HOTLINE

PRINCETON PLASMA PHYSICS LABORATORY

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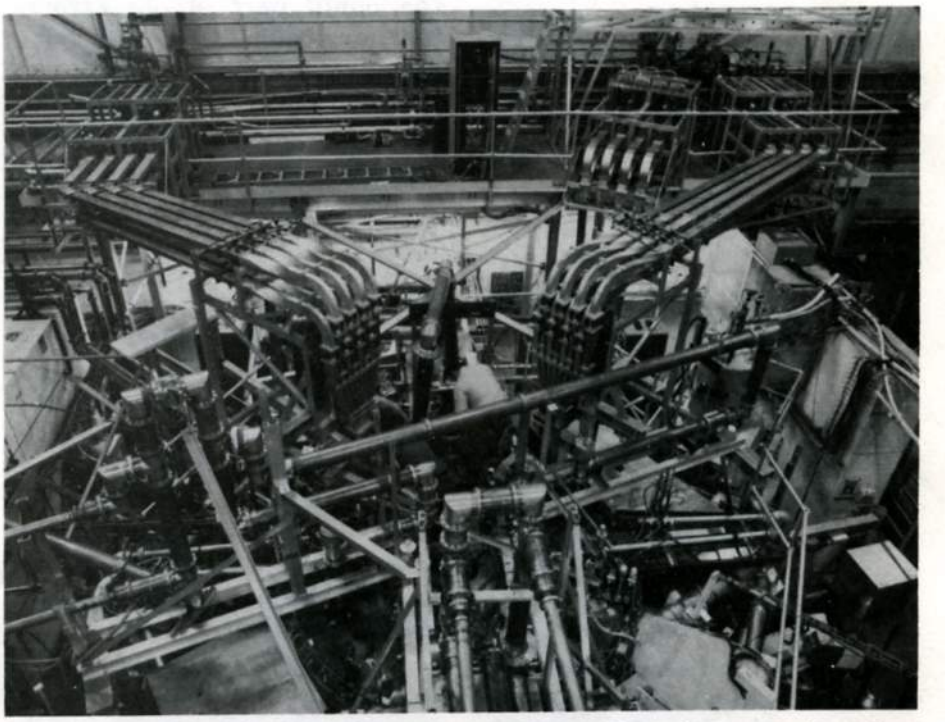
PLT Sets RF Heating Record

Two very significant achievements have been obtained recently in the PLT radio-frequency (rf) program. 5 MW of 30 MHz ion cyclotron radio frequency (ICRF) power has been delivered to a six coil antenna array, and the new 2.45 GHz lower hybrid current drive (LHCD) system has been made operational into three 8 waveguide grill launchers. Both achievements are the culmination of over two years of concentrated effort by the several hundred people from many parts of PPL who support the PLT project. The results represent hallmarks in the development of rf heating and current drive techniques for potential use in fusion reactors.

The ICRF power delivered to PLT is the highest applied on tokamaks thus far in the world fusion program. With ~ 4.2 MW of power actually transferred to the plasma, the ion temperature rose to around 5 keV (~ 60 million ° C) at a plasma density approaching 4×10^{13} cm^{-3}. This ion heating efficiency is comparable to that achieved with neutral beam injection (NBI) at lower density on PLT in 1978. In addition, the electron heating with ICRF has been found to be more efficient than with NBI at the higher density on PLT. The electron temperature touched peak values of 4 keV at the 5 MW power level, and the total energy stored in the plasma exceeded 100 kJ.

At a frequency of 2.45 GHz, the LHCD system will ultimately deliver 1.5 MW, or 0.5 MW to each of three couplers. It is designed to extend the PLT current drive operation to higher densities up to ~ 5×10^{13} cm^{-3}. Also, top port and midplane port launcher geometries are being used to investigate the coupling physics. An individual coupler has already operated at 60% of full power, and for the first time a top launcher has been shown to drive current somewhat more efficiently than previously obtained with a midplane 800 MHz system. Moreover, currents have been driven at a density 1.5×10^{13} cm^{-3}, which is twice the value at which current could be driven with the lower frequency system. These results are not only important for current drive over a wider



The PLT rf heating system is visible in this photograph, taken in September 1984.

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range of densities on PLT, but also contribute significantly to the data base for the TFTR LHCD design study.

In the future, the PLT group will study rf heating and current drive, separately and together, under conditions more representative of reactor scenarios than in previous years. Efforts will focus on improving rf heating and current drive performance, and on explaining the underlying basic physics to permit extensions of these techniques to the reactor regime. With the continued excellent support of the PPL personnel involved, the PLT group expects to achieve these important goals on the way to developing a fusion reactor.

New PBX Beta Mark

PBX passed a milestone September 14 when a 540 kA bean-shaped plasma with a beta value of 5.3% was created within six months after the experiment was initiated. The result topped the 4.5% value reported by GA Technologies, Inc. at the International Atomic Energy Agency conference held in Baltimore two years ago.

Commenting on the PBX progress, project co-head Dr. Michio Okabayashi called the achievement "a physicist's milestone" rather than a program milestone. The record-setting plasma had a current of 540 kA, a magnetic field of 0.87 tesla and a density of above 5×10^{13} particles/cm^3.

"This is not a milestone to the DOE," Dr. Okabayashi emphasized. "We did try to surpass the GA record, but our goal is to push the beta still higher."

Neutral beam injection on PBX was begun in May, and the plasma control system was improved in August. Since that time, PBX has been operating "quite productively," according to Dr. Okabayashi. "The plasmas have been quite well-behaved. We haven't seen any instabilities so far that would prevent pushing up the beta level."

After having set the new beta record, PBX continued operation through the middle of October. The machine was then shut down for three weeks to allow for repairs to the passive limiter plates. Installation of additional plasma diagnostics, such as a CO_2 interferometer, was also scheduled.

Dr. Okabayashi pointed out that this was PBX's first major opening. He added that the alterations made during the opening "will let us run easier in the future. The real challenge (for PBX) comes from now on. We've reached the uphill part of our effort. But we can't push (the beta level) up with brute force; we have to be smart enough to rearrange our hardware and to continue improving the plasma parameters."

After the opening, Dr. Okabayashi estimated it will take several weeks to clean up the vacuum vessel interior again. "But we should be able to get back into the high beta regime before Christmas," he continued. "I feel quite confident in that, and in our ability to push the beta up in the following months."

He pointed out that it took five months after the start of PBX neutral beam injection to reach the 5.3% beta region. "We should now be able to get back into that region in about three months or so."

"All the physicists are working hard, and we've had very nice cooperation from the theorists and from our technical people. This kind of achievement can't be done by a small group, and everyone's collaboration made it possible."

The PBX configuration should theoretically permit formation of stable plasmas with beta values exceeding 10 percent.

S-1 Improvements

A passive stabilization system has led to a significant improvement in the parameters obtained by spheromak plasmas, according to S-1 Experimental Operations Head Dr. Masaaki Yamada.

This summer's installation of a figure-eight coil system has led to "dramatic improvements" in the stability of S-1 plasmas, according to Dr. Yamada. The coils are located on either side of the flux core, and protect the plasma against magnetohydrodynamic instabilities. As the plasma begins to move within the vacuum vessel, the coils force it back into its proper position.

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The shifting and tilting instability modes previously found in spheromak plasmas have been quelled since the coils were installed in August. Plasmas with 1 msec lifetimes are now routinely created. "The difference is that now we have more reproducible, well-behaved plasmas," Dr. Yamada said.

After the figure-eight coils were installed, plasma current increased from the 200 kA range to over 300 kA. Plasma temperatures also rose from the 15 to 50 eV range to the 40 to 80 eV region. A half-dozen S-1 plasma shots attained temperatures topping the 100 eV mark; more thorough measurements must be conducted to verify the reproducibility of that result, however.

The newly installed S-1 pumping system, which includes cryopanel pumping as well as titanium gettering, has already improved the base plasma pressure by approximately a factor of four. Dr. Yamada foresees S-1 plasmas with temperatures topping 100 eV being produced following the completion of vacuum system improvement.

"The S-1 group feels very confident that we can routinely reach higher electron temperatures than previously obtained," Dr. Yamada said. "This is mainly due to having a high current in a clean plasma. With our continued improvements, we should exceed the initial objectives of the S-1 experiments."

The S-1 experimental team is also investigating whether the scaling confirmed in RFP (reverse field pinch) devices can be applied to spheromak plasmas as well.

Dr. Yamada also commended the teamwork of the S-1 group, "which is the most important part of our improvement!"

Heating Guidelines

In an effort to combat increasing energy costs and deal with budgetary restrictions, PPL is continuing the winter heating policy it has followed for the past several years. The policy has resulted in significant savings through conservation efforts by the laboratory community.

The policy requires thermostats to be set to maintain a minimum of 65 degrees Fahrenheit. Heat will also be turned off or cut back on weekends, weather permitting. Exceptions will be made for designated experimental areas, but unannounced inspections will be held throughout the heating season to ensure compliance with temperature restrictions.

Space heaters, which can only be purchased with the approval of Plant Engineering, or individual room controls should be set to maintain a maximum temperature of 68 degrees. Unneeded lights should be turned off.

If you have an office or space you feel requires supplemental heat, or know of any energy wasting situations, call Plant Maintenance at ext. 3092.

X-Ray Laser Grant Approved

PPL physicist Dr. Szymon Suckewer has received a $1.2 million grant from the Department of Energy for research into the development of a short wavelength x-ray laser.

The proposal for the project, which stemmed from an idea Dr. Suckewer developed last year in cooperation with his colleagues from Princeton University, Maryland University, and the National Bureau of Standards, was recently approved by the Division of Advanced Energy Projects, Office of Basic Energy Science of the DOE. Dr. Suckewer will receive $700,000 in the first year of the two-year grant period.

The proposal calls for the pairing of two lasers, one for creating a fast recombining plasma and the other for selective excitation of ions in the plasma, in an attempt to reach the shorter wavelength regime.

Aetna Forms

All Aetna claim forms for employees participating in the Princeton University Health Care Plan may be picked up at the C-Site reception area in the LOB, or at the B-Site reception area in Sayre Hall. All forms include simple instructions for their completion, as well as a self-addressed envelope for mailing.

Employees are asked to refrain from requesting that Personnel Division staff complete and mail their claim forms for them.

New Safety Record Reached

PPL patted itself on the back December 3 during a ceremony held to highlight the laboratory's new safety record. Director Dr. Harold P. Furth changed the numbers on the C-Site safety sign to reflect the one million manhours PPL employees have worked without a lost time accident.

Dr. John Tobin, head of the Occupational Medicine and Safety Division (OM&S), pointed out that the achievement has significantly lowered PPL's accident performance index (P.I.) The P.I. is used by DOE as a measure of its contractors' safety experience. It is calculated by dividing the occurrence rate of specific accidents by 200,000 manhours of work.

In 1981, PPL's performance index was 7.3, dropping to 7.0 in 1982 and 1983. The lab's current performance index stands at 1.9, which is under the year-end goal of 3.0. The average P.I. for contractors reporting to the DOE Chicago Operations Office is 3.0, rounded off to the nearest whole number. PPL's performance index on this basis would be 2.0.

Dr. Tobin acknowledged the part increased emphasis on safety training, periodic safety meetings, and the lab-wide Area Safety Coordinator program have played in reducing PPL's accident rate. But he gave most of the credit for the reduction to "the tremendous development of safety consciousness on the part of laboratory employees, assisted by the active leadership of laboratory management. People are working more safely, and supervisors are conducting periodic inspections of their areas to identify unsafe conditions."

Dr. Tobin pointed out that the performance index goal for calendar year 1985 has been set at 2.0. "With continued interest and effort on the part of employees, supervisors and managers alike, we can achieve it," he asserted.

Added precautions during the winter months will go a long way toward achieving that goal. "Each year, we have a lot of ice-slipping injuries," Dr. Tobin explained. "We have asked the University to intensify efforts for the early cleaning of ice and snow from laboratory roads, parking lots and sidewalks." Employees are urged to be extra cautious of their footing in bad weather conditions.

Continued vigilance will also keep the laboratory accident rate low. Unsafe conditions should be brought to the area supervisor's attention, and a Safety Report on the situation should be completed. Reports are sent to OM&S, where they are logged and the responsibility for acting on each situation is assigned to an appropriate supervisor. Employees receive notification of all follow-up action on their reports.

According to Dr. Tobin, all safety reports submitted to date have been processed and disposed of, with the exception of those that entail major work.

In the coming years, the PPL safety program will reinforce the belief that safety is the responsibility of line management. Safety should be based in each individual work group, with employees initially voicing their safety concerns to their supervisors. OM&S staff members serve primarily as

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resource people, providing technical expertise and assistance while the responsibility for safety is distributed throughout the line organization.

Dr. Furth (left) and Don Carden of the DOE Princeton Area Office (right) raised a National Safety Council banner commemorating PPL's new safety record during the ceremony.

Access Control

In order to upgrade PPL's access control system to meet expanding laboratory needs, a new computer system has been installed. However, as in most cases of transition to a new system, certain unforeseeable problems arise. For example, some employees are having difficulty gaining access to certain areas with their ID cards.

The Security Department is making every effort to solve these "settling in" problems. Employees are requested to be patient, since these problems are rapidly being resolved.

Should you have any problems gaining access into areas which you were previously allowed to enter by using your PPL ID card, go to the C-Site Security Desk and request a personnel ID application form from the officer. Fill out the entire form completely, including your driver's license number and the numbers of the license plates for all your vehicles. Your ID sequence number (the one embossed on the back of your ID card, which begins with #199-) should also be entered on the form.

When the form is completed, return it to the desk officer. The information will be placed into the computer, and your problems with area access should be resolved.

Employees who continue to encounter access difficulties should contact Doug Watson or Lori Trani at ext. 2895.

Administrative Achievement

In addition to the overall improvement in the PPL safety record, the Administrative Department has posted a safety milestone of its own. As of November 29, the department had not had a lost time accident in 220 days. In fact, only two lost-time accidents occurred in the department during all of FY84.

Patents

PPL has a Patent Awareness Program designed to recognize creative inventors, and to raise the patent-mindedness of laboratory staff. A Committee on Inventions, consisting of chairman John Johnson, secretary Nancy Jones, and members Frank Bennett, Peter Bonanos, Schweickhard von Goeler, and Richard Rossi, makes cash awards to inventors for their new or novel ideas. Additional monies are awarded if DOE files a patent application on the discoveries.

Invention disclosures filed since June include:

- Symmetric Tandem Mirror, by S. Yoshikawa
- Disruption Control Passive Conductors, by J. Murray
- Method and Apparatus for Fast Ramp-Up of Tokamak Current with Waves, by N. Fisch and C.F.F. Karney
- Protection for Probes, Limiters, Etc. in Toroidal Fusion Devices, by S. Yoshikawa and D. Manos

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- Compact Torus Stellarators Hybrid Configuration, by H. Furth and C. Ludescher
- Bonding of Powders to Substrates by Plasmas, by S. Cohen and S. Yoshikawa
- Coil to Maintain Equilibrium in Stellarators with Large Transform per Period at High Pressure, by A. Reiman and A. Boozer
- Laser Optical Pumping-Spin Exchange Production of Large Quantities of Highly Polarized Hydrogenic Isotopes, by R. Knize, W. Harper, and J. Cecchi
- Cross Potential in Tokamak Configuration, by J. Murray and G. Bronner
- Current Maintenance by Charged Fusion-Product Particle Production in Toroidal Fusion Devices, by S. Cohen, R. Budny, and S. Yoshikawa
- Carbon Heated Lanthanum Hexaboride Cathode, by J. Goree, R. Horton, and M. Ono
- Toroidal Midplane Neutral Beam Armor and Limiter for Indented Bean-Shaped Plasmas, by H. Kugel, S. Hand, and H. Ksayian
- Cyclotron Acceleration Enhancer of Muon Fusion, by R. Kulsrud
- Lathe Tailstock Rotatable Support, by K. Mann

For further information about invention disclosures or the patent process, contact Meg Harmsen at ext. 2659.

Two Named to APS Exec Committee

Laboratory staff physicists Douglass Post Jr. and Francis Perkins Jr. have been elected to the Division of Plasma Physics executive committee of the American Physical Society (APS). Dr. Post will serve as a three-year committee member, while Dr. Perkins was elected to a four-year term as councillor for the group.

Dr. Post, who received his Ph.D. from Stanford University, has been a PPL staff member for 10 years. A principal research physicist working on computer modeling of tokamaks, he heads both the Tokamak Modeling Branch of the Applied Physics Division, and the Physics Division of the Ignited Studies Project.

In addition to his new post on the APS executive committee, Dr. Post also sits on the executive board of the American Nuclear Society's fusion section.

Dr. Perkins, who joined the laboratory staff in 1966, heads the PPL Theory Division. He is currently researching both the theory of heating magnetically confined plasmas with electromagnetic waves, and the theory of small-scale plasma instabilities and the turbulent heat conduction which they cause. He is also a lecturer in the Princeton University Astrophysical Sciences Department, and teaches in the University's graduate education program.

Dr. Perkins received his Ph.D from Cornell University in 1964. In addition to his recent election as an APS councillor, he has served as APS Plasma Physics Division Chairman in 1980 and as an APS Fellow.

Each APS divisional executive committee sets policy for and runs its respective division, organizing the annual divisional meeting. Division of Plasma Physics committee members also organize the plasma physics sessions held at other APS meetings, provide oversight on articles submitted to a variety of APS publications, and serve on the committees that elect APS Fellows and make appointments to APS prize committees. They also participate in APS human rights activities where plasma physics issues are concerned.

APS members must be nominated for an executive committee, and are elected through secret balloting by the general membership.

"Perfect" Bowler

PLT specialist/technician Fran Dodd attained perfection November 12 when he rolled a perfect 300 game in the Princeton University Men's Bowling League at the Colonial Lanes.

Dodd, 57, has been a bowler for 40 years. He has been a member of the League since its inception in 1964, and currently bowls on the COB team with teammates Don Grove, Art and Jerry Gething, Cleo Williams, and Marty Perron.

Fran's perfect performance came in the middle of a three-game series. After

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finishing the first game with four strikes (giving him a 208 score), he threw 12 more to give himself a perfect second game. "I wasn't really worried until the last ball," Fran recalled. "At that point, I realized that that last ball was for all the marbles, and I got a little concerned. So I lined up where I always do, threw the ball almost from reflex, and hoped for the best!"

Although Fran has had 300 games before, they all occurred during exhibition matches, "and they don't count," he explained. This time, however, he will receive a ring from the American Bowling Congress to commemorate his achievement. In addition, his name will adorn an alley flag at Colonial Lanes.

Transitions

The HOTLINE offers its congratulations to the following PPL employees, who are proud new parents:

Sandy Phillips of PM&O and her husband Don, whose daughter Quincy was born October 29;

Peggy Kamperschroer of PLT and her husband Jim, whose daughter Amy Leigh was born November 16;

Masauki Ono of the Research Division and his wife Sakiko, whose son Hiroyuka was born November 22.

Correction

In the last issue of the HOTLINE, a word was omitted from a caption accompanying the story on the X-ray laser. The caption on Page 2 should read "Engineering associate David Voorhees adjusts a monochromator mirror on the X-ray laser experiment. The experimental device is close to achieving lasing action." The HOTLINE regrets the error.

FOR SALE -- Dodge 1978 Tradesman 300 window van. $1895 or best offer. Call Dee at 201-658-3664.

FOR SALE -- Contemporary style Thomasville sofa and chair. Off-white background

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Safety Training Courses

The following Health and Safety training courses are scheduled for January:

Course	Responsible Instructor	Date Scheduled
Confined and Oxygen Deficient Space	K. Semel Ext. 2531	January 22 9-11 a.m.
Back Injury Prevention	M.A. McBride Ext. 3468	January 10 8:30 a.m.-12:30 p.m.
Fire Extinguisher Training	S. Larson Ext. 3166	January 8 and 22 2-3:30 p.m.
Cardiopulmonary Recuscitation (CPR)	S. Larson Ext. 3166	January 21, 23, and 25 9 a.m.-noon OR 1-4 p.m.

Employees must obtain permission from their immediate supervisor to attend these classes. Supervisors must call the responsible instructor to enroll their employees.

with paisley print in Herculon fabric. Hardly used. $400 or best offer. Call 201-658-3664.

FOR SALE -- Complete tropical fish set-up. Ten gallon tank and all accessories. $65 value, will sell for $40. Call Tony DeMeo, ext. 2755.

FOR SALE -- Colonial dining room furniture. Buffet, hutch, table with four chairs. $350 or best offer. Call Tony DeMeo, ext. 2755.

FOR SALE -- Toyota AM-FM car stereo w/speakers. Brand new, never used. $125 or best offer. Call Meg at ext. 2659.

WANTED TO BUY -- Old slide rules and old calculators for my collection. Call Ernst de Haas at ext. 2290.

Transitions

Adrian V. Cini, 53, of the PPL Engineering/Diagnostics Section, died November 6. Mr. Cini was born in Philadelphia, and had been a laboratory employee since 1978. He is survived by his wife, Helen; three sons, Carl J., Paul P., and Mark J.; and two daughters, Irene Rodill and Faith A. Cini.

Volunteers: People People

The following volunteer listings were supplied to the HOTLINE by the Voluntary Action Center (VAC) of Morris County. For further information about any position, contact the VAC at 201-538-7200.

Work best under pressure? Then volunteer for a weekend shift at a hospital emergency room. Shifts can be scheduled for three or four hour intervals.

Inventive? A therapy program for handicapped children needs battery-driven toys specially adapted for the childrens' use. You can concoct the conversions at your convenience.

Enjoy being in charge? A therapy program for muscularly impaired adults needs an administrator to oversee formation of new Morris County chapters. Coordinating volunteers, delegating tasks, and promoting the program are just a sample of the tasks to be accomplished. Your expertise will be required for four to five hours per week.

The following group of volunteer opportunities was supplied by the United Way of Somerset Valley. For further information about specific listings, contact each agency directly.

The American Heart Association needs volunteers to direct program areas, stuff envelopes, and develop, publicize and implement activities. To offer your assistance, call Richard Reuzuilli or Russ Stanley at 201-685-1118.

The Association for the Advancement of the Mentally Handicapped is seeking volunteers to teach mentally handicapped adults recreation or life coping skills. Contact Patrick Breslin or Marilyn Peluso at 201-685-1444.

The Delaware Raritan Girl Scout Council, Inc. needs indi-

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Snow Closing

During the winter months, it may become necessary for the laboratory to delay opening or close entirely due to heavy snow, icy conditions or floods. On those occasions, special announcements will be made over the following radio stations:

Princeton	WHWH	1350 kc
Trenton	WTTM	920 kc
Trenton	WPST (fm)	97.5 mhz
Levittown	WBCB	1490 kc
New Brunswick	WCTC	1450 kc

In additional, the Answering Service of Princeton will provide emergency closing information at 609-924-1760. When calling, individuals should identify themselves as Plasma Physics Laboratory employees. This number should be called ONLY if you are unable to receive information by radio broadcast. Callers will only be told whether PPL is open or closed; the answering service will provide no other information.

If the laboratory remains open, employees who find it impossible to report to work because of hazardous conditions should notify their immediate supervisors.

viduals to help out with publicity, community and media relations, graphics, fund raising, and work on obtaining grants. If you're interested, contact Barbara Guidice at 201-821-9090.

The next group of volunteer opportunities was supplied by the Princeton Area Council of Community Services, a member of the United Way-Princeton Area Communities. For information about any listing, contact the agency directly.

Big Brothers/Big Sisters of Mercer County offers children ages six to 16 the friendship and guidance of a responsible, mature adult. The program, which is supervised by professionals, needs individuals to provide one-to-one, long-term guidance to youngsters from single parent homes. To volunteer, contact the agency at 609-695-2447.

The Chamber of Commerce of the Princeton Area helps maintain or increase the economic viability of the 14 communities it serves. Chamber committees are involved with legislation, education, economic development, tourism, and the quality of life in the area. Assistance is needed for typing, answering telephones, writing letters, responding to tourist mail, answering requests for area information, filing, and a variety of research projects. If you're interested, call the Chamber at 609-921-7676.

The Historical Society of Princeton runs a small museum focusing on Princeton history. The museum includes a children's museum, library, photo archive, and book and gift shop. The Society also sponsors trips to historical places and evening lectures. Volunteers are needed to serve as guides for Bainbridge House, teaching docents for the Children's Museum, library researchers, or exhibit organizers. To find out more, call the Society at 609-921-6748.

Violation Review

The following safety reminders are drawn from a list of common OSHA violations:

- All places of employment, passageways, storerooms, and service rooms shall be kept clean, orderly, and in a sanitary condition.
- The floor of every workroom shall be maintained in a clean, and so far as possible, dry condition. When wet processes are used, drainage shall be maintained, and false floors, platforms, mats, or other dry standing places should be provided where practicable.
- When mechanical handling equipment is used, sufficient safe clearances shall be allowed for aisles, at loading docks, though doorways, and wherever turns of passage must be made. Aisles and passageways shall be kept clear and in good repair, with no obstruction across or in aisles that could create a hazard.

If you encounter what you believe to be an unsafe situation, contact your supervisor or your Area Safety Coordinator.

United Way

AT WORK

For those who think the biggest problem in the greater Princeton area is heavy traffic, it may come as a shock that abused and battered children are also a part of local life. In fact, over 20 families from Hightstown, Princeton, East Windsor, Cranbury, West Windsor, Plainsboro, and Lawrenceville received help for this problem from the Catholic Welfare Bureau last year.

This Trenton-based agency uses funds provided by the United Way-Princeton Area Communities to deal with problems of family violence (child abuse and neglect, spouse abuse, and elderly abuse). It provides clinical treatment, parenting education, and social services in an attempt to develop strength and resources within the family.

The United Way advises that families seeking help with family violence, or any person who suspects its existence, contact the New Jersey Division of Youth and Family Services (DYFS) at 800-453-1000. This special hotline is devoted solely to family violence problems. Even if visible signs of abuse are not evident, referrals for known or suspected incidents of child abuse or neglect should be made to DYFS first.

If an individual prefers, the Catholic Welfare Bureau can also be contacted by calling

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609-394-5181. In addition, Parents Anonymous, a self-help group primarily concerned with child abuse cases, can be reached by calling 800-352-1000.

Catholic Welfare Bureau's family violence program is one of the many crucial services that is provided thanks to individual and business contributions to the United Way.

DOE Uses Special Microscope to See Atoms

Ordinarily, we see things by probing them with light rays. The amount, intensity, and form of light an object reflects back to our eyes determines how we see that object.

But the wavelength of a light ray is about five thousand times larger than an atom. That means an atom will not reflect ordinary light, so we can't see it in the same way we see other things.

Since atoms are the fundamental constituents from which all material is constructed, the Department of Energy (DOE) believes the ability to see atoms will permit scientists to devise ways of making better semiconductors, to develop materials with improved properties to substitute for metals, and to learn more about the behavior of proteins — the fundamental building blocks of life.

Because the wavelength of a light ray is too big to illuminate an atom, an atom can only be seen when illuminated by rays with wavelengths smaller than the atom. Electrons accelerated to high speeds by high voltages possess the required short wavelength.

On September 30 of last year, a new $8 million National Center for Electron Microscopy was dedicated at DOE's Lawrence Berkeley Laboratory in California. The Center contains the most advanced electron microscopes in the world, including the only one in the United States that permits scientists to see a single atom. That very special microscope actually exceeds its design specifications, letting scientists see individual atoms even more clearly than they had anticipated.

How does a researcher's ability to see an atom benefit the average person?

Thus far, the capability to see an atom hasn't been available long enough to answer that question in specific terms. But, because of the interrelation of a material's properties and its chemical and atomic structure, the capability to see individual atoms will help scientists understand the behavior of various materials more completely.

The ability to determine the arrangement and kind of atoms of which proteins are composed should help scientists understand why proteins provide the essential ingredient of life.

In the same way, scientists should be able to determine why some materials are good conductors of electricity while others are not, and why silicon is useful for making solar cells and transistors -- perhaps even how to make better materials for that purpose.

The new atomic resolution microscope will be used by researchers from industry, the academic world, and government laboratories nationwide to determine in greater detail the ways materials fail, how new materials with improved properties can be created, and how atomic structure can be altered.

The Department of Energy makes the microscope available for a wide variety of research involving the structure and chemistry of atoms. As a result, it expects to reap results that will benefit us all.

INFORMATION SERVICES WISHES YOU ALL A HAPPY HOLIDAY SEASON!

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