the next few years, either the dark matter of our universe will be discovered, or a large range of supersymmetric models will be excluded from possibility. Either way, the CDMS II experiment will play a major role in advancing our understanding of particle physics and of the cosmos.

Photo courtesy CDMS II

Project manager Dan Bauer from Fermilab holds one tower of detectors as Vuk Mandic from UC Berkeley examines them. Each tower of detectors contains 1 kilogram of germanium for detecting dark matter and 200 grams of silicon to distinguish WIMPs from neutrons. Thin layers of silicon, aluminum, and tungsten covering the detector surfaces measure both the heat and charge released when a particle interacts inside.

The CDMS II Collaboration

Brown University
Case Western Reserve University
Fermi National Accelerator Laboratory
Lawrence Berkeley National Laboratory
National Institutes of Standards and Technology
Princeton University
Santa Clara University
Stanford University
University of California-Berkeley
University of California-Santa Barbara
University of Colorado at Denver
University of Florida
University of Minnesota.

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Please send story ideas to: Public Affairs Office, MS 206, Fermilab, P.O. Box 500, Batavia, IL 60510, or e-mail to ferminews@fnal.gov. Letters from readers are welcome. Please include name and daytime phone number.

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To purchase tickets for Arts and Lecture Series events, or for further information or telephone reservations, **call 630-840-ARTS (1-800-840-2787)** weekdays between 9 a.m. and 4 p.m. Phone reservations are held for five working days, but will be released for sale if not paid for within that time. Will-Call tickets may be picked up, or available tickets purchased, at the lobby box office on the night of the performance beginning at 7 p.m. When coming to this event, only the Pine Street entrance to Fermilab will be open. *For more information, check out our web page at* **www.fnal.gov/culture.**

SAM BUSH

Saturday, May 15, 2004
Tickets- $25 ($13 for ages 18 and under)

Sam Bush has become synonymous with the Telluride Bluegrass Festival. Founder and driving force behind the legendary New Grass Revival, Bush's ability to make music that exceeds all expectations is evident from two projects just in the past year. *Bluegrass Mandolin Extravaganza* and *Short Trip Home* were nominated for Grammy Awards as Best Bluegrass Album and Best Classical Crossover Album, respectively.

Summer Season Preview:

Muriel Anderson's All Star Guitar Night
June 26, 2004 / Tickets- $15 ($8 for ages 18 and under)

Savoy-Doucet Cajun Band
July 10, 2004 / Tickets- $16 ($8 for ages 18 and under)

Jim Walker & Free Flight
July 31, 2004 / Tickets- $18 ($9 for ages 18 and under)

Mystical Arts of Tibet
August 21, 2004 / Tickets- $16 ($8 for ages 18 and under)

MILESTONES

RETIRING

■ *FERMINEWS,* which began its run in 1978. Last issue, June 2004.

MEMORIAM

PASSED AWAY

■ Harry Louis Melanson, a Fermilab physicist for 20 years and member of the DZero collaboration; on Saturday, April 17 at Delnor-Community Hospital in Geneva, Illinois.

■ Ronald J. Walker, a Fermilab physicist of 32 years and Deputy Cryogenic Department Head; on Monday, April 26 at his home in Naperville following a lengthy illness.

LUNCH SERVED FROM
11:30 A.M. TO 1 P.M.
$10/PERSON

DINNER SERVED AT 7 P.M.
$23/PERSON

Chez Léon MENU

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

LUNCH
WEDNESDAY, MAY 5

Ham & Spring Vegetable Salad
with Shallot Vinaigrette
Angel Food Cake
with Mango Ginger Sauce

DINNER
THURSDAY, MAY 6

Baked Spring Rolls
with Chili Peanut Sauce
Miso Glazed Chilean Sea Bass
Sesame Spinach
Pineapple Cake

LUNCH
WEDNESDAY, MAY 12

Cajun Salmon
with Jicama & Melon Salad
Mango and Lime Cake

DINNER
THURSDAY, MAY 13

Skewered Shrimp
with Apricot Curry Glaze
Pork Tenderloin
with Portobello Mushroom Sauce
Asparagus
with Lemon Herb Sauce
Orange Souffle

LUNCH
WEDNESDAY, MAY 19

Tandari Chicken Salad on Romaine
Fruit Salad
with Papaya Mint Sauce

DINNER
THURSDAY, MAY 20

Seafood Salad
Beef & Vegetable Kabobs
Rice Pilaf
Espresso and Cream Cake

LUNCH
WEDNESDAY, MAY 26

Pork Hoi sin Roll wraps
Sesame Scented Cucumbers
Yucca and Coconut Cake

DINNER
THURSDAY, MAY 27

Santorini Salad
with Grilled Shrimp
Lamb Rib Chops
Tomato Risotto
Grilled Vegetables
Strawberry-Orange Ricotta Cake
with Pistachios

Fermilab

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