FermiNews

Fermi National Accelerator Laboratory

Volume 21 | Friday, March 20, 1998 | Number 6

INSIDE

CDF Corrals the Last of the Mesons

....at least the last of the normal ones

by Judy Jackson, Office of Public Affairs

By tradition, Fermilab scientists announce discoveries first at their own laboratory, and researchers from CDF, the Collider Detector at Fermilab, carried on the tradition with a March 5 seminar presenting the newest member of the meson family, the B_c meson.

Fifty years ago, scientists discovered the first meson, the pion, in cosmic rays on a mountaintop. CDF's newly minted particle, the B_c ("Bee Sub See"), a combination of a charm quark and an antibottom quark, created in collisions at the Tevatron, is likely to be the last of the quark-antiquark pairs that constitute normal garden-variety mesons.

Physicist Shin-Hong Kim, of Tsukuba University in Japan, presented "the discovery of a non-elementary particle" to an all-Fermilab audience. Kim explained the CDF researchers' methods for identifying the B_c from its decay products and separating the particle's distinctive electronic signal from meson-mimicking

continued on page 2

$u\bar{u}$ π°,η,η'	$u\bar{d}$ π^{+}	$u\bar{s}$ K^{+}	$u\bar{c}$ $\bar{D}^{\circ}$	$u\bar{b}$ B^{+}
	$d\bar{d}$ π°,η,η'	$d\bar{s}$ K°	$d\bar{c}$ D^{-}	$d\bar{b}$ B°
		$s\bar{s}$ η,η'	$s\bar{c}$ D_s^{-}	$s\bar{b}$ B_s°
			$c\bar{c}$ J/ψ	$c\bar{b}$ B_c^{+}
				$b\bar{b}$ Y

Tsukuba University physicist Shin-Hong Kim, of CDF, discussed the discovery of a new meson at a Fermilab seminar on March 5.

Photo by Reidar Hahn

Photo by Reidar Hahn

Rutgers physicist and CDF collaborator Tom Devlin at the seminar announcing the B_c.

Last of the Mesons

continued from page 1

background events. Kim said the collaboration had determined a mass of about 6.4 GeV/c^2 for the B_c (for reference, the mass of the proton is about 1 GeV/c^2) and a whirlwind B_c lifetime of about .46 picoseconds.

The CDF collaboration is a team of 450 physicists from 39 universities and laboratories from seven countries. Data from the high-energy particle collisions in the experiment's collider detector yield results on a wide range of topics—the top quark is another example. Different teams within the collaboration concentrate on particular areas of physics analysis.

Kim said the B_c team studied 100 million proton-antiproton collisions for evidence of the B_c's unique characteristics. Of the 31 events that passed muster as possible B_c mesons, as many as a dozen could be explained away as mistaken-identity background from other processes. That left 19 events that could not be background. The odds were better than a million to one that the experimenters were seeing something new. Measurements of the new particle's mass, lifetime and production rate then clinched its identification as the B_c.

Discussion at the seminar was lively, with members of the audience giving particular scrutiny to the collaboration's calculation of backgrounds. CDF researchers said they plan to submit the paper announcing the discovery of the B_c to *Physical Review D* very shortly.

Meanwhile, CDF collaborators wrestled with how to tell the rest of the world about their new meson. While some proposed introducing the new particle with a certain fanfare, others favored a distinctly low-profile approach.

From across the accelerator ring came congratulations from colleagues at the DZero experiment.

"While I was not able to hear the CDF seminar," said DZero cospokesman Hugh Montgomery, "the B_c discovery doesn't surprise me. CDF has produced a series of world-class B physics results and has clearly established the hadron collider as a preeminent B physics tool. If I were a betting man, I would put a few dollars on the Tevatron in the race to find CP violation in B physics." ■

Meet the Mesons

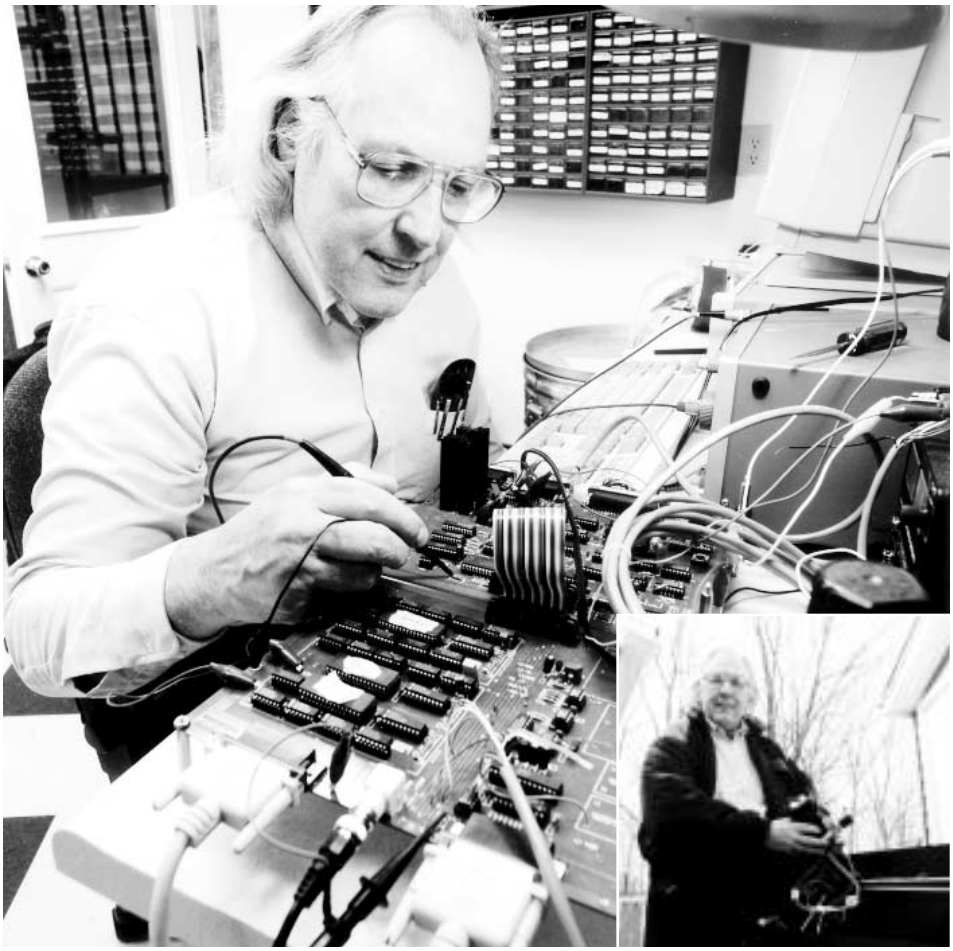
$u\bar{u}$ π°,η,η'	$u\bar{d}$ π^+	$u\bar{s}$ K^+	$u\bar{c}$ $\overline{D}^\circ$	$u\bar{b}$ B^+
	$d\bar{d}$ π°,η,η'	$d\bar{s}$ K°	$d\bar{c}$ D^-	$d\bar{b}$ B°
		$s\bar{s}$ η,η'	$s\bar{c}$ D_s^-	$s\bar{b}$ B_s°
			$c\bar{c}$ J/ψ	$c\bar{b}$ B_c^+
				$b\bar{b}$ Υ

Mesons are made of the fundamental particles called quarks and their antiparticles, antiquarks. A quark plus an antiquark combine—very briefly—to make a meson. Quarks come in six flavors—up, down, strange, charm, bottom and top—but top quarks don't live long enough for meson formation. The remaining five quarks and five antiquarks can combine to make mesons. But 10 of these combinations are merely antiparticles of another 10, and those are regarded as equivalent. (Up-antidown equals antiup-down.) That leaves 15 possible combinations. Until now, physicists had discovered 14 in particle collisions in cosmic rays or particle accelerators. Now CDF has captured the final meson combination, the B_c, made of a charm quark and an anti-b.

The chart shows the possible quark-antiquark combinations. Each box includes an example of a meson containing that combination. Some mesons are mixtures of different combinations of quark-antiquark pairs. For example the π° is a mixture of $u\bar{u}$ and $d\bar{d}$.

Earlier attempts to find the B_c meson by CDF and groups at CERN gave provocative hints of its existence, but were able only to place upper limits on its production rate.

Besides the 15 "normal" quark-antiquark mesons, theorists speculate that other exotic types of meson may exist. Last year, an experiment at Brookhaven National Laboratory found evidence for what may be the first example of such an exotic meson.



Photos by Fred Ullrich

Tom Droege works on one of his homemade detectors. Inset: Droege's latest-model telescope is mounted atop an addition to his home.

Tom Droege and His Celestial Fax Machine

By Mike Perricone, Office of Public Affairs

Imagine a fax machine that could transmit a page as big as the sky.

Tom Droege imagined it, and built it. Now the world is beating a path to his Website, and he is directing an international collaboration with close to 200 members in 14 countries.

"It's the best kind of collaboration—no meetings, no structure, no boss," said Droege, looking over a long list of e-mail messages on his computer.

The Amateur Sky Survey (TASS) grew from Droege's search for a "retirement project." He has been an electrical engineer and instrument designer for 35 years, some 25 of them at Fermilab. He's now working half-time at the Lab, but as he looked ahead toward retirement, he wanted the fun of running his own project instead of being a constant assistant.

He has been successful enough to attract the cooperation of noted astronomer Bhodan Paczynski of Princeton University, who has contributed filters and charge-coupled devices (CCDs). Paczynski also is attempting to place one of Droege's detectors at the Las Campanas observatory in Chile, where he is collaborating on the All-Sky Automated Survey.

What Droege has undertaken, with a core group of about a dozen regular Internet collaborators, is a whole-sky survey to record variable stars. He has shipped 22 homemade detectors, using what he calls "high school electronics," to amateur astronomers across the country and in Canada. They repay him by writing segments of the software to catalog the data collected from a 3-degree-wide band of sky.

He has spent $50,000 of his savings on the instruments, which he calls "peanuts" compared to the cost of software.

"It's really a multimillion-dollar software project," Droege said. "The way we're getting the software done is luring people through the Internet, people who are fascinated by the problem and interested in astronomy and willing to write pieces of the code."

It all began with a comet, a chip, and a collection of camera lenses he bought for $19 each.

When the comet Shoemaker/Levy collided with Jupiter in the summer of 1994, Droege imagined building a comet-searching device. On the Internet, he linked up with real-world astronomers who urged him to redirect his efforts toward measuring variable stars.

"A star might go nova," Droege said, "and if we've got measurements for the last three weeks showing how it developed, that would be fantastic. The earlier you catch this happening, the more scientific information you have and the more exciting it is to astronomers."

The information is collected through a manual-focus camera lens and recorded on the type of CCD found in a fax machine, then relayed to a computer.

"The sky is moving—actually the earth is rotating—but if you put a lens in front of it, and put a fax chip under the lens, it's just like drawing a piece of paper through a fax machine," Droege said. "The technique is called drift scanning. You don't need to have any moving parts in the device in order to take the picture."

Droege set up earlier cameras in his backyard, but the latest is on the roof of a new addition to his Batavia home—an addition that includes a 500-square-foot workspace. On the lower level is a small swimming pool where Droege can swim in place for exercise; at 67, he has had two hip replacements.

"I saved all my life and invested well," he said. "I can finance enough of this project to keep me busy until I die." ■

The Amateur Sky Survey website address:
http://www.tass-survey.org/

U.S. LHC Project Passes a Milestone

Lehmann review panel agrees to baseline U.S. LHC Accelerator Project

by Judy Jackson, Office of Public Affairs

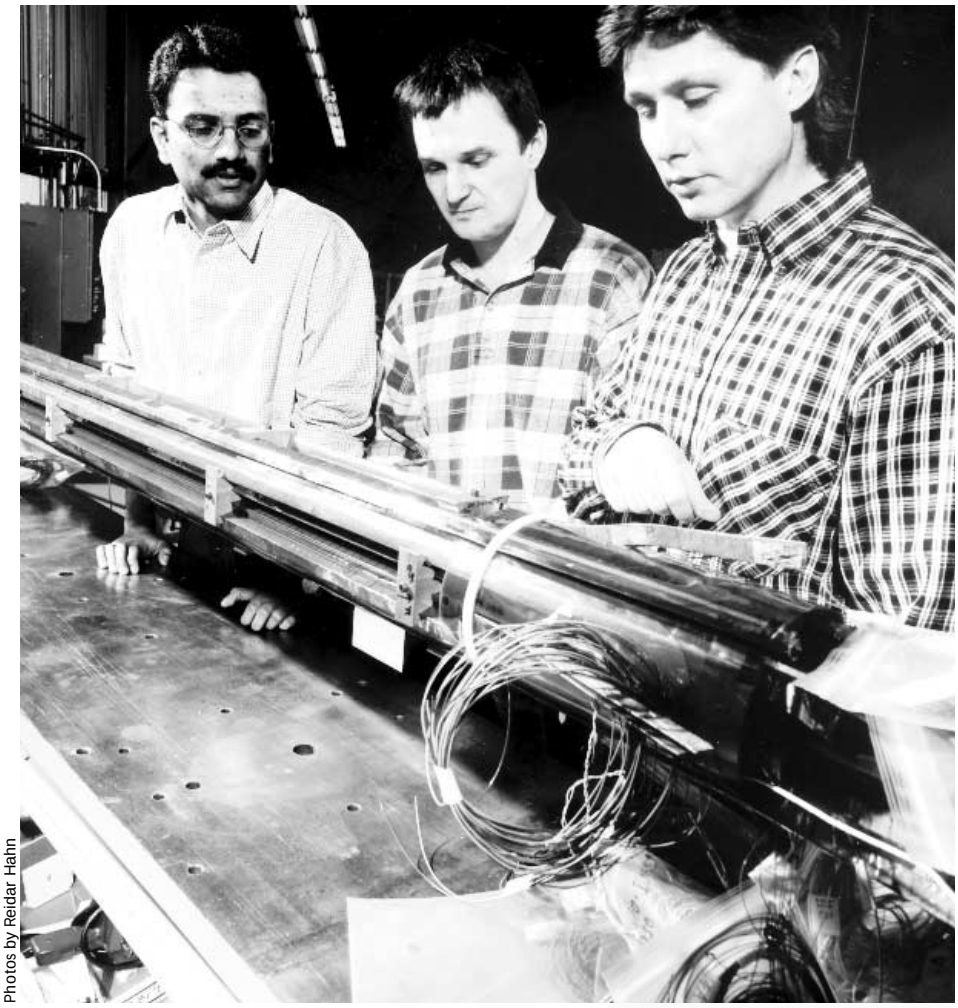
With the eyes of much of the U.S. high-energy physics community upon them, the collaborators in the first-ever U.S. project to help build a foreign accelerator cleared an important hurdle late last month. Not only did they clear it, in fact, but the main question that emerged from the February 23-26 Lehman Review of the U.S. LHC Accelerator Project was whether the bar might be set too low.

The review committee's job, as defined by its chair, the Department of Energy's Dan Lehman, in his letter to panel members, was to "review and assess the technical feasibility of achieving the proposed contribution of the DOE Laboratory Collaboration, the credibility of the associated cost and schedule estimates, and the adequacy of the management plan to accomplish the scope of work."

After examining the technical and managerial aspects of the project in detail, the tell-it-like-it-is panel of DOE officials and expert consultants agreed that the project, a three-laboratory collaboration that will help build and install components of the new Large Hadron Collider to be built at CERN, should be baselined.

What does baselining mean? According to Lehman, it signifies that the review committee is satisfied "that the project has been adequately developed so that a quantitative expression of project scope, schedule and cost elements can be defined. Establishing a baseline includes setting technical, cost, and schedule criteria to serve as a standard for measuring the performance and progress of the project." Subsequent Lehman reviews then assess a project's progress with respect to the baseline.

Not every initial project review results in a baseline. Last year, Lehman reviews of the US/CMS and US/ATLAS projects that will help construct the LHC's two main detectors sent those projects back to the drawing board. ATLAS recently achieved baseline on its second try. CMS will try again this spring.



Photos by Reidar Hahn

Fermilab engineers Deepak Chichili, Igor Novitski and Fred Nobrega examine the electromagnetic coils at the heart of HGQS02, test model of the interaction region superconducting quadrupole magnets that Fermilab will build for the LHC at CERN.

The Lehman review of the U.S. LHC Accelerator Project, a Fermilab-led collaboration of Brookhaven National Laboratory, Lawrence Berkeley National Laboratory and Fermilab, had a high profile. At a December 8 ceremony in Washington, held to mark the signing of the agreement between U.S. and CERN on U.S. participation in the new European accelerator, officials on both sides called the U.S./LHC agreement an unprecedented partnership.

"When we sign this agreement," Energy Secretary Federico Peña said, "it will mark the first time the U.S. government has agreed to contribute significantly to the construction, through domestically produced hardware and technical resources, of an accelerator outside of our borders."

The pressure to complete the U.S. LHC contributions on time and on budget goes still higher because of the Congressionally-mandated $531 million cap on total U.S. funding for the LHC accelerator and detector projects over the next seven years. Whereas other projects may sometimes have a little wiggle room for unanticipated cost increases, there is no such margin for the U.S./LHC projects. By law, they cannot exceed the funding cap.

Physicist Mike Harrison, of Brookhaven, and Tony Chargin, a reviewer from Lawrence Livermore National Laboratory, during a break in proceedings.

Thus, project managers must plan the scope of their LHC contributions to leave a large enough margin of funding to provide for unexpected contingencies that may arise during the course of the project. One question that Lehman reviewers always ask for every large construction project is whether the contingency funding is adequate for the level of risk the project entails.

For the U.S. LHC Accelerator Project, the review committee concluded that not only was the contingency adequate, but perhaps it was more than adequate. To be on the safe side, Project Manager Jim Strait and his colleagues had "descoped" their project somewhat from the initial plans for the U.S. accelerator contribution. Maybe, the review committee suggested, there was room to "rescope" a little.

"The Accelerator Project Office should develop plans and decision dates for increasing scope as the actual costs accrue and contingency [funding] may become available," the committee stated in its recommendations at the review's closeout.

"The Committee supports the FY1998 work plan and scope of deliverables but recommends the re-evaluation of costs and schedules with the goal of producing a plan for increasing the list of US deliverables to CERN."

The review committee also noted that there seemed to be plenty of time to accomplish the project's goals and worried that scientists might become bored by spinning out over seven years some tasks that, the committee believed, could be accomplished in four. Stretching out the time, they said, also makes the project cost more. The committee recommended exploring with CERN ways to make funds available ahead of the U.S. funding schedule in order to "accelerate and also optimize the U.S. tasks."

CERN physicist Tom Taylor, deputy LHC Division leader, welcomed the committee's comments.

"We have been egging him on to take in more scope," Taylor said of Project Manager Strait. "It would be in our mutual interest. We all want to build as much as we can with the money we have. We at CERN are limited in money as well. I thank the reviewers for their encouragement for the U.S. to take in more scope."

For his part, Strait told the review panel he would take their recommendations extremely seriously.

"We have not been happy with the reduced scope," Strait said. "We hope to add scope as contingency becomes available."

Fermilab physicist Steve Holmes, project manager for the $230 million Main Injector project now nearing completion at Fermilab, called the review panel's conclusions "a real vote of confidence from DOE."

"If the reviewers thought there might be too much contingency, they must have felt that those guys understood their scope and their costs very well," Holmes said. ■

Photos by Reidar Hahn

DOE's Bruce Strauss, left, organized the review. U.S./LHC Accelerator Project Manager Jim Strait, of Fermilab, center, and Deputy LHC Division Leader Tom Taylor, of CERN, noted reviewers' recommendations during the closeout session.

Jim Kerby, Fermilab LHC project manager and national Project Manager Jim Strait, moments before the closeout of a review they had prepared for during many months. "I'm going to spend the day with my kids tomorrow," Kerby said after the closeout. "I want to be sure they remember who I am."

Bill Barletta, division director of the Accelerator and Fusion Research Division at Berkeley Lab, listened as reviewers presented their findings.

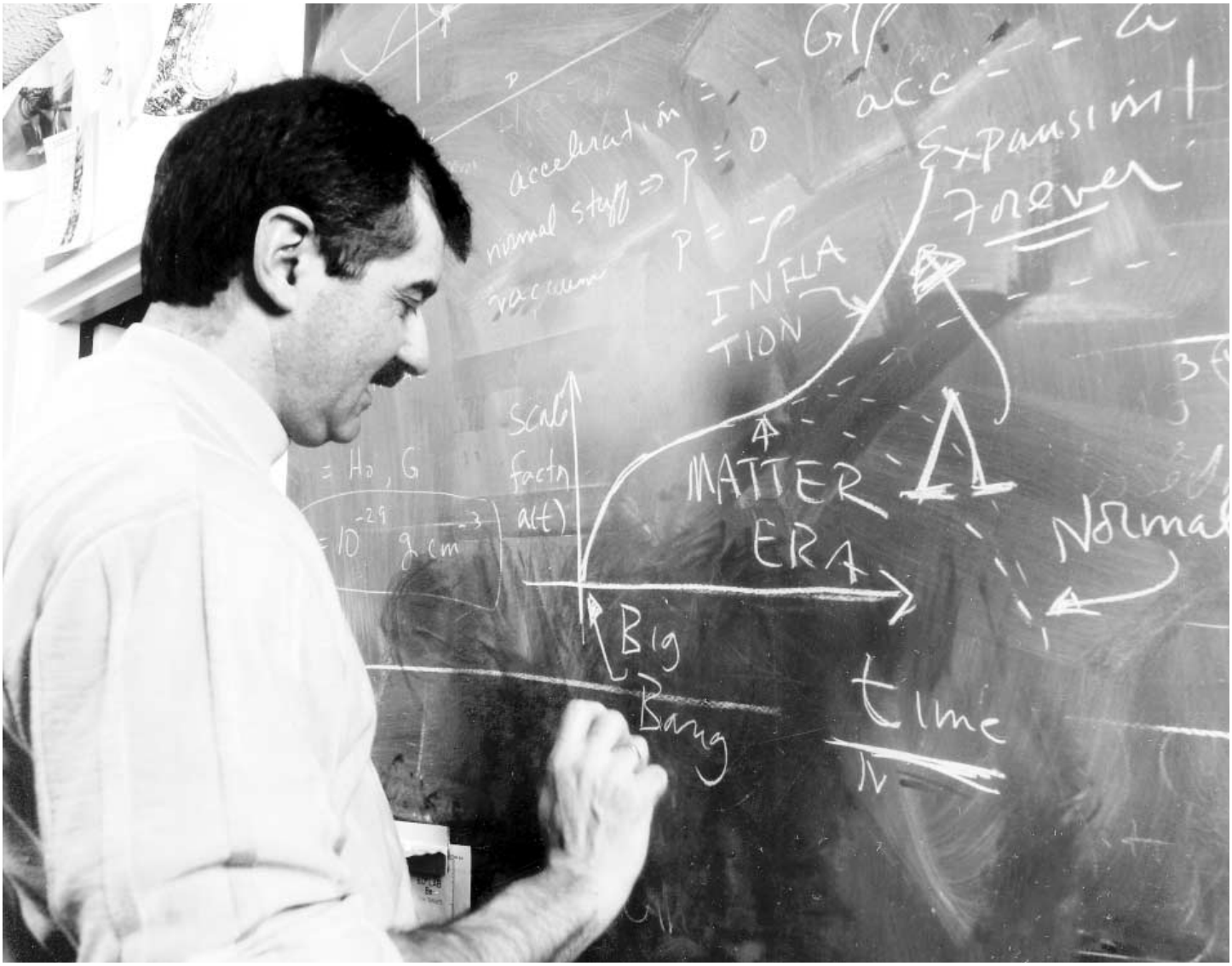


Photo by Reidar Hahn

Theoretical astrophysicist Rocky Kolb says, "So now we have a universe that has dark matter, baryons, a cosmological constant, radiation; and if neutrinos have mass, then there's more than one type of dark matter (hot, cold, warm). Who needs all this stuff?"

The Cosmological Constant Is All the Rage

With data streaming in from observations of supernovae, theoretical astrophysicists are revisiting Einstein's "biggest blunder."

by Sharon Butler, Office of Public Affairs

It may be a Kuhnian paradigm shift, or it may be a big mistake.

Two sets of astronomical observations now have come to the same cautious conclusion. By measuring the brightnesses of supernovae millions of light-years away and calculating their distances and the rates at which they are receding, astronomers say that the expansion of the universe is not decelerating, as they and everyone else had expected. Instead, they say, the universe is flying apart faster than ever before.

If that's true, then perhaps Albert Einstein never should have thrown away his cosmological constant. In the 1920s, to "correct" the equations in his theory of general relativity, Einstein had inserted a cosmological constant, symbolized by a capital lambda. His equations had shown the universe to be dynamic, either expanding forever or contracting to infinite density, a philosophically unacceptable state of affairs. With his cosmological constant to offset gravity's pull, Einstein could keep the universe just where it was. But E.P. Hubble discovered 13 years later that the universe was indeed expanding, and Einstein discarded his mathematical fix, calling it the "biggest blunder of my life."

Now, however, faced with compelling evidence from observations of supernovae, cosmologists say the concept may have some merit after all.

It's either "really profound or completely wrong" says Rocky Kolb, of Fermilab's Theoretical Astrophysics Group and the University of Chicago. "People have found cosmological constants before," he jokes. "It's usually the last refuge of scoundrels."

Supernovae data

Collecting data from supernovae is not easy, says Heidi Newberg, a Fermilab experimental astrophysicist who earlier worked with one of the two scientific collaborations that collected the supernovae data. "A supernova that is far enough away to be useful for cosmological measurements is visible only with the world's top telescopes [and only] for a couple of months."

The telescopes need to be fitted with advanced cameras (called charge-coupled devices) that can cover large areas of the sky and probe deeply into space. The scientists don't know where the supernovae will appear, just as shooting stars take you by surprise. But a certain percentage of stars are bound to go off. Once they do, astronomers then follow them with different telescopes around the world, charting how the brightnesses of the exploding stars vary with time.

"Finding the 40 supernovae that [challenged] our understanding of the universe took eight years of writing proposals, developing software, building up a record of success (to allow access to the better telescopes), and sticking to the search despite the weather, uncooperative instruments, and critics," Newberg says.

As for the proposed cosmological constant, Newberg says, "It may be that reintroducing lambda is the right thing to do and that it will solve all of the problems. However, it is too early to tell whether this is the right choice. One might be able to change relativity in some other way, or to change one of the other assumptions we have made about the universe."

Vacuum energy

For now, though, the cosmological constant, or some variation, is all the rage.

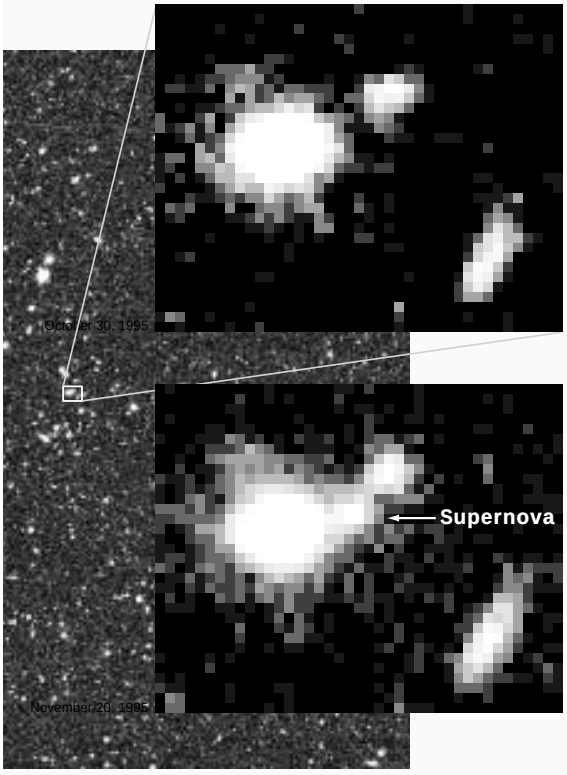
Theoretical astrophysicists know the cosmological constant as the energy associated with a vacuum, not as an antigravity force, as some journalists have called it.

Contrary to intuition, a vacuum is not empty at all. "In the quantum world, the vacuum is a busy place," says Fermilab

continued on page 8

Photo by Reidar Hahn

Experimental astrophysicist Heidi Newberg collected reams of data on tape when she participated in the Supernova Cosmology Project's first search for distant supernovae.



A view of distant galaxies (left), with a closeup of one (top) and a supernova that later appeared. From the Supernova Cosmology Project, one of two collaborations whose data appear to show that the expansion of the universe is accelerating.

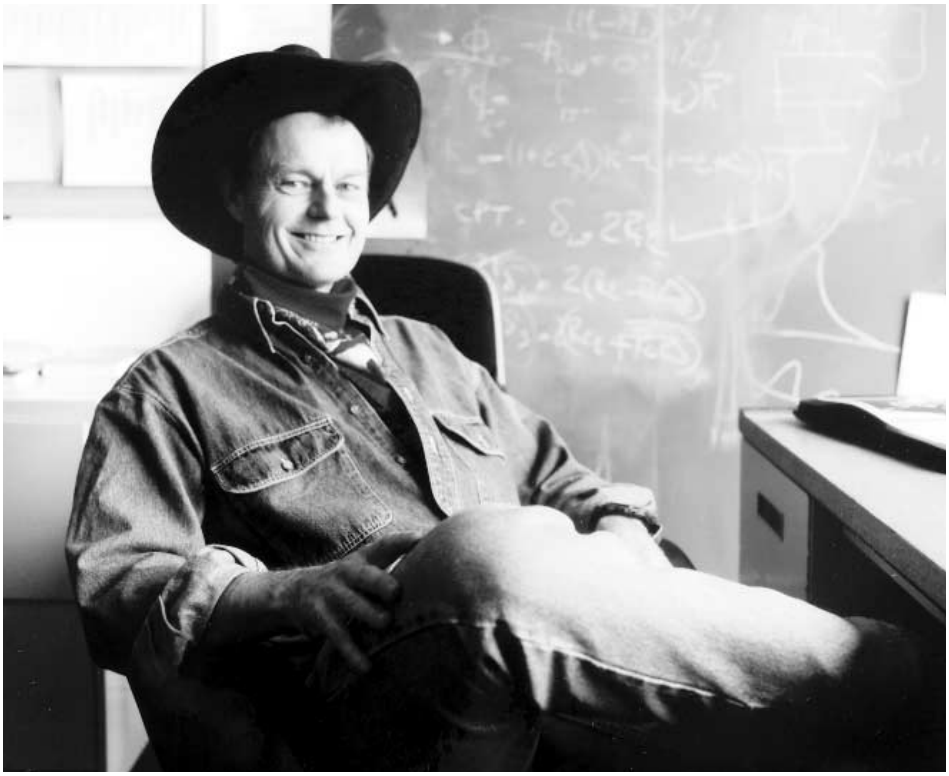


Photo by Reidar Hahn

Experimental astrophysicist Roger Dixon says, "When you think about it, something pushed the universe apart in the first place. It would surprise me if that field or force turned itself off in the meantime, but I'm just a simple, country experimentalist."

Intrigued? On March 31, Fermilab's Theoretical and Experimental Astrophysics groups and Theoretical Physics Group will hold a one-hour "News from the Universe," with short presentations on the recent experimental results and their theoretical and cosmological implications.

Also, May 1–3, the Theoretical Astrophysics Group, with the University of Pennsylvania, will sponsor a workshop titled "The Missing Energy in the Universe," with feature talks by many of the experimentalists and theorists working on the problem. See http:///www.physics.upenn.edu/~www/astro-cosmo/caldwell/workshop/ for updated information.

Cosmological Constant

continued from page 7

theoretical particle physicist Joe Lykken, "and its energy density is typically not zero." The energy arises from quantum-mechanical interactions: the creation and annihilation of virtual particles and antiparticles. By stretching space, the vacuum energy counteracts gravity's relentless pull.

In recent years, this vacuum energy has found a useful place in cosmological models. For if the universe is flat, as inflation theory suggests, then it must have a certain critical density to keep it balanced between two fates: ever-expansion or ultimate collapse. The trouble is, astronomers have never been able to find enough matter—whether standard baryonic matter or more exotic dark matter—to preserve this balance. As much as 70 percent of the matter needed is missing, and the cosmological constant has been called in to fill the gap.

That the cosmological constant may indeed exist, then, comes as no surprise for theoretical astrophysicists. The surprise is that the cosmological constant is so very small—only about 10^{-29} or 10^{-30} grams per centimeter cubed.

Coming from the perspective of particle physics, Fermilab's theoretical astrophysicists reckon that the constant should be 120 orders of magnitude larger than it apparently is—which makes astrophysicists think that the cosmological constant is no constant after all.

"The usual assumption physicists have made is that there is some yet-to-be-discovered principle that drives the cosmological constant to zero, regardless of what other quantum physics may be affecting the vacuum energy," says Lykken. "In that case, the cosmological constant changes with time, slowly 'relaxing' to zero over a period of perhaps billions of years. This is a reasonable idea, but nobody has the slightest idea of how to really make it work."

One alternative is a class of models called quintessence, after Aristotle's fifth element of matter. Like the later aether, quintessence was supposed to permeate the heavens. The models try to show how a cosmic energy density might vary in both time and space.

Josh Frieman, head of Fermilab's Theoretical Astrophysics Group, has developed one such model in collaboration with Chris Hill, of the Theoretical Particle Physics Group. The model uses a pseudo-Nambu-Goldstone boson, a light particle associated with symmetry-breaking, and describes how the vacuum energy might be small today but evolve to a value of zero. The advantage of the model, Frieman says, is that such particles—pions, for example—do exist; Frieman and his colleagues are just using the particles in a different context.

Superstring theory also offers an alternative to explain the cosmological constant. Tom Banks, of Rutgers University, has offered speculations derived from superstring theory and the study of black holes. He used measurements of the cosmic background microwave radiation and the hypothetical scale of symmetry-breaking in the most popular models of supersymmetry. According to Lykken, Banks came up with a constant that roughly agreed with the supernovae observations.

"Still, it is much too early to conclude what, if anything, superstrings will teach us about the cosmological constant," says Lykken.

With the data accumulating from the supernovae observations, theorists can begin to test alternative models of the cosmological constant. But for now, Frieman says, "We're still groping." ■

The Search Is On

Who will Fermilab's next director be?

by Sharon Butler, Office of Public Affairs

With the announcement by John Peoples that he intends to retire in July 1999 as Fermilab's director, Universities Research Association, Inc., which oversees the laboratory's operation, is busy appointing a search committee for Peoples' successor. By the end of March, URA hopes to be able to announce the names of the committee's members and chair and to have in hand a formal charge for the committee setting out the criteria and deadline for the selection process.

URA has promised to find the "best possible person to lead Fermilab through the early years of the 21st century." To make that possible, it is setting up an interactive Web page, linked with Fermilab's, that will allow the high-energy physics community to communicate with committee members.

Meanwhile, however, Fermilab employees and users already have their own ideas about the kinds of credentials the next director should have.

On top of the list for most people were: a vision for the future of high-energy physics, a strong reputation within the scientific community, and commitment to the field.

He or she must be "absolutely devoted to high-energy physics," said G.P. Yeh, a physicist in the CDF collaboration. "The person must have a vision for the direction of high-energy physics, and has to be respected by all of us in the field."

And of course, Yeh added, the person has to be "great, fair, and all that stuff." Whether the person is an experimentalist or a theorist, or from outside Fermilab or inside, is not important, Yeh said.

Fermilab engineer Dave McGinnis, asked what criteria he would use to select Fermilab's next director, was hesitant at first to comment because, he said, "whenever I open my mouth I seem to get in trouble." But then he decided he would allow *FermiNews* to quote him "since I'm always in trouble." He said his "dream director" would know as little as possible about accelerators—presumably because he would prefer the director didn't meddle.

Management skills seemed to be less of a priority, although one beleaguered physicist, who asked to remain anonymous, said the director should not be like Pascal's law, which states that pressure applied to a fluid is transmitted undiminished to all parts of the fluid; i.e., "pressure applied to the top of a hierarchy [should not be] transmitted undiminished to all parts of the hierarchy."

Social skills figured on some people's lists, too. Mark Leininger, of the Computing Division, put it succinctly: The director needs to have "a head for science and a heart for people." ■

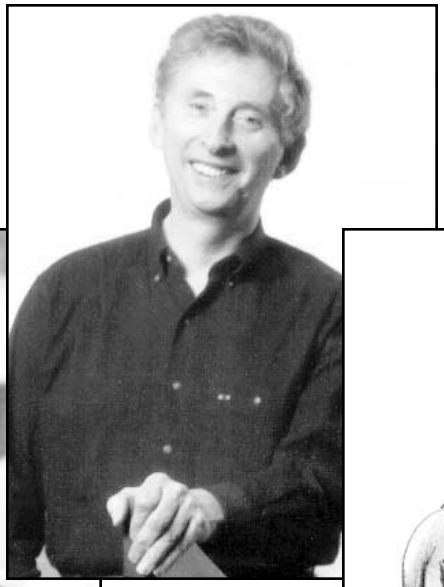
1967

◄ Robert Wilson, Fermilab's founding director, built the Laboratory's first accelerator.

1978

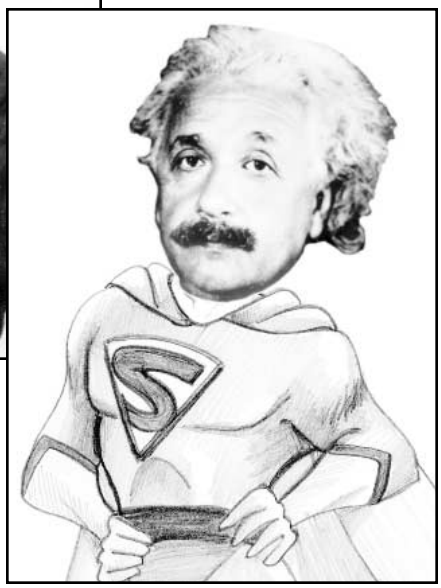
◄ The Tevatron saw its first proton-antiproton collisions while Leon Lederman was director.

1989



◄ The top quark made its first appearance on John Peoples' watch.

1999



Fermilab employees and users expect great things from their next director.

Run II Upgrade UpDate 2000

All the king's horses and all the king's men
Are busy putting the detectors together again.

by Sharon Butler, Office of Public Affairs

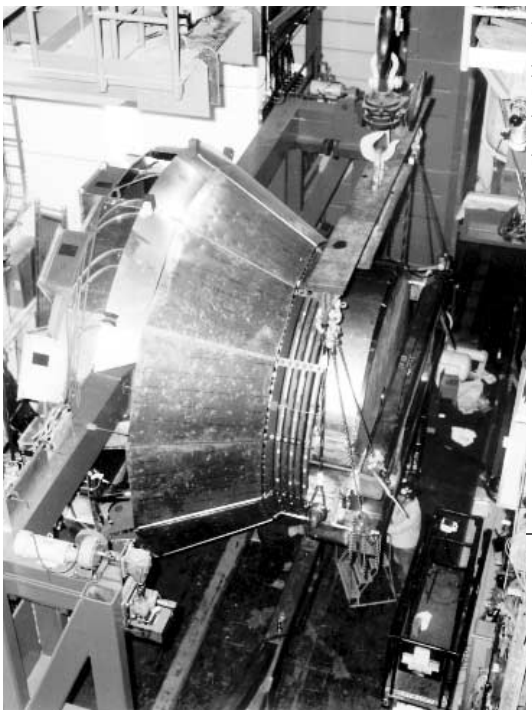


Photo by Reidar Hahn

Workers mount an electromagnetic calorimeter on an end plug for the CDF detector.

Last month, Scott Doer, of Lab 5, stood on the high gallery in the CDF assembly hall shaking his head as he watched workers in the pit below mounting what looked like an oversized tin hockey puck on the face of the detector's east end plugs. "I've been waiting for this moment for almost seven years," he said.

That's how long the lab has been building the fiber optic and scintillating panels (called pizza pans because of their wedge shape) that go inside the hockey puck, officially called an electromagnetic calorimeter.

At 13 tons, the calorimeter is a giant, unwieldy case that measures the energies of the particles passing through it. Fermilab's Meson Assembly Building Shop constructed a special U-shaped contraption, itself weighing two tons, just to pick the calorimeter up off the floor, rotate it and set it in its rightful place.

It was a frustrating day. The calorimeter had to be bolted onto the end plug with flat-head screws, and the bolts weren't lining up with the holes on the inner mounting ring. Workers consulted on an elevated platform, climbed onto the calorimeter, wiped their brows and consulted some more. One of them yanked at the 13-ton calorimeter, trying to make the holes at the outer and inner diameters align.

Then word came up. "We got a little grinding to do," someone said. The calorimeter wasn't sitting right because the inside ring was too long, by a mere three-sixteenths of an inch. Two days later, after some head scratching and a lot more consulting, the workers coaxed the calorimeter into position and the installation was done. ■

Over at DZero, men in white coats are busy taking apart 22 of 100 giant chambers that will sit around the outside of the detector to track muon particles. The technicians have to pull their ends off, to expose the multiple elongated cells inside, and pull out the old wires and electronics, and the old pads on which copper conductors sat.

In Run I, the pads had given off a gas that contaminated the muon chambers and ended up on the wires that thread through each cell. DZero got through the run by blowing the contamination off the wires with an electrical discharge, according to Bill Freeman, who is keeping a watchful eye on scheduling for the Run II upgrade.

"But that takes time, and it's a complicated process," said Herman Haggerty, a physicist with DZero. "And since we'll be running so high in the next run, with the increase in intensity, we don't want to have to be decontaminating these things every week."

So, each cell in the 22 muon chambers now has to be refitted with new pads, constructed of more expensive but more reliable G10 material—"greenish, fiberglassy-looking sort of stuff," as Freeman described it.

Once the new pads are installed, technicians will insert a fine hair of gold-plated tungsten wire through a tiny plug hole at the end of each cell and run it through to the plug hole at the other end. "It amazes me that a human can put a 2/1000-inch wire through a 3/1000-inch hole, neither of which you can see," said Haggerty.

The old electronic boards also have to be upgraded with new, faster, digital ones, since the muon chambers require an "incredibly complicated readout system," Haggerty said.

And what happens to the old electronics and the 60-some leftover muon chambers from Run I? The NuMI experiment will use about half the chambers, but Haggerty nods regretfully at a row of trash cans lined up along the wall, each filled with colorful motherboards: "We tried giving them away all over the world, even to China, but we didn't get any takers." ■

Chez Léon

MENU

Lunch served from
11:30 a.m. to 1 p.m.
$8/person
Dinner served at 7 p.m.
$20/person

For reservations, call x4512
Cakes for Special Occasions
Dietary Restrictions
Contact Tita, x3524

Lunch
Wednesday
March 25

Eggplant Rolls
Escarole and Endive Salad
Apricot Cake

Dinner
Thursday
March 26

Coquille St. Jacques
Marinated and Grilled
Rib Lamb Chops
Potato Gratin
Cardamom Carrots
Fresh Kiwi Tart

Lunch
Wednesday
April 1

Cheese & Pinto
Bean Quesadillas
with Salsa Fresca
Jicama & Romaine Salad
with Cumin Vinaigrette
Papaya with Fresh Lime

Dinner
Thursday
April 2

Smoked Salmon with Capers
Lemon & Dill
Cider-Marinated Grilled
Duck Breast
with Spicy Mango Chutney
Wild Rice with Mushrooms
Vegetable of the Season
Strawberry Tart

LAB NOTES

Walk This Weigh

Introducing Walk This Weigh, a new walking & weight management program sponsored by the Recreation Office. Now you can walk your way to a healthier, more fit, energetic attractive version of your current self with the all new Walk This Weigh program. This walking & weight management plan sets you on the path to better fitness by encouraging consistent exercise and sensible eating. It's not a diet and it's not a competition—it's a weigh of life. This 90 day program begins April 1 through June 30.

- Exercise & weight management habits that last a lifetime.
- 50 nutrition tips to decrease fat and cut calories without dieting.
- Walking routines to keep you motivated.
- Healthy eating patterns that fit your lifestyle.
- Activities & incentives for added fun.

An "Apple A Day Helps You Walk This Weigh" kickoff event. Join us in the Atrium from 11:30-12:30 and pick up an apple before you start your Walk This Weigh program. Apples will be available to registrants only. Registration forms and program packets can be picked up at these locations:

- Recreation Office, WH15W, x2548, x5427
- Medical Office, WHGF
- 1 West at the Covert Bailey video "Pot Bellies & Thunder Thighs" March 24.

Registration deadline is March 27.

Step Aerobics/Muscle Toning

Step Aerobics - 9 week class
Monday & Wednesday
5:30-6:30 p.m.
March 30-May 27
Cost $54.00

Muscle Toning - 9 week class
Tuesday & Thursday
5:30-6:30 p.m.
March 31-May 28
Cost $54.00

Classes are held in the Recreation Facility and are open to beginners as well as advanced exercisers. Registration & payment must be made in the Recreation Office or send a check payable to 'Bod Squad,' to M.S. 126. Registration deadline is March 23. Must be a current facility member.

Fermilab Golf Leagues

Its almost spring and time to think about Golf! Come join us for some fresh air, exercise and meet new friends. Play begins in April and there are openings in all four leagues, for information call the following:

Fox Valley - Tuesdays - April 7
Michelle Gleason, x3211 or michelle@fnal.gov
Gary Golinski, x4055 or golinski@fnal.gov

Hughes Creek- Tuesdays - April 28
Don Arnold, x2871 or arnold@fnal.gov
Bob Andree, x3703 or andree@fnal.gov

Fox Valley - Wednesdays - April 8
Terry O'Brien, x4851 or obrien@fnal.gov
Mike May, x4948 or mikemay@fnal.gov

St. Andrews - Wednesdays - April 22
Pat Liston, x2332 or pml@fnal.gov

Sign up fees due April 1 to the league officers you signed up with.

CALENDAR

MARCH 21

Fermilab Art Series presents: The Acting Company: Romeo & Juliet, $22. Performance begins at 8 p.m., Ramsey Auditorium, Wilson Hall. For reservations or more information, call 840-ARTS.

MARCH 24

Wellness Works presents: Covert Bailey video "Pot Bellies & Thunder Thighs" in 1 West at noon.

MARCH 26

Wellness Works presents: Katie Kreder, Cholesterol Count Down, 1 West, noon-1 p.m.

MARCH 27

Fermilab International Film Society presents: *Dr. Strangelove or: How I learned to Stop Worrying and Love the Bomb,* Dir: Stanley Kubrick, Great Britain (1963). Admission $4, in Ramsey Auditorium, Wilson Hall at 8 p.m.

ONGOING

NALWO coffee mornings, Thursdays, 10 a.m. in the Users' Center, call Selitha Raja, (630) 305–7769. In the Village Barn, international folk dancing, Thursdays, 7:30–10 p.m., call Mady, (630) 584–0825; Scottish country dancing Tuesdays, 7–9:30 p.m., call Doug, x8194.

MILESTONES

HONORED

- Rocky Kolb, by the American Astronautical Society. Kolb received the 1996 Eugene M. Emme Astronautical Literature Award for his book, *Blind Watchers of the Sky—The People and Ideas That Shaped Our View of the Universe.*

RETIRING

- Euhel Campbell, I.D. # 2861, on March 27, from Technical Division / Material Control.
- James Garry Sr., I.D.# 2614, on March 30, from ES&H / Fire Group.
- Donald Sorensen, I.D. # 2355, on March 31, from Beams Division / BE Engineering Support.

DIED

- August "Gus" Rehbein, formerly a designer in the Beams Division, on January 8.
- Frederick Lobkowicz, a Fermilab experimenter and professor of physics at the University of Rochester, on February 3.
- Daniel Moline, formerly of the Computing Division, on February 8.
- David Hartness, of the Technical Division / Development and Test, on February 14.
- Edward Heim, formerly of the Wilson Hall Machine Shop, on March 7.

CLASSIFIEDS

FOR SALE

■ '96 Corvette, Collector's Edition, Sebring Silver, black interior, automatic, loaded, very clean, $27,000. Call Jim, x3371 or (815) 729-9072.

■ '94 Toyota Corolla, 4-dr., silver, 61K miles, a/c, automatic, power doors & locks, new tires, 1.8L engine. Very clean, good condition, $8000 obo. Contact Janina, x4596 or (630) 837-7854 after 4 p.m.

■ '92 Dodge Dakota red pick-up truck, 4 wheel drive, air, Am-Fm cassette, cruise, tilt wheel, automatic trans, bed liner, sliding rear window. Excellent condition. Many extras, $9950. Call (847) 459–3520.

■ Queen Size waterbed. Includes frame, mattress & bookshelf headboard. $150 obo. Contact Laura, x4011, lpaterno@fnal.gov or (630) 584–5781.

■ Power Mac 7200/120, 120 MHz Power PC, 601 RISC processor, 256 L2 cache, 16 MB expandable to 256 MB, 8 speed CD ROM, new, $1000. Call (630) 262–1834, or e-mail regina@fnald.fnal.gov.

■ Nordic Track exercise ski machine, hardly ever used $450 obo; Ski's, Atomic Arc 195, Salomon 547 Sport Bindings, size 12 US or 13 EU Trappeur 2000 boots also have poles, ski & boot bag $200 obo. Call Terry, x4572 or e-mail skweres@fnal.gov.

■ 4 - 15X8 Crager aluminum wheels & tires (fit Ford F150). 2 - 15X12 Centerline Wheels, brand new. Wes, x2258 or (630) 553–5317.

■ Men's hiking boots, Merrell Wilderness, 8-1/2, brand new, never used. Current cost $225, will sell $150 or reasonable offer. Mark, x4776, markl@fnal.gov.

■ Tickets for Naperville Men's Glee Club Sunday Concert, March 22. Naperville North High School Auditorium, Mill Street & Ogden Avenue at 4 p.m. General admission, $10. Guest Performers are the University of Illinois Varsity Men's Glee Club & Naperville North High School Boy's Chorus. Call (630) 653–5154 or Bill Wickenberg, x4381. http://arachne.cns.iit.edu/~nmgc/

■ Charming 2 BR house, beautiful hardwood floors, picket fence, bright kitchen w/large window, new roof, DeKalb. Only $92,500. Call (815) 748–5966, ask for Stacy or Paul.

■ Two-unit house, Aurora, separate utilities, newer furnaces & water heaters. Updated plumbing, electric, & bathrooms. Vinyl sided exterior. Enclosed porches. Live in 1 unit & rent the other, $129,900. Call Glenn (815) 467–7309 for an appointment.

■ Former spec home, lots of upgrades in Geneva. Two story Colonial over 2300 sq.ft., 4 BR including master suite w/sitting room, large living room, dining room, family room w/fireplace, & kitchen w/breakfast nook, 2.5 baths. Master bath has separate shower stalls, whirlpool & skylight. Finished basement, fenced backyard, large patio, $219,000. Contact Simon, (630) 208–0074 (evenings) or swalk@fnal.gov.

FERMILAB ARTS SERIES PRESENTS

Shakespeare's ROMEO & JULIET

PERFORMED BY
THE ACTING COMPANY

In celebration of 25 years of theater excellence, the Acting Company performs Shakespeare's most beloved story of tragic love, Romeo and Juliet at Fermilab's Ramsey Auditorium on Saturday, March 21 at 8 p.m. Tickets are just $22. For further information or telephone reservations, call (630) 840–ARTS weekdays from 9 to 4 p.m.

Photo by Susan Johann, c 1997

"Customary though this observation has become, it must be repeated: The Acting Company is one of this country's most exciting, creative and impressive theater companies."

~ The Miami Herald

FermiNews
Fermi National Accelerator Laboratory

Published by the
Fermilab
Office of Public Affairs
MS 206
P.O. Box 500
Batavia, IL 60510
630-840-3351
ferminews@fnal.gov

Fermilab is operated by Universities Research Association, Inc., under contract with the U.S. Department of Energy.

The deadline for the Friday, April 3, 1998, issue of FermiNews is Tuesday, March 24.

Please send your article submissions, classified advertisements and ideas to the Public Affairs Office, MS 206 or e-mail ferminews@fnal.gov.

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

☆ U.S. GOVERNMENT PRINTING OFFICE:
1998--646-054/80012

50%
TOTAL RECOVERED FIBER
10% POST-CONSUMER FIBER