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Plan for High-Energy Future Affirms Key Role for Fermilab

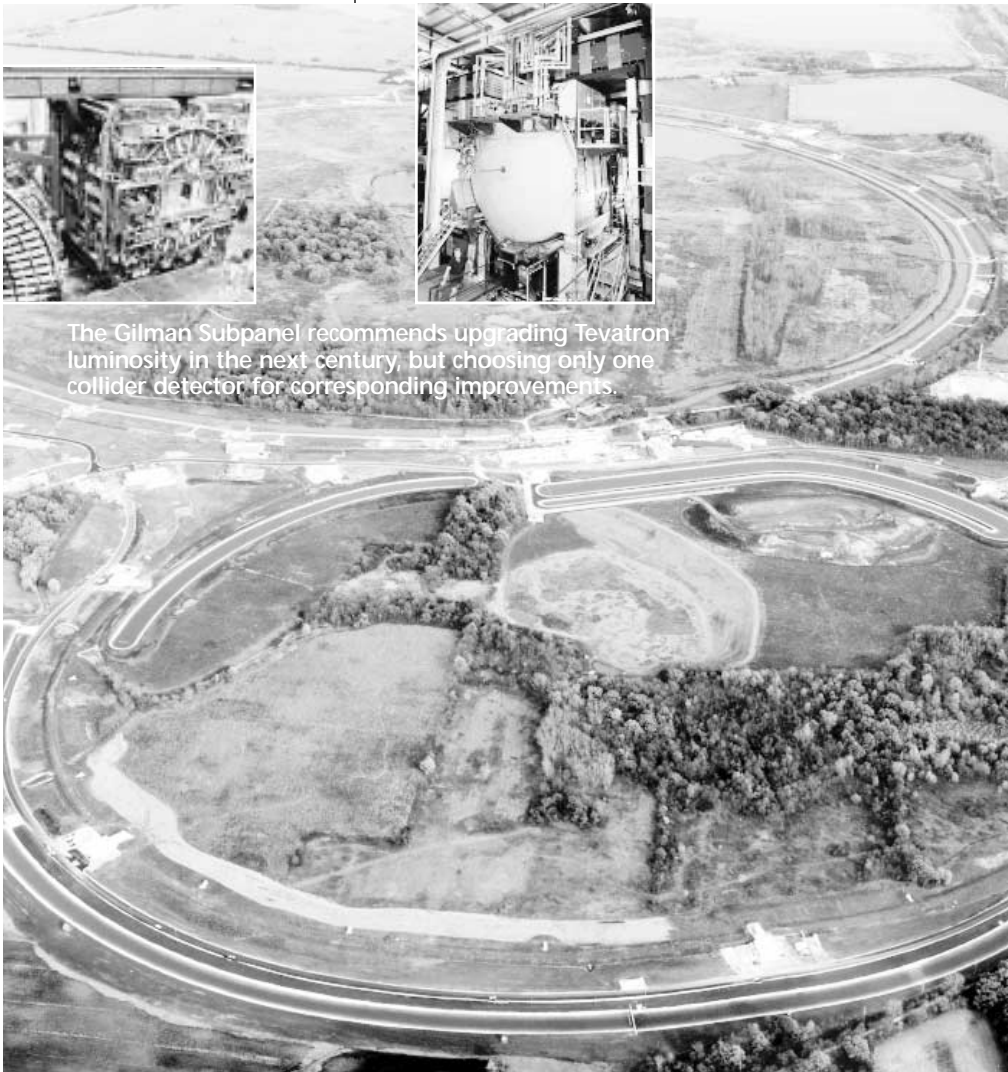
by Judy Jackson, Office of Public Affairs

Timing is everything. And, many argued, the timing couldn't have been better for the release of the long-awaited report of the Gilman Subpanel on Planning for the Future of U.S. High Energy Physics. Coming on the heels of an administration budget request boosting science funding for the first time in years, and with Congress making friendly—and bipartisan—noises about basic research, the report arrived at a moment when it appeared that high-energy physics might truly have a future worth planning for.

"Without this budget, I wouldn't have known what to say," Energy Research Director Martha Krebs told a February 18 meeting of DOE's influential High Energy Physics Advisory Panel, of the Gilman task force's recommendations. "I wouldn't know whether there was hope for your aspirations. But with the general agreement between the Administration and Congress that investments in science, including high-energy and nuclear physics, have value, I think your report comes at a truly opportune time."

Fermilab physics programs, current and future, are key elements of the subpanel plan, which HEPAP members unanimously accepted and voted to forward to the Department of Energy. The subpanel's recommendations give highest priority to making optimum use of the forefront U.S. physics facilities—including Fermilab's Tevatron upgrade—

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The Gilman Subpanel recommends upgrading Tevatron luminosity in the next century, but choosing only one collider detector for corresponding improvements.

The Gilman Subpanel's highest priority is to make best use of forefront facilities nearing completion, including Fermilab's Tevatron with the new Main Injector.

Photo by Reidar Hahn

HEPAP

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now nearing completion, and recommends funding “at a level that ensures these facilities fulfill their physics potential.” Recommendations for future facilities include investigating three potential future accelerators, two of them now under study at Fermilab.

After Drell, now what?

Subpanel Chairman Fred Gilman, professor of physics at Carnegie Mellon University, explained that the 22-member panel carried out its planning charge in the context of the 1994 Drell plan, the work of a previous HEPAP subpanel headed by Stanford Linear Accelerator Center’s Sidney Drell. In the wake of the demise of the Superconducting Super Collider, the Drell plan recommended that the U.S. particle physics community pick up the pieces and move on with a strong research program that included “significant participation in the Large Hadron Collider accelerator and detectors, both to provide research opportunities at the energy frontier and to ensure that U.S. physicists remain integrated in the international high-energy physics community.”

The signing of the LHC agreement between the U.S. and CERN, the European Particle Physics Laboratory, realized this key recommendation. However, Gilman said, with federal appropriations equaling only a small fraction of the additional \$50 million per year that Drell had recommended, it was “now appropriate to review the U.S. program.”

The charge from DOE’s Krebs to the Gilman subpanel, the 40th such HEPAP task force to be convened since 1968, called for the group to “consider the potential scientific opportunities and recommend a scenario for an optimal and balanced U.S. HEP program over the next decade.” Krebs instructed the group to assume constant funding, but also to examine the effects of both a slight budgetary increase and a slight decrease. Krebs also asked the group to give particular attention to optimizing the university-based physics research program, an area of increasing concern in the context of the changing university-laboratory research partnership.

Twenty-eight in one day

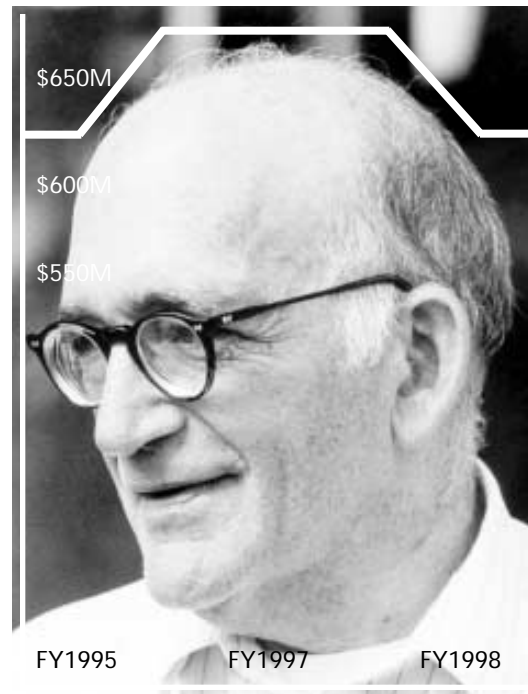
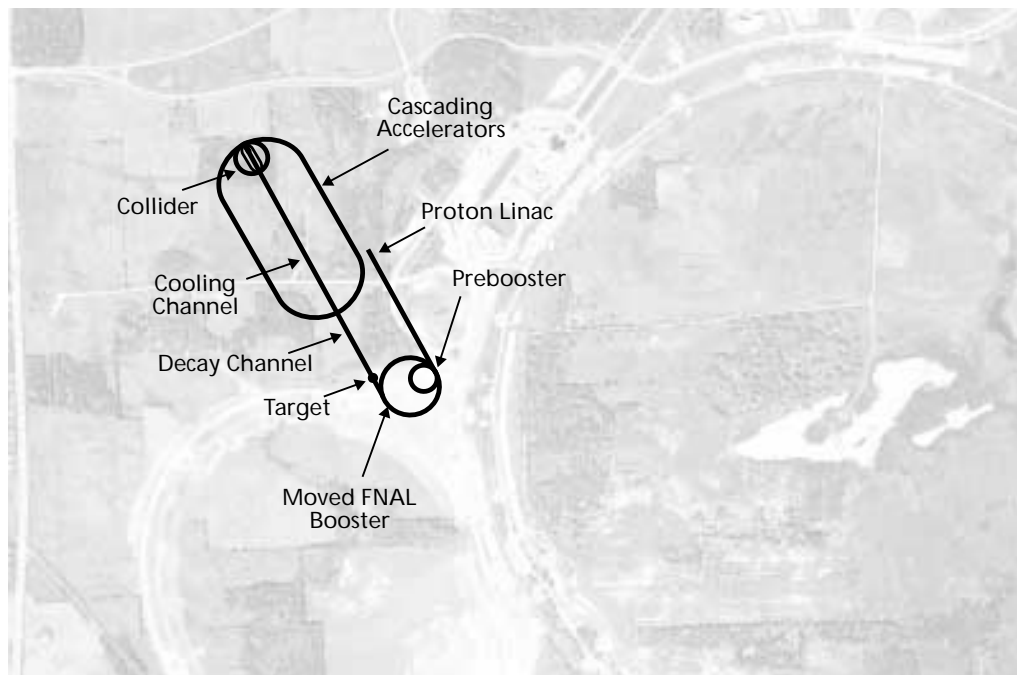
In its year-long effort to understand and synthesize the views of the U.S. particle physics research community, Gilman subpanel members sought all the input they could get. By report-writing time, they were awash in information from letters and e-mail messages, opinions on particular questions solicited from leaders in the field, and statistical and financial data from government agencies. At fact-finding meetings around the nation, including one held at Fermilab in August, the task force heard 150 presentations by a legion of physicists from grad students to greybeards.

“I’ll never forget the meeting at SLAC when we heard twenty-eight presentations in one day,” said Fermilab physicist and subpanel member Patty McBride. “It was overwhelming.”

In fact, said Chairman Gilman, for him the hardest part of the subpanel’s task was to take all this input and assemble it into a global view. It helped, he said, that the subpanel’s members were able to put aside concerns about their own physics turf and concentrate on the national program.

“There were no single-issue members,” Gilman said. “We listened, we argued, and we all worked on all of the issues.”

One possibility for a new facility at the energy frontier is a muon collider, hypothetically outlined here on the Fermilab site.



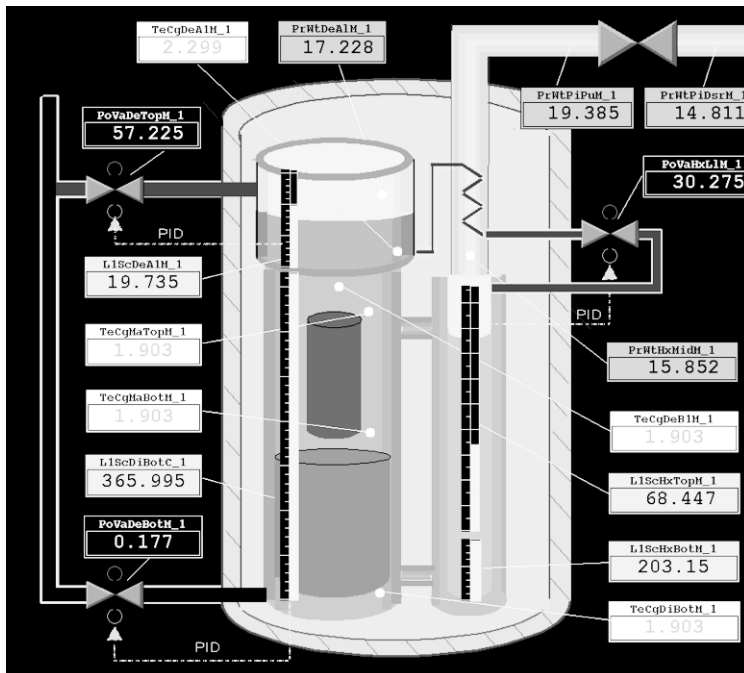
In a seminal post-SSC plan for high-energy physics, a 1994 subpanel chaired by SLAC physicist Sidney Drell proposed the temporary “Drell Bump” in funding to support U.S. participation in the Large Hadron Collider. However, “the bump,” says Drell, “unfortunately turned out to be more of a wart.” With U.S. LHC participation a reality, the Gilman subpanel addressed the continuing direction of the field.



Photo by Reidar Hahn

Fermilab physicists Patty McBride and Steve Holmes found their experience on the Gilman Sub-panel interesting. McBride was “impressed by people’s ability to concentrate on a national plan, not just protect their own turf.” Holmes said he enjoyed “going around to hear everybody’s plans and aspirations—to have that for your job is nice. When you are asked to understand how the U.S. should best move forward, you digest the information in a different way.”

The Gilman plan endorses U.S. participation in the LHC. Diagram shows a test of the first prototype of an interaction region quadrupole magnet built for the LHC at Fermilab.



Recommendations

The work resulted in seven major recommendations to “maximize the potential for major discoveries by making best use of existing U.S. facilities and participating in unique facilities abroad; to position the U.S. for a long-term leading role at the energy frontier; and to prepare the next generation of scientists.”

Best Use of Facilities: “The Subpanel places its highest priority on optimum use of the forefront facilities nearing completion. The Subpanel recommends that funding for [the] Tevatron collider, PEP-II, and CESR operations, and for the physics groups using them, be at a level that ensures these facilities fulfill their physics potential.”

LHC: “The Subpanel strongly endorses the physics goals of the LHC and U.S. participation in the accelerator project and the ATLAS and CMS experiments. The funding level and schedule contained in the CERN-U.S. LHC agreement should be followed. The Subpanel expresses its gratitude to Congress for making possible U.S. participation in the LHC.”

Future Facilities: “The Subpanel recommends that a new facility at the energy frontier be an integral part of the long-term national high-energy physics program.”

Linear Collider: “The Subpanel recommends that SLAC continue R&D with Japan’s KEK toward a common

design for an electron-positron linear collider...[and] that SLAC be authorized to produce a Conceptual Design Report for this machine....This is not a recommendation to proceed with construction. A decision on whether to construct a linear collider should only follow the recommendation of a future subpanel convened after the CDR is complete.”

Muon Collider: “The Subpanel recommends that an expanded program of R&D be carried out on a muon collider....The scale and progress of the R&D program should be subject to additional review in about two years.”

Very Large Hadron Collider: “The Subpanel recommends an expanded program on cost-reduction strategies, enabling technologies, and accelerator physics issues for a VLHC...The scale and progress of this R&D program should be subject to additional review in about two years.”

University Funding: “The Subpanel recommends that, over a two-year period, the annual DOE operating funds for the university program be ramped up by a total of 10 percent above inflation.”

Additional recommendations included upgrading the Tevatron’s luminosity after Run II, but upgrading only one of Fermilab’s two collider detectors to match; the active pursuit of opportunities in B physics, including Fermilab’s BTeV proposal; limiting experiments at Brookhaven’s Alternating Gradient Synchrotron to “at most two concurrent experiments that compete within the national program;” and a strengthened program of non-accelerator physics. The subpanel also recommended “that Fermilab carefully evaluate the configuration of the NuMI/MINOS facility in the light of results becoming available from experiments elsewhere.”

In the event of decreased funding, the report recommended protecting the highest-priority items, warning that “everything else would be reduced or eliminated.

With more money, the subpanel said, the U.S. could move forward faster with development of technologies for future accelerators, strengthen support for universities, make the very most of existing facilities, and take the lead in the next international collider.

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New Heads, Same Course in Particle Physics Division

By Mike Perricone, Office of Public Affairs

The goals remain the same, but names are changing in the Particle Physics Division.

"The major focus for the next two years," said Division Head John Cooper, "is CDF and DZero, and getting them into the collision halls in February of 2000."

"The person with a typical job in a department should not be concerned about any of these changes," Cooper continued. "It will take a little time to get to know the new person at the top of the (organizational) box, and that's about the only difference."

Despite the number of changes, Cooper said the course of the division remains "steady as she goes until the colliders roll in." Stephen Pordes, who moves from head of Technical Centers to head of Engineering and Technical Teams, seconded the notion.

"I think that phrase is a perfect description," Pordes said. "By the end of this year, I would like to be in the clean production stage for everything. Once we're in that stage, I believe we can pour the coals on, and by the end of 1999 we can actually have working detectors. That's terribly important for Fermilab."

Cooper said the shifts began with Bob Trendler wanting to move back to do technical work again from his post as head of Engineering and Technical Teams. One replacement then prompted another down the organizational chart.



Rob Plunkett is a new associate head of Engineering and Technical Teams.

Photos by Reidar Hahn



Mike Albrow is the new head of Experimental Physics Projects.

"Bob's been an administrative head for a long time, and he knows how to do things," Cooper said. "He was immensely valuable in the reorganization a year ago. These are meant to be terms of a few years, not forever."

Trendler, who said the time was right for him to make a change, will remain involved with the division office in hiring engineers and technical staffers. He'll also be participating in the technical planning of some of the new PPD project initiatives, such as CMS, and in some project safety reviews.

"I look back with great satisfaction," Trendler said. "I've been involved with various management jobs at the Lab for a lot of years. The people here are first rate, and the management style allows a lot of personal freedom. And consequently, we get excellent work from excellent employees."

While emphasizing continuity, Cooper also indicated there was room for a heightened awareness of safety in getting ready for Run II. "I hope we can raise everybody's consciousness," he said.

Rob Plunkett, a new associate head of E&TT, said safety is "completely compatible with getting our mission done in the most efficient way."

"You often find cases where the focus on safety improves the efficiency of your operation in the long run," he continued. "It's an important element of teamwork when people understand that safety is an overriding concern of management, and that they're working in a highly supportive environment." ■

New Particle Physics Lineup

Here are the new names in the boxes in the Particle Physics Division lineup:

■ Stephen Pordes moves from head of Technical Centers to head of Engineering and Technical Teams, while remaining deputy head of the Division;

■ Pordes replaces Bob Trendler, who becomes an assistant head of the Division;

■ Rob Plunkett is a new associate head of Engineering and Technical Teams, working with Rich Stanek, who remains as associate head; Plunkett becomes leader of the Mechanical Support team in E&TT, with Jim Kilmer moving from leader to assistant leader;

■ Mike Crisler becomes the new head of Technical Centers, replacing Pordes;

■ Mike Albrow becomes head of Experimental Physics Projects and Bob Hsiung becomes associate head, replacing Jeff Appel and Roger Dixon, respectively;

■ Hans Jostlein becomes an assistant head of the division, while remaining associate head of Technical Centers.



Mike Crisler is the new head of Technical Centers.

Photo by Fred Ullrich

Holmes Takes Over for Finley at Beams

By Mike Perricone, Office of Public Affairs

Time is a challenge for Steve Holmes, but a welcome opportunity for Dave Finley.

Holmes, who remains project manager for the Main Injector project, succeeded Finley as head of the Beams Division on February 16. In announcing the appointment, Fermilab Director John Peoples acknowledged that "the Tevatron Collider physics program has the highest priority among the new facilities for high-energy physics in the U.S. Not surprisingly, the collider program has the highest priority at Fermilab as well."

Holmes, whose term as project manager expires on December 31, 1999, understands the Department of Energy is determined to meet the Main Injector project deadline of March 1999.

"The DOE has two priorities, and they've been very clear about them: one, that you finish on budget; two, that you finish on schedule," said Holmes, unpacking in his new office down the hall from the Main Control Room.

"The next year to 18 months are going to be a real challenge," Holmes continued. "We have a tremendous amount of work to do."

Finley, who had been head of the Accelerator Division, became the first head of the Beams Division in January, 1997, when the Lab was reorganized into Beams, Computing, Particle Physics and Technical Divisions. He has served at the division management level for more than seven years, half that time as a division head, and openly enjoys the prospect of moving back to hands-on physics.

"The director said, quote, 'Go do something purely technical for a year,' unquote," said Finley, propping his feet on the desk in his new 13th-floor location. "This is my chance to go back to being a boy scientist."

He has listed 12 possible areas of concentration on his blackboard, ranging from the Pierre Auger Project to



Steve Holmes, the new head of Beams Division, prepares for "the big crunch" with the Main Injector Project.

head and the Main Injector project manager are the same person again. In some ways, it's still two jobs, but I'm approaching it as one job."

First up is repairing the Main Injector's low-conductivity-water cooling system, which Holmes said will start by the beginning of March. Standing water spawned bacteria whose acid byproducts ate through the welds of the stainless steel piping, causing more than 200 leaks.

Holmes said the division has catalogued repair methods and compiled a data base including every weld in the tunnel, with a specific repair assigned to each weld. Participating vendors will practice their techniques in the tunnel, becoming qualified for the actual repairs.

"Our goal is to have the water system fixed by June 1," Holmes said. "If we do, then (the delays) shouldn't affect the schedule too much."

The DOE office in Germantown, Maryland, has been keeping tabs with weekly videoconferencing, and Holmes knows all DOE eyes are on the project.

"This division has met challenges in the past, and I have a lot of confidence in our staff," he said. "I feel if I make sure everybody understands the goals, they'll pull it off." ■

teaching. He hints that he's likely to combine science with teaching, because he wants "to live some place where the water doesn't freeze outdoors regularly" when he retires in 10 years or so.

"I'll make a decision on St. Patrick's Day," Finley said. "I can't make a bad choice, because there are no bad choices here at all. This is not the last you're going to hear from me."

Holmes served three years as head of the Accelerator Division from 1991 to 1994; then his focus changed to completing the Main Injector.

"Now we're in the big crunch," Holmes said. "The division has to be focused on Run II, and the feeling is that we will be more efficient if the division



Dave Finley revels in his opportunity to return to being a "boy scientist."

Photos by Reider Hahn

Geneva: City on the Edge of a Quandary

By Mike Perricone, Office of Public Affairs

Geneva, Illinois, has attracted settlers and shoppers since 1835, when James Clayton Herrington opened a general store that claimed to carry everything needed for frontier life: iron pots and pans, ax heads, garden tools, calico cloth and whiskey.

After more than 160 years of success, one of the earliest Illinois settlements west of Fort Dearborn now faces the question of many small cities caught in the middle of suburban expansion: how does a community balance charm and growth?

"We're trying to maintain the feeling and the atmosphere of a small town where everyone knows each other, while the town continues to grow," said Fermilab physicist and Geneva Alderman Chuck Brown, who first served as alderman from 1987 to 1992 and rejoined the Council in 1996.

"The first time I ran for office, it was on a 'Controlled Growth' platform," Brown continued. "Those are loaded words in Geneva."

Geneva is home to more than 80 Fermilab employees; Brown has lived there since 1974, when he joined the Lab. In those 24 years, he has seen the town's population grow from 7,000 to 18,000—with a peak of 23,000 expected early in the next century. He already sees subdivisions west of Randall Road, which he sees as a "psychological impediment" to a connection with the downtown shopping area—the heart of Geneva's identity.

"I don't believe we can ever allow growth to compromise our downtown," said Geneva Mayor Tom Coughlin. "I feel that a lot of people have moved to Geneva because of our downtown—including myself."

The modern downtown grew from a home business in Far East silks and artifacts begun in 1923 by Kate Raftery. The Little Traveler, her home storefront at 404 South Third Street, attracted more shops to this street of historic homes. Today, the downtown business area of

Third and State streets encompasses two historic districts, which are listed in the National Register of Historic Places.

"With the old homes, the restaurants and the neat little shops, Third Street has a very international feel," said Fred Ullrich, head of Fermilab's Visual Media Services and a Geneva resident since 1981. "We have friends who visit us from all over the country, and they all think Third Street in Geneva is really comfortable. And when people come to Fermilab from CERN (the accelerator laboratory in Geneva, Switzerland), they really appreciate the international flavor of this Geneva."

That flavor grows from the town's history, stemming from an influx of Swedish immigrants in the 1850s when a branch of the Galena and Chicago Union Railroad was extended to Geneva. The "Swedish Days" festival (held this year on June 23-28) has celebrated that heritage for 48 years.

Seasonal festivals are a major community activity (and revenue source), a cooperative effort of the city government and the Chamber of Commerce. Spring brings a Celebration of the Generations (May 2-3). The Festival of the Vine (September 11-13) celebrates harvest season. And the Christmas Walk (December 4-5) features the lighting of a tree on the Kane County Courthouse lawn, and appearances by Santa Claus and Santa Lucia, who arrive by horse-drawn carriage to offer traditional Swedish holiday cookies.

At a loose end between festivals? Geneva is home to the Kane County Cougars minor-league baseball team. The Chicago Freeze, a team for 16-to-20-year-old hockey players on their way to college or professional careers, plays at the Fox Valley Ice Arena.

Need to work off some festival calories? Delnor-Community Hospital, the city's largest employer, has a new 67,000-square-foot health and wellness center with lap pools, exercise and



This is the third in a series of articles on Fermilab's neighboring communities.



Alderman Chuck Brown and his wife, Mary Kay, pause before one of the shops in Geneva's downtown business area.



COMMUNITY PROFILE



Geneva faces the challenge of maintaining its character while continuing to grow.



Photos by Fred Ullrich

Lined with trees and old-fashioned street lamps, Third Street is a pleasant place for shopping or strolling.

aerobics rooms, gym, whirlpools, saunas, cafe and juice bar, and a "Fit & Fun" children's center.

And speaking of children, Brown declares Geneva's school system to be the equal of any in the area—though Ullrich notes the high school is becoming overcrowded.

Is there anything not to like about this place?

"The good qualities of the town are still good, but the amount of building is becoming

overwhelming," said Borys Jurkiw, of Fermilab's Personnel Department. "That's a reflection of its attractiveness."

Jurkiw, whose wife is from Chicago, moved from England in 1979 and took a position at Fermilab. He and his wife started raising their two children in Chicago, but relocated to Geneva nearly eight years ago when he decided he wanted to spend more time with his family "instead of spending it sitting in traffic jams."

Now the traffic is coming closer to home.

"When we moved here," Jurkiw recalled, "Randall Road was a single-lane road north of here and there was only one traffic light between Elgin and St. Charles. Now, it's a busy highway to rival any in the area."

Ullrich is also wary of encroaching density.

"Building has really started to take off," he said. "People who've been here awhile are not really happy with the amount of growth."

Growth appears to be inevitable. The Pillsbury Company recently proposed building a 125,000-square-foot manufacturing plant, creating 150 jobs, in Geneva's first industrial park, just north of Fermilab.

"It's not a done deal yet," said Coughlin, citing issues of power and water.

The city, which provides electricity inexpensively to residents through the Geneva Electric Company, must determine if it can meet Pillsbury's power needs. And Pillsbury is the largest company so far to confront Geneva with the issue of handling wastewater.

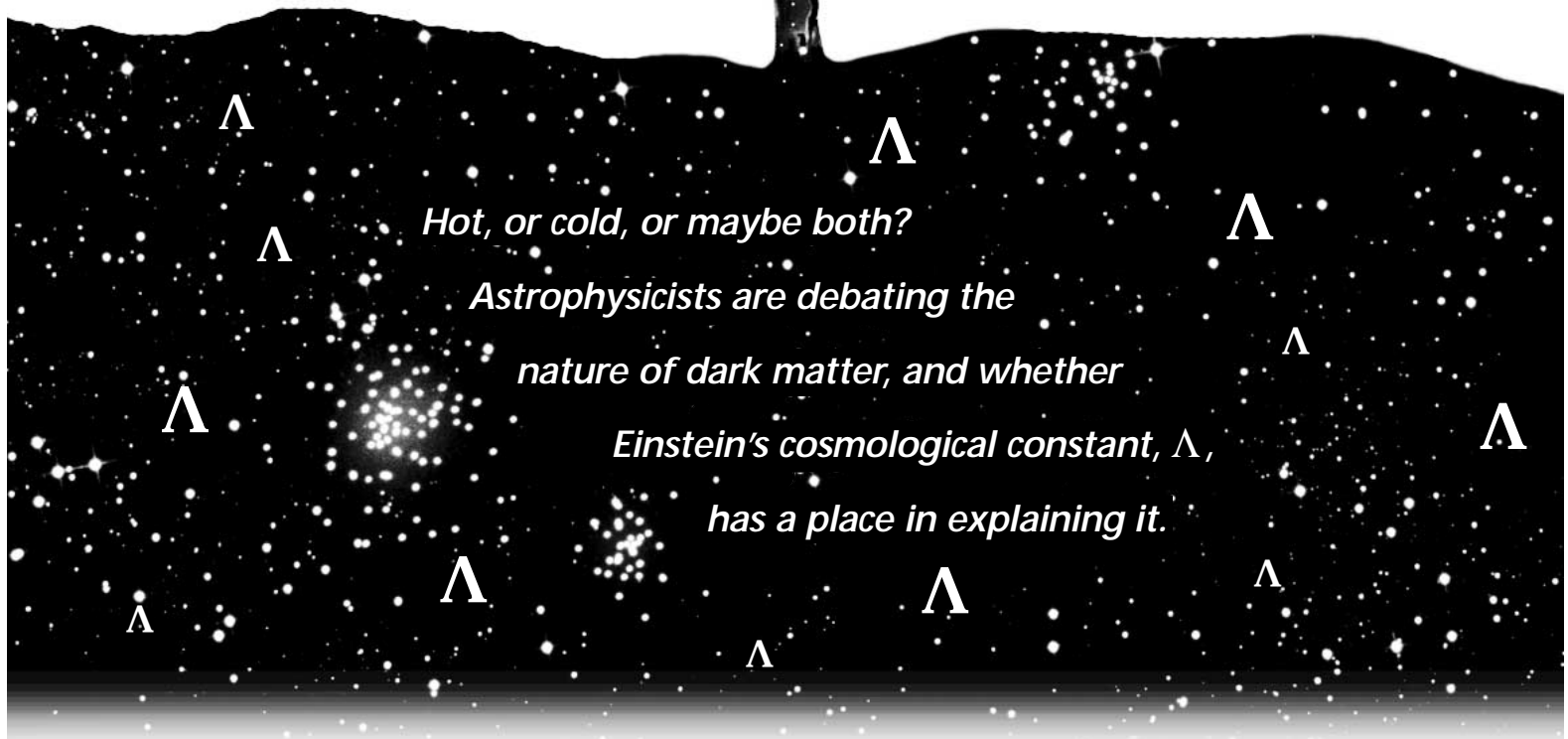
"These concerns have been addressed by Pillsbury to the satisfaction of our Public Works Department, so the issue goes next to the Planning Commission in mid-March," Coughlin said. "We need to make sure we check this out thoroughly, but we can't let it drag on or we'll lose them."

Geneva residents have voiced their opposition to a proposal by Union Pacific for a large railport on Route 38 south of DuPage County Airport. Brown said the hope of attracting industry is offset by fears of traffic congestion, which Coughlin said will probably exceed the estimates of 700 trucks per day at the 24-hour facility.

"Will this end up looking like Comiskey Park?" Coughlin asked rhetorically. "We have to sit down and analyze the benefits, or lack thereof."

Can this charming town maintain the delicate balance of continuing to grow while staying small?

"This is a great place to live and a great place to raise children," said Coughlin, with five children in his own family. "Our goal, and my personal goal, is to keep it that way." ■



Hot, or cold, or maybe both?

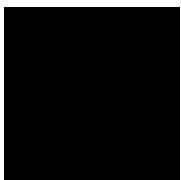
Astrophysicists are debating the

nature of dark matter, and whether

Einstein's cosmological constant, Λ ,

has a place in explaining it.

Illustration by Tracy Jurinek



Dark matter

Dark Matters

by Sharon Butler, Office of Public Affairs

Seeing is believing, but even without seeing as much as 90 percent of the matter in the universe, astronomers believe it exists.

That's because they'd have to overturn Newton's time-honored laws of gravitation and motion if this invisible dark matter, as it is called, were nowhere to be found.

Scientists deduce the existence of dark matter from an anomalous observation: The rotational paths that stars trace are not what the laws of physics would predict if the universe contained only the "luminous" bodies we see in the night sky. More mass—dark matter—has to be present.

Piecing together the best theories of gravitation and cosmology with data on the motion of clusters of galaxies and on the large-scale structure of the universe, astronomers believe that the light arriving in their telescopes represents only about 10 or 20 percent of the matter in the universe.

The theory of inflation, which claims that the universe expanded in convulsions split seconds after the Big Bang, concurs. In fact, it predicts that there is 100 times more mass in the universe than meets the eye.

Why is it that we can't see this dark matter? What is it made of?

Some scientists have conjectured that dark matter is just ordinary, or baryonic, matter composed of protons and neutrons: perhaps clouds of gas and dust, or huge Jupiter-like objects that give off too little light to be seen, or small black holes, from which light cannot escape.

But baryonic dark matter, calculations show, can account for only about 10 percent of the total dark matter. If there were any more, the amount of deuterium, helium, and lithium in the universe would differ considerably from what we observe today.

That conclusion has set scientists looking for more exotic stuff.

Hot dark matter

Astronomers have proposed two kinds of dark matter: hot and cold.

Hot refers to particles born in the Big Bang and traveling at nearly the speed of light even as the searing temperatures of the universe cooled and the galaxies began to form.

The prime candidate for hot dark matter is the neutrino, a neutral particle that zips around solo, rarely interacting. Even though neutrinos are tiny—the mass of the neutrino, if it has any mass at all, must be less than 30 eV—zillions exist to fill in the seemingly empty spaces in the universe.

But neutrinos alone can't account for all the dark matter. As computer models show, with neutrinos only, scientists have difficulty explaining the formation of galaxies and quasars when the universe was only half a billion years old. If neutrinos were the only kind of dark matter, the universe as we know it today, with all its lumps and clusters, would not exist.

Cold dark matter

Cold dark matter refers to particles that were produced in the Big Bang but are so massive that they became nonrelativistic as the universe began to cool eons ago. A large number of these particles may be left over from the Big Bang. They are called, generically, WIMPS, short for weakly interacting massive particles.

We can't see them, the theory goes, because they interact with other particles only by means of the weak force and gravity, the weakest force of all—a fact that makes them difficult to detect.

Supersymmetric particles, which scientists are hoping to find when the Large Hadron Collider is commissioned at CERN, or even in

Run II at the Tevatron, might be one kind of WIMPS. Rocky Kolb, deputy head of Fermilab's Theoretical Astrophysics Group, says his favorite candidate for dark matter is the photino, the supersymmetric partner of the photon.

There also might be axions or quark nuggets or primordial black holes. Whatever their identities, Fermilab experimental astrophysicist Roger Dixon and his colleagues have devised an ingenious experiment to look for the elusive particles. The scientists have deployed ultrapure crystals of germanium and silicon, cooled to almost absolute zero. Dark matter particles scattered by weak interactions should nudge the nuclei in these crystals, creating signals that will be picked up by extremely sensitive sensors. If WIMPS exist.

Einstein's cosmological constant

Even with both hot and cold dark matter inserted in cosmologists' equations, the computer models don't come close to mimicking the evolution of the universe, to arrive at the modern-day structure—unless a cosmological constant, Λ , is introduced.

This is the same cosmological constant Albert Einstein added to "correct" his equations for the theory of general relativity. He, like others of his day, believed that the universe was permanent, that "the heavens endure from everlasting to everlasting." So when his equations showed the universe to be dynamic, either expanding forever or contracting to infinite density, he invented his cosmological constant to keep the universe just where it was.

Thirteen years later, when E.P. Hubble proved the universe to be expanding, Einstein would call his cosmological constant "the biggest blunder of my life."

"We haven't been able to make that factor go away," Dixon says.

And he remains skeptical. "I don't want to use it; I don't even drink coffee with people who want to use it," he jokes.

In fact, in the best tradition of science, the whole theoretical construction requiring dark matter remains open to question.

"Maybe there is something fundamental about gravity or something about the beginning of the universe that we don't understand," Dixon says. "Even inflation could be wrong. But this is the best solution we've cooked up so far. That's why it's so important to do experiments to find [dark matter]."

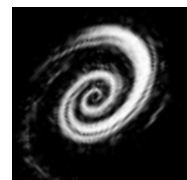
Because, after all, seeing still is believing. ■



Photo by Fred Ullrich

Of Einstein's cosmological constant, Fermilab experimental astrophysicist Roger Dixon says, "I don't even drink coffee with people who want to use it."

**Astronomers
have proposed
two kinds of
dark matter:
hot and cold.**



Not dark matter



This penguin is the Linux official mascot, chosen by Linus Torvalds to represent his image of the operating system he created. Others question whether "a fat penguin really embodies the grace of Linux."

Fermilab for Linux

by Sharon Butler, Office of Public Affairs

The 20-something Finnish computer whiz who invented the Linux operating system e-mailed Fermilab last week on learning that the Laboratory would not only be using the free software for its on-line and off-line analyses but had decided to support the system (see www.fnal.gov/cd/CDN/CDN-jan98/cdn-1.html).

"I'm wringing my hands maniacally, and laughing in a very disturbed manner. 'Whahahahaaa, I'm taking over the world, yes, yes, YES!'" Linus Torvalds joked.

On a more serious note, though, Torvalds said he was not surprised. The operating system has always had its base in technical and university research centers.

Just two years remain before Run II. With its explosion in the number of particle collisions, Run II places unprecedented demands on Fermilab's computing facilities. Experimenters will be collecting at least 20 times more data than in Run I, requiring a potentially costly upgrade in the Laboratory's data-processing capabilities.

What to do?

Intel's Pentium-Pro 200-MHz chip, introduced to the market in 1995, opened up the possibility of using commodity PCs instead of the more specialized UNIX workstations used in Run I—at a much lower price.

Add to the PCs the Linux operating system, which is free of maintenance costs, and the savings, Fermilab realized, would become even more significant.

Fermilab began toying with the idea of switching to the more cost-effective PCs fitted

with Linux software, but the idea took off only when G.P. Yeh, a Fermilab physicist in the Computing Division working in the CDF collaboration, got involved.

The crucial question, Yeh said, was "Would it work?"

As a test, Computing Division staff—including Don Holmgren, Don Petravick, Ron Rechenmacher, Jim Fromm, Connie Sieh and Ken Stox—built a small cluster of PCs for off-line data analyses. Yeh had his colleagues in CDF's Taiwan group transfer the collaboration's computing code, which runs on Silicon Graphics and IBM UNIX workstations, to the PCs and make them run using Linux. To their surprise, the task took a mere three weeks—not a year or more as expected. "It was really simple," said Yeh, "because Linux is just a generic UNIX."

Meanwhile, Holmgren and Andy Beretvas, of the Computing Division, ported many of the standard high-energy software programs used in off-line analyses, with equal success.

Yeh and his group went further. They suggested using PCs with Linux operating systems for Level III triggers, computer farms that process the on-line data from a particle detector. In Run I, Fermilab had used high-end Silicon Graphics Symmetric Multiprocessors because of the large network bandwidth required. Advances in switch technology and networking in general have since made the PC option feasible. CDF's Massachusetts Institute of Technology group, which is responsible for upgrading the collaboration's Level III triggers, tried the new idea, and Petravick, Holmgren and Rechenmacher again got involved, figuring out how to interconnect the computers in the high-speed network. No surprise this time. The idea easily worked.

Yeh laughed, "Now people are saying 'It's so obvious, we should use PCs and Linux.'"

Computing Division staff are now supporting Linux. And scientists in the E871 and E815 experiments, the Theoretical Physics Group and the Sloan Digital Sky Survey collaboration are using the PC/Linux configuration.

And so, Yeh said, "we are quietly changing the way we compute."

Torvalds is also pleased. Before he got "completely side-tracked into computers," he wrote, he was "one of the math-physics geeks" and "very interested in particle physics.... I still feel kind of proud that I'm involved even if it is in a fairly distant manner." ■

(Left to right) Ron Rechenmacher, of the Computing Division, Kevin McFarland, a physicist from the Massachusetts Institute of Technology, and G.P. Yeh, a Fermilab physicist, examine Run I data using the new off-line test farm.



Photo by Reidar Hahn

HEPAP

continued from page 3



Photo by Reidar Hahn

Martha Krebs, director of DOE's Office of Energy Research, said getting Fermilab and SLAC ready to be productive is critical not only to high-energy physics but to the future of other DOE efforts as well.

"A good report"

HEPAP members, agency officials and physicists attending the presentation responded positively to the report.

HEPAP Chairman Mike Witherell said he believes the Gilman Subpanel report sets the directions for the field in the next few years.

"Its recommendations are already having an effect on the DOE budget allocations and on the research plans of the national laboratories," Witherell said. "When making the case for funding high-energy physics, we need to show that we have a well-thought-out plan with clear priorities that has the support of the community. The subpanel report gives us such a plan."

DOE's assistant director for High Energy and Nuclear Physics, Peter Rosen, agreed.

"The community owes Fred Gilman and all the members of the subpanel a tremendous vote of thanks," Rosen said. "Their report makes a clear and compelling case for the field, and it lays out a roadmap for the future. I am sure that it will be most helpful as we carry the budget process forward."

Fermilab Director John Peoples called the plan "a good report. It provides guidance without prescribing the process, and it creates a balance between facilities exploitation and preparing for the future."

Perhaps HEPAP member and Columbia University physicist Bill Willis had the definitive word from the physics trenches.

"Our community always gets behind all our subpanel reports," Willis said, "but in this case, I think they will back it sincerely." ■

LAB NOTES

Summer Day Camp

Fermilab's Summer Day Camp is open to children of employees, users and approved contractors ages 7-12. Cost per session per child is \$225. Three supervised sessions are offered: Session I: June 15-July 3, Session II: July 6-July 24, Session III: July 27-Aug. 14.

The day camp is held in the lower level of Kuhn Barn with supervision from 7:30 a.m. until 5:30 p.m. Daily programs consist of arts & crafts, sports, swimming, field trips, etc. Applications are available in the Recreation Office, WH15W, Users Office and Aspen East. Deadline for applications is March 30 at 5 p.m. Acceptance into the camp is made by lottery drawing on March 31. For more information, contact the Recreation Office, x2548, x5427, jeanm@fnal.gov or <http://fnalpubs.fnal.gov/benedept/recreation/recreation.html>.

Thursday Golf League

Fermilab's Golf League at Phillips Park is looking for players on Thursday evenings. Play starts in early May and continues through August. To obtain more information or sign up, contact Steve Baginski, x3721 or baginski@almond.fnal.gov, or Joe O'Malley, x2504.

MILESTONES

HONORED

■ David Kestenbaum, on February 14, by the American Association for the Advancement of Science, with the Evert Clark Award for Young Science Journalists for outstanding science reporting and writing of the year. Kestenbaum, a recent CDF Ph.D. from Harvard, now writes for *Science* and is a contributor to *FermiNews*.

PAIRED UP

■ Fermilab's Canada geese, in the first sign of spring at the Laboratory. From now through nesting time, an odd-numbered gaggle is a rarity, as Fermilab's geese group in even numbers for the season.

RETIRED

■ Charles Marofske, I.D. # 54, from the Laboratory Services Section Office. His last work day was February 27, 1998.

LETTER TO THE EDITOR

Please let your local readers know that almost all of the general audience physics books listed on p. 8 of the 2/6/98 issue of *FermiNews* are available in the Fermilab Library, on the third floor crossover of Wilson Hall. (We don't have the Star Trek book, but will be getting it!)

The Library online catalog can be searched on the Web at <http://www-lib.fnal.gov/library/welcome.html>, or via telnet to [fnlib.fnal.gov](telnet://fnlib.fnal.gov).

Thank you.

Sara Tompson, M.S., Fermilab Library Administrator, x6014 or sarat@fnal.gov

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 11

Cumin Roasted Game Hens
Black Bean Stew
Spanish Rice
Pineapple Caramel Flan

Dinner Thursday March 12

Sausage and Corn Chowder
Ginger-Glazed Salmon Steak
Stir-fried Snow Peas
and Scallions
Steamed Jasmine Rice
Spinach Salad with
Toasted Sesame Seeds
Fruit Sorbet with
Almond Madeleines

Lunch Wednesday March 18

Spicy Sausage,
Mushroom and
Three-Cheese Calzone
Radicchio, Arugula
and Endive Salad
with Balsamic Dressing
Lemon Cheesecake

Dinner Thursday March 19

Chesapeake Bay Crab Soup
Pork Tenderloin
with Madeira Cream Sauce
Spaghetti Squash with Herbs
Vegetable of the Season
Crepes Framboise

CALENDAR

MARCH 8

Barn dance at the Village Barn from 7-10 p.m. Live music is by Val and Friends, with calling by Mike Miller. The dances are contras, squares, & circle dances. All dances are taught; people of all ages and experience levels are welcome. You don't need to come with a partner. Admission is \$5. Children under 12 are free. The barn dance is sponsored by the Fermilab Folk Club. For more information, contact Lynn Garren, x2061, or Dave Harding, x2971.

MARCH 10

Wellness Works presents: Covert Bailey video "Steroids, Cholesterol & Other Fat," 12-12:30 p.m. in 1 West.

MARCH 11

The Fermilab Barnstormers Radio Control Model Club will host its annual Delta Dart Night at Kuhn Barn starting at 5:30 p.m.

The Delta Dart is a small rubber band-powered airplane constructed of balsa wood and tissue paper. Built in about 45 minutes, you can fly it that evening for fun and prizes. No experience is necessary. Barnstormers club members will be there to guide you through every step of construction and even offer tips on flying.

Materials cost \$1 for adults & teenagers; no fee for juniors (12 and under). Everything is provided. The junior's fly off begins at 7 p.m. sharp. Guaranteed fun for all! For more information, call Alan Hahn, x2987, Fred Krueger, x5515, Rick Mahlum, x4316, or Jim Zagel, x4076. (Groups please call for availability or to schedule possible alternative arrangements.)

MARCH 12

Brown Bag Seminar: "Depression Across the Life Cycle: Differences in Experience & Treatment," Noon-1 p.m., 1 West.

MARCH 13

NALWO potluck dinner at Kuhn Barn, 6:00 p.m., with drinks and appetizers. Dinner begins at 6:30 sharp! Everybody is asked to bring either a main dish serving 6-8 people or a dessert for 12. We will have soft drinks for everybody, pizza for the kids and wine for adults. Babysitting is provided. If you can't bring anything, please contribute \$3. For further information, call Angela Jostlein, (630) 355-8279.

Fermilab International Film Society presents: *Trainspotting*, dir: Danny Boyle, Great Britain (1995). Admission \$4, in Ramsey Auditorium, Wilson Hall, at 8 p.m.

MARCH 15

Afternoon barn dance at the Village Barn from 2-5 p.m. Live music is by the Common Taters, with calling by Paul Watkins. The dances are contras, squares, & circle dances. All dances are taught; people of all ages and experience levels are welcome. You don't need to come with a partner. Admission is \$5. Children under 12 are free. The barn dance is sponsored by the Fermilab Folk Club. For more information, contact Lynn Garren, x2061, or Dave Harding, x2971.

MARCH 17

Wellness Works presents: Covert Bailey video "Height-Weight Charts That Work," 1 West, 12-12:30. Blood pressure screening in Atrium by the Credit Union from 11:30-1 p.m.

MARCH 21

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

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.

Conversational English classes, 9-11:30 a.m., Thursdays, in the Users' Center.

CLASSIFIEDS

FOR SALE

■ '91 Nissan 240SX-SE hatchback, 62K miles, excellent condition, loaded, full power options, overdrive. Red and ready, \$6,950. Call Ed Dijack, x6300 or (630) 665-6674.

■ '83 Dodge Aries, excellent condition and low mileage (for its age), 71K, gray exterior, burgundy interior, automatic, 4 doors, sturdy. Asking \$1,250. Call x2119 or (630) 717-6196 (Juan or Christianne).

■ Nordic Track exercise ski machine, hardly ever used, \$450 obo; skis, Atomic Arc 195, Salomon 547 sport bindings, size 12 US or 13 EU Trappeur 2000 boots, also have poles, ski & boot bag, \$200 obo. Contact Terry, x4572 or skweres@fnal.gov.

■ Kenmore freezer, 12.6 cubic feet, \$100; women's down jacket, like new, blue, x-large, \$40; new picnic basket, \$15. Call (630) 243-1125.

■ Hoover vacuum cleaner (almost new); halogen lamp. Contact Monique, srivasta@fnal.gov.

FOR RENT

■ House in Batavia, 2/3 bedrooms, one bathroom, one car garage. New furnace, central air-conditioning, washer & dryer. Near H.C. Storm grade school. Located in a quiet and nice neighborhood. Rent is \$1,200 a month with \$1,200 security deposit. For more information, call Rich Flores, (630) 406-1957. House available March 1, 1998.

FIRST COME, FIRST SERVED

■ Fifty half-price tickets for *Beauty and the Beast* for most performances; show ends March 29. Pick up tickets at the Atrium front desk.



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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.

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