

The accelerator run has begun

The Fermilab accelerator officially began its 1991 fixed target run on July 16.

According to **Taiji Yamanouchi**, Head of Program Planning, twelve major experiments are now running and about five groups are using beam for detector development.

Gerry Dugan, Head of the Accelerator Division, reported that the start up has been relatively smooth. "At the moment, we are working to get higher beam intensity," said Gerry.

The demand for higher beam intensity has come earlier in the run than in the past. Due to the increased down time, experiments were very ready for this run. According to Gerry, users are already requesting somewhat over 10^{13} protons per cycle, an intensity

demand usually needed a month or more into the run instead of only two weeks. "We are working to bring the accelerator up quicker and trying to get more of a cushion there," said Gerry.

Peter Garbincius, Head of the Research Division, said that every beamline is now up and running, although shielding activities continue for certain beam modes and running conditions.

He regrets that this year Research Division support for the experiments and beamline commissioning may not have been at the customary level. "Because our staff was still working on the shielding project, we had to make a choice between assisting individual experiments or getting the whole program up," said Peter.

Remediating the shielding problem was a major effort on the parts of the Directorate, Accelerator Division, Research Division, Construction Engineering and the ES&H Section.

Research and Accelerator Divisions completed the assessment in which they identified problems and proposed solutions. The ES&H Section, headed by **Don Cossairt**, reviewed the assessments and proposals, identified any areas that needed clarification and offered technical support in understanding shielding and doing shielding calculations. Construction Engineering, headed by **Wayne Nestander**, organized and completed necessary construction projects.

"To date, there have been twenty-nine areas and facilities assessed and reviewed," said Don. This represents a six-month effort on the part of many employees. "There are a lot of heroes in this activity," said Peter. "I congratulate and thank them all. I would also like to thank the Users for their patience and understanding, and hope that they have a good run, take good data and make themselves and Fermilab proud."

"There are a lot of heroes in this activity," said Peter Garbincius, Head of Research Division. "I congratulate and thank them all."

The run ends a ten-month down period during which scheduled maintenance and upgrades were done and shielding assessments and remediations were completed. Scheduled Accelerator Division projects included installing three separators in the Tevatron which will be used during the next collider run; completing work in the DØ area in preparation for the installment of the low beta system; and making progress on the accelerator controls upgrade which includes the replacement of the PDP-11 consoles with VAX stations.

Besides the shielding activities and preparations for the fixed target run, other major activities of the Research Division include completing the construction of the DØ experiment and the upgrades of the CDF detector for installation in the accelerator's collision halls this winter.

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Lab dedicates IBM computer farm

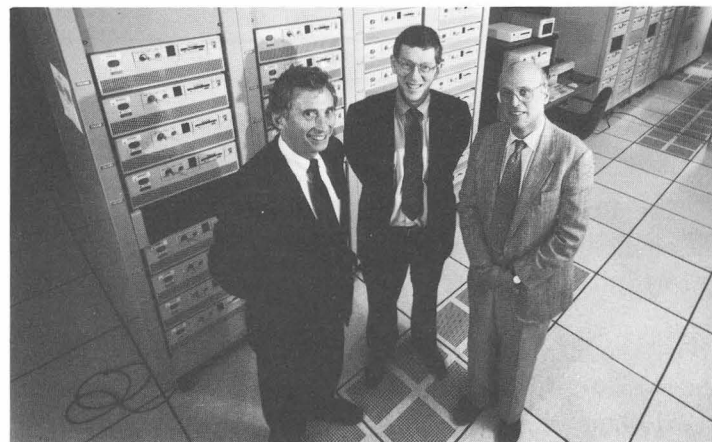
Fermilab and IBM, Inc. dedicated a powerful new computing facility that sets new standards for cost-effective, high-performance computing. The system consists of a "farm" of sixty-eight IBM RISC SYSTEM/6000 workstations. The individual processors cooperate on parallel solutions of demanding computing problems. Such loosely coupled configurations of independent computers have been dubbed "farms."

The IBM farm, which has the computing capacity of more than 1,700 traditional mini-computers, is the latest in a series of highly cost-effective computing farms at Fermilab.

The farm marks the beginning of an IBM/Fermilab research collaboration on farm computing. IBM Vice President for Science and Technology John Armstrong said, "Since the mid-80s, Fermilab has been a pioneer of loosely coupled parallel farms of computers to meet the demanding requirements of its science. Fermilab researchers continue to push the technological envelope in this area, which has recently emerged as a

key direction for high performance computing. This year, IBM entered a research collaboration with Fermilab, recognizing Fermilab's leadership in the area of farm computing, as well as the area's broad applicability for our customers. IBM welcomes the opportunity to leverage its own research efforts by joint programs with Fermilab and other government-funded laboratories."

Recently, in testimony before the Senate Committee on Energy Research and Development, Fermilab's Director, **John Peoples**, stated, "Although our quest is for fundamental knowledge, and not its practical application, we must solve many practical problems to carry out our work. We need to do sophisticated experiments and perform enormously complicated theoretical calculations, and both of these activities rely on a lot of innovative thinking... Our research simply cannot go forward without the development of new technology... Work that at first glance may appear esoteric is actually vital to supporting and strengthening the country's intellectual and technological development.



John Peoples, IBM's John Armstrong and Tom Nash (l-r) helped dedicate the Chip Kaliher Parallel Processing Farm.

In fact, the best way for us to pursue our goals involves links with education and industry that coincide with the best interests of the public that supports us."

A continuing challenge at Fermilab is the availability of enough computing power to process all the data produced by its many experiments. Computer farms have solved this problem by exploiting the fact that smaller computers have become much more cost-effective than large ones for solving many problems. In a situation where funds are limited, but demand for computing is not, computing resources can be maximized by using large numbers of small computers.

The processors in a farm are connected over a communications network so they are able to exchange data. This allows all the computers to share data from a single set of tape and disk

drives. The sharing of these peripheral devices and the fact that a farm works collectively on a single problem at a time distinguishes farms from mere collections of workstations. Special software has been written at Fermilab to make it possible for scientists to use a farm effectively in a manner similar to that of a single large computer. Called "Cooperative Processes Software," this software runs on a variety of computer platforms, even allowing for the use of heterogeneous farms made up of different types of computers.

Tom Nash, Head of the Computing Division, led the group that built the first computer farms. "We recognized in the early 80s that our experimental computing needs could only be met if we took advantage of the cheapest computer technology," he said. "In those days that meant raw thirty-two

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"Although our quest is for fundamental knowledge, and not its practical application, we must solve many practical problems to carry out our work."

— John Peoples, Director

Computer farm continued

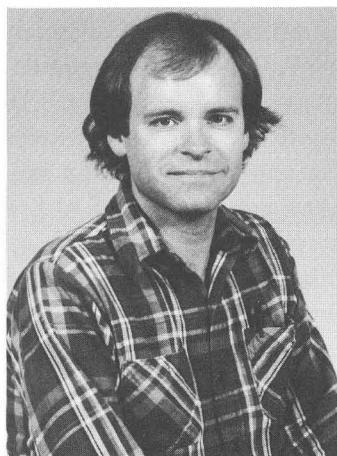
bit microprocessors. Now we can use powerful RISC-based workstations. The technical challenge continues to be ensuring that collections of small, cheap computers work together effectively and in a way that is manageable by our computer users. During all this time physicists have worked with computer designers and software specialists to provide solutions. These solutions, developed in our unique application-driven computer design environment, are now being recognized as valuable outside of our special field of science."

Fermilab's first farms came on line in 1986. These were based on Fermilab-designed CPU modules using commercial thirty-two-bit microprocessors (primarily the Motorola 68020) in a standard bus (VME), as the Laboratory hastened to exploit this newly available computing technology. These first farms were highly successful, growing to over 500 individual computers in eight separate farms. As industry took advantage of this same technology to produce low-cost high-performance workstations, later generations of farms were designed using workstations from vendors including Digital Equipment Corporation and Silicon Graphics, Inc. The new IBM farm was acquired following what was one of the first formal competitive request for proposals for a

farm computer system. Eight computer vendors submitted proposals.

Each Fermilab experiment collects data from millions of collisions of high energy particles. Each collision "event" is recorded as an intricate electronic description built up from the many devices that detected the particles in the event. A computer program examines the information for each event and reconstructs it into the physics parameters that define the momentum, energy and point of origin for each of the particles produced in the collision. This information is used by physicists to analyze the experiment and compare with theoretical expectations. An immense amount of computer time is needed to reconstruct all the events produced. The Fermilab computer farms have been primarily applied to this event reconstruction application. Each event's data is assigned to one of the computers in the farm. Without the use of computer farms, the experiments would be severely limited in their ability to process data.

The new IBM RISC SYSTEM/6000 farm has been benchmarked on the typical Fermilab mix of reconstruction programs. It runs at more than 1,750 times the speed of a VAX 11/780. The Digital Equipment Corporation's VAX 11/780 is a mini-computer that first appeared in the early 1980s. Its per-



The computing farm is dedicated to the memory of Charles "Chip" Kaliher. Chip passed away March 23, 1991. Chip had been a Fermilab employee since 1985.

formance is commonly used as a standard of approximately one million complex instructions per second (MIPS). By this measure, Fermilab's total installed computer farm capacity, including the new system, exceeds 4,000 VAX-MIPS, and this number will grow to nearly 6,000 VAX-MIPS by the end of 1991.

The new computing facility was dedicated to the memory of Charles "Chip" Kaliher, a Fermilab computer specialist who died suddenly earlier this year. Chip had been a leader of Fermilab efforts to make several generations of Fermilab farms available to its computer users. The new system was named the Chip Kaliher Parallel Processing Farm. It will be known on

computer networks as FNCK in Chip's honor.

Among the speakers at the dedication were Director John Peoples and John Armstrong, Vice President for Science and Technology at IBM. Chip Kaliher's family also took part in the dedication ceremony.

Taste of Fermi tonight!

The annual "Taste of Fermi" is tonight at the Users Center Grove. The menu includes such classic Fermilab treats as Tevatron Tacos, Big Bang Hot Dogs, P-Bar Hot Dogs, Booster Brats, URA Beef, Top Quark Gyros and Main Injector Chili. Drinks will be available as well.

Feasting is not the only activity Nalrec has planned. Employees and their families can enjoy Closed Particle Dancing, a trend so new it has yet to hit the hippest clubs. The Dixie Highway Band will provide the music. In addition, Nalrec has arranged adult games, with prizes for winners. Children will discover the Moon Walk and pony rides. Everyone can try their luck in a raffle, and test their pitching arms trying to dunk their brave Fermilab friends inside the dunk tank.

Don't miss this evening of fun.

Compressor systems help keep accelerator running

It's well known that a myriad of different people and parts are necessary to support the 1991 accelerator run. Today *FermiNews* focuses on an especially interesting component of the great machine—the helium screw compressor system

"They've never shut down the rings because of anything that's happened here," said **Carl Pallaver** (AD/Cryo Systems), the Senior Designer who maintains the system. Considering the intricacy of the equipment, that's quite a feat.

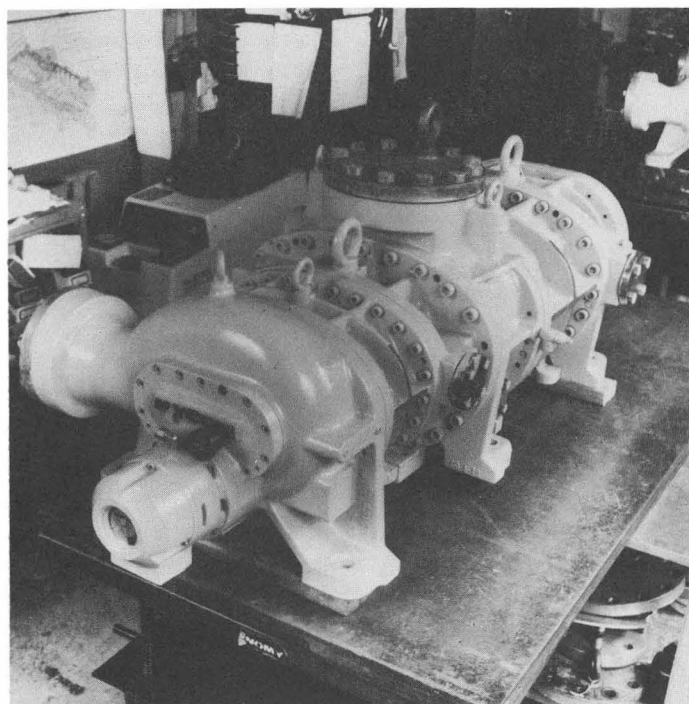
The purpose of the system is to compress helium gas. The helium is then sent to twenty-six satellite helium refrigerators, and used to cool the superconducting electromagnets in the Tevatron. "It's a difficult cryogen to keep a liquid. Should it turn to gas, you're out of commission," Carl said. Helium gas becomes liquid at -452° F.

The task of cooling the helium is accomplished by thirty-four identical screw compressor systems, purchased from the Japanese company Mycom but customized by Carl and his satellite refrigerator compressor group. The driver, Carl wrote in a 1988 report, "is a 400 H.P., 3,600 R.P.M. horizontal induction motor with a soft starter." Each compressor package includes "the compressor, motor, oil separator/reservoir, oil

pump, oil cooler, after cooler, with all required instrumentation and controls." In addition, the compressors feature "a purification system consisting of three stages of coalescers for oil mist removal, charcoal bed for oil vapor removal, molecular sieve bed for water removal, and a final filter to prevent particulates from entering the high pressure helium gas header." These compressors are a substantial improvement over the piston-style machines which wear out quickly.

Each compressor alone costs \$30,000. A detailed maintenance program keeps the compressors in top shape. "We do all our own maintenance, except re-winding motors," Carl said, adding that full credit for successful operations must be shared with his "competent co-workers": **Mike Benignetti, Bill Martin, John Pucci and Ted Roberts** (all AD/Cryo Systems).

In the early days (mid-1980s) of the compressors' operation, it became apparent that the final-stage drive rotor bearings were what seemed to wear out first. The group needed a way to predict when wear on the bearings would begin to affect performance. Instead of buying costly vibration indicators, Carl designed a shaft-movement indicator which costs \$600 to make, but would be \$3,000 to buy. Carl attached the indicator at the



A helium screw compressor—part of the Tevatron cryogenic system.

final-stage drive rotor bearings. As soon as the indicator senses excessive bearing wear (enough to allow rotor movement), the machine shuts down, preventing further damage and allowing Carl and his colleagues to correct the problem.

The indicator seems to be working. Mycom recommends that bearings be changed before they have been in operation 18,000 hours. Some of the Fermilab machines, however, the beneficiaries of careful maintenance, have operated almost 40,000 hours. Carl and Bill Martin even made a ninety-minute video showing exactly how to overhaul a compressor.

The group is always looking for more ways to im-

prove the system, but the employees are very careful about fiddling with what already works. All the machines must be absolutely identical, so "if we make a change, it has to be right," Carl said.

Although a few machines are almost always being repaired or improved, "we try to have them all running every Friday, so we can have a nice, peaceful weekend," Carl said.

The accelerator run is Carl's favorite time. "The worst time (for the compressors) is when they're not operating," he said. "They're like cars. They're not good when they sit." The operation is also smoother in winter. "When I see ice on the pond, I'm happy. After six

Continued on page 5.

Fermilab Gallery exhibits Sidney Laufman paintings

A collection of paintings by twentieth century-American artist Sidney Laufman is currently on display at the Fermilab Gallery on the Wilson Hall second-floor cross-over. The exhibit will continue through August.

Laufman was born in 1891 in Cleveland, Ohio. He studied at the Cleveland School of Art, the School of the Art Institute in Chicago and the Art Students League in New York. The young artist traveled to Paris in 1920, and stayed there for thirteen years. Laufman's work during this time was Modernist in concept and included still-lives, figures and landscapes.

He had a successful one-person exhibit at the Gallery Devambrez in 1922. In 1923 an exhibit of twenty-nine paintings at the Marie Sterner Gallery in New York City received critical acclaim. There were other exhibitions abroad and in the U.S. during his Paris years including a 1927 two-man exhibit with Henri Matisse in Chicago. Laufman also began accumulating prestigious awards and prizes as well as national recognition in the American art community.

He returned to New York in 1933, and from

1938 to 1950 taught at the Art Students League. He also worked on the Federal Arts Project.

Laufman often joked about having outlived his reputation as an artist. However, when he was older than ninety, critic John Russell of the *New York Times* wrote of Laufman's ability to capture the true sense of nature painting: "So exact a sense of place is not often found."

Sidney Laufman died in 1985 at age ninety-four. He left a body of work that spanned over sixty years of artistic achievement and contributed to the great movements of twentieth-century American art. He was a consummate professional and a diligent archivist. His studies, works on paper and small oils, most of which have never been viewed before, were stored with care. His diaries, copies of speeches, lectures, exhibit records, newspaper editorials, etc. have been given to the Archives of American Art.

The Fermilab Gallery is most grateful to Carolyn Klein of Klein & Benisek Art Consultants and Harold Rowe of Rowe Company for the loan of part of the Sidney Laufman Collection.
—David M. Sokol

Rose Tickets offer discounts to

Rose Tickets are now on sale in the Activities Office, WH1E. This special ticket provides admission to or discounts on the price of films, live theatre performances, museums, sporting events, special family outings and more. The ticket costs \$3.

A few of the dozens of area establishments that honor Rose Tickets are the Museum of Contemporary Art (two-for-one admission), Drury Lane Theatre (one Rose Ticket plus one-half box office price certain days) Santa Fe Speedway (certain Saturdays) and the Bristol Renaissance Faire (one Rose Ticket plus six dollars).

Stop by the Activities Office and pick up a brochure for more details on where, when and how much you can save when you use your Rose Ticket.

Compressor continued

days of ninety-five degree temperatures, we start to hold on by our fingertips."

Despite the August heat, the compressors are running well, and the satellite refrigerator compressor group is doing its part to keep the 1991 accelerator run on schedule.

Congratulations to



Benefit notes

Attention: New employee benefit booklets

During the week of July 22, 1991, the Benefits Office mailed to employee's mail stops four booklets titled: *Life & Accident Plans*; *Group Medical Plans for Active & Retired Employees*; *Group Dental Plan* and *Long Term Disability Insurance*. The booklets (along with the retirement booklet mailed to plan participants in December, 1990) replace the 1986 edition of *Fermilab Pension and Group Insurance Programs*.

The booklets summarize the life, accident, medical, dental and long term disability plans offered at Fermilab. **Please share the booklets with your families.** If you did not receive copies, please call X3395, 4362 or 4361.

Interconnections '91 features job opportunities

Fermilab's Education Office hosted *Interconnections '91: Scientific and Applied Technology Literacy and the Corporate Workplace* in June 1991. Interconnections, a staff development program for school district teams, was sponsored by a collaboration of representatives of Caterpillar Company, Waubonsie Community College and the Corridor Partnership for Excellence in Education. The program was funded by an Illinois State Board of Education Science Literacy Grant.

Thirty-one teachers and counselors from area schools attended Fermilab's half-day program, which was part of the teachers' week-long educational experience. The afternoon began with a panel discussion on the wide variety of job opportunities at the Laboratory. Panel members included **Paul Czarapata** (RD/EE Dept.), **Joel Fuerst** (AD/Cryo Systems), **Scott Holm** (RD/EE Dept.) and **Jim Lasenby** (LS/Employment). The panelists advised teachers to help students seek out internships and corporate educational experiences.

After the panel discussion, the teachers traveled out to work sites around the Laboratory. **Hans Jensen** (RD/Col. Det. Dept.) showed the groups around CDF, and **Jerry Peterson** (TS/Machine Shop) set up a Machine Shop tour with **Dave Billingsley** (TS/Machine Shop) and **Oscar Leary** (TS/Machine Shop). **Paul Czarapata** talked about Electrical Engineering, **Ed Crumpley** (Construction Engr.), made a presentation about Construction Engineering, and **Richard Andrews** (AD Mech. Support) covered Mechanical Support. **Paul Mantsch** (TS/Admin.) helped out in the Magnet Factory.



Oscar Leary tells area teachers about his job at Fermilab.

Stephanie Baker, Robin Dombeck, Priscilla Meldrim, Laura Vasquez, Tamra Hack and Carol Benson, all of the Education Office, led tours.

"The teachers were pleased to find out that there is such a wide variety of jobs here for all levels—Ph. D's to tech school grads," said Robin Dombeck (LS/Education Office). "They enjoyed the chance to interact with people, and find out what they do and how they got to where they are."

Robin said that the Lab employees did a commendable job of conveying their attitudes about their positions. One teacher found that all the employees he talked to seemed to feel that their job was important, she added.

Roads & Grounds rescues fawn

The employees at Roads & Grounds had a not-quite-typical afternoon on Friday, August 2. Early in the afternoon, they received a phone call that a tiny deer was running into the street. A team of employees went to the site, between E3 and E4 service buildings on the Main Ring Road, and found a blind, month-old fawn.

Jim Kalina (Roads & Grounds) captured the fawn, who heard the crew coming and tried to run away. He then contacted one wildlife sanctuary, but was told that the sanctuary was more in the business of birds. The sanctuary representative referred Jim to another sanctuary in Woodstock, which cares for injured deer. The Woodstock sanctuary agreed to take the deer, so the fawn was carefully crated and shipped to safety.

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Jim Kalina carries a Fermilab fawn to safety.

Applause applause applause



Thirty-two ten-year employees were honored for their service to the Laboratory at a May 10, 1991 luncheon. Dennis Theriot, Associate Director presented the awards.

The attendees are (l.-r.): Row 1: **Dennis Theriot** (Directorate representative), **Rick Dixon** (TS/Engineering), **Carol Alderson** (BS/Accounting), **Ed Oliver** (BS/Dist./Rcvg./Ship.), **Mike Urso** (RD/Cryo Dept.), **Wilson Cross** (RD/Cryo.), **Paul Mulligan** (TS/Machine Shop). Row 2: **Phillip Martin** (AD/Main Ring), **Allen Rusy** (TS/Adv. Magnet R & D), **Bob Kubinski** (RD/DØ Constr. Dept.), **Mark Ruschman** (TS/Engineering), **William Marsh** (AD/Controls), **Glen E. Smith** (RD/Exp. Areas Supp.), **James O'Neill** (TS/Machine Shop). Row 3: **Robert L. Slazyk Sr.** (AD/Mech. Support), **Tim Griffin** (RD/Facil. Dept.), **Mike O'Boyle** (RD/Exp. Areas Support), **Len Davis** (TS/Supercon. Mgnt.). Row 4: **Ron Threadgill** (TS/Machine Shop), **Mitch Adamus** (AD/RF), **William Van Duzen** (BS/FO/Refrig.), **Kerry Mellott** (RD/DØ Constr. Dept.), **Gene Underwood** (TS/Conv. Mgnt. Prod.), **Brad Claypool** (AD/EE Supp.). Row 5: **Bill Boroski** (TS/Engineering), **Bill Stearns** (BS/Dist./Rcvg./Ship.), **Mark Eriks** (TS/Machine Shop). Row 6: **Bryan Needham** (BS/Roads & Grounds), **Ron LeBeau** (AD/Mech Support), **Ron Rioux** (TS/Supercon. Mgnt.), **Mark Haibeck** (CD/Distributd. Comp.), **Larry Seaney** (TS/Machine Shop).

Annual Report available

Copies of the 1990 *Fermilab Annual Report* are available in the Publications Office, WH6NW. Stop by and pick up yours. No phone or mail orders, please.

Give it your energy

Hot, humid August days call for cooling, but *overcooling* is expensive and wastes energy. Don't use or buy more cooling equipment capacity than you actually need.

Regarding air-conditioning equipment. . .

- **Keep your cooling system well-tuned with periodic maintenance by a professional serviceperson.** Ask the serviceperson how the energy efficiency of the system may be increased.

- **If you need central air-conditioning, select a unit with the lowest suitable capacity and highest efficiency.** A larger unit than you need not only costs more to run but probably won't remove enough moisture from the air. A more efficient unit will cost less to operate.

Ask your dealer to help you determine how much cooling capacity you need for the space you have to cool and for the climate in which you live.

- **Make sure the ducts in your air-conditioning system are properly sealed and insulated,** especially those that pass through the attic or other uncooled spaces.

- **If you don't need central air-conditioning, consider using individual window or through-the-wall units in rooms that need cooling from time to time.** Select the lowest capacity and highest efficiency for the rooms you need to cool. As a rule, these will cost less to buy and less to operate than a central system.

- **Install a whole-house ventilating fan in your attic or in an upstairs window** to cool the house when it's cool outside, even if you have central air-conditioning.

It will pay to use the fan rather than air-conditioning when the outside temperature is below 78° F. When windows in the house are open, the fan pulls cool air through the house and exhausts warm air through the attic. Two smaller window fans will help cool the house when the air cools down outdoors.

—*Tips for Energy Savers*, DOE

Cla\$\$ified Ad\$

Real estate

House for sale by owner. 13 rms (6 bdrms), large lot, 2-car garage. Aurora. \$85,000. No soliciting of realtors, please. Call 708-892-2137.

House for sale by owner. 4 bdrms, 2 story home. Woodland Hills area, Batavia. Many upgrades throughout. Motivated sellers. For more information call Cindy at 708-879-0516.

Miscellaneous

Water heater, 40 gal. electric, A.O. Smith EES low boy model, 3 yrs. old. Ex. con., replaced with gas, \$125. **Satellite dish**, 9 ft. dia., pole mounted with remote positioner, downstation needs preamp and descrambler, \$200. Call Jerry, X4571 or 801-9408.

Vehicles

1977 Honda Goldwing GL1000, Black with Vetter Windjammer fairing and lowers, saddlebags and trunk. Metzler tires in good con. Electronic ignition. New seat. Carburetors rebuilt recently. 50k. \$1,400 obo. 708-840-3160 or 708-584-5769.

1989 Mastercraft Prostar 190 competition ski boat, inboard 351, 250 hp, custom trailer, stereo/tape, \$15,500. Call X4777.

Boys' 10-speed bike. 24" tires, 19" frame. New tires and seat. Good con. \$55.

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Call Mike, X4948 or 708-896-3476.

1987 Chevy S-10 pickup, 2.8 V-6, 5-spd, cruise, tape deck. Bed liner, new brakes, Tahoe package. Best offer over \$6,500. Call Terry, X3654 or 815-286-3619.

1980 Ford F100 1/2 ton pickup, 6 cylinder, 300 cu. in. engine, 3 sp. man., running brd., bed rail. Well-maintained. \$1,550 o.b.o. Call Russ, X2888 or 708-898-9208.

1982 Toyota Corolla Tercel, 2-dr., 4-sp. am/fm tape deck, very good radio, good con., \$1,100. Call Meng at X2982 days and X4901 evening.

1988 Dodge Colt, Sony am/fm stereo cass., A/C, 45k mi., 4-spd., ex. con., like new, \$3,299 obo. Call 708-963-6134 after 6 p.m.

Lost & found

Possibly missing a watch at the pool? Child's glasses also found. Call the Activities office at x4544.

Chamber Series tickets available

Tickets for the 1991-1992 Fermilab Chamber Music Series are available only until August 20. Series tickets cost \$31, fifteen percent less than the cost of individual tickets to the three concerts. Call (708)-840-ARTS to reserve your seats. Individual tickets go on sale August 20.

The Chamber Music Series includes these three acts:

September 21, 1991: Mozartean Players

The Mozartean Players combine a mastery of the original-instrument idiom with a level of technical ability rivaling that of the best modern instrumentalists. Steven Lubin (fortepiano), Stanley Richie (violin) and Myron Lutzke (cello) specialize in the music of Mozart, Haydn and Beethoven.

November 9, 1991: I Musici de Montreal

Led by Maestro Yuli Turovsky, a cellist of international renown for his performances with the Borodin Quartet, this fifteen-member chamber orchestra has made quite a splash on the international scene. I Musici, well known for its recordings on the Chandos label, has proved to be a persuasive ensemble of the highest caliber.

January 18, 1992: Raphael Trio

Since its Carnegie Hall debut in 1975, this ensemble has generated excitement across the country with its numerous recordings and frequent appearances on National Public Radio. Says the *New York Times*, "Interpretive intensity fired the evening—Mr. Epstein's exuberance meshing happily with Mr. Castleman's firm, sweet tone and Mr. Salm's sumptuously resonant playing."

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