

ATF: Record Brightness, Increased Energy, New Beam Line

With its brightness now at a world's record for electron linear accelerators, its energy increased by 40 percent, and its third and final beam line just completed, the Accelerator Test Facility (ATF) "is essentially a new machine," says Ilan Ben-Zvi, ATF Head.

Located in Bldg. 820, the ATF is a small linear accelerator (linac), which operates in conjunction with a high-powered, short-pulse laser to produce an electron beam.

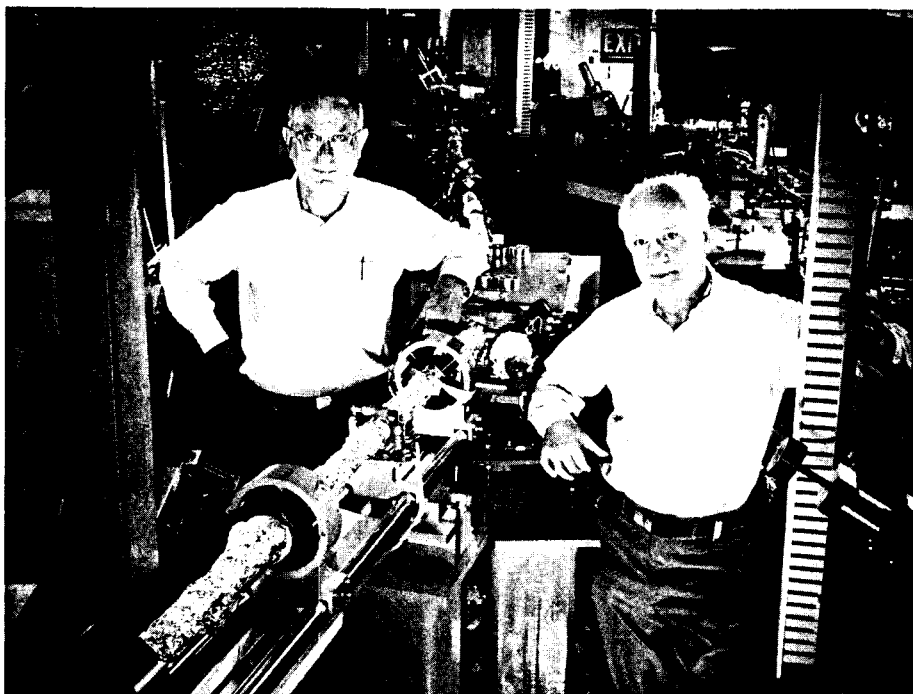
Staffed by about 20 physicists, engineers and technicians from the Instrumentation Division, the National Synchrotron Light Source (NSLS) Department and the Physics Department, the ATF was commissioned in 1992. It is a testbed for BNL's Center for Accelerator Physics (CAP) and the NSLS, for use by accelerator physicists from BNL and around the world to research new methods of accelerating high-brightness electron beams and novel ways of producing intense, coherent short-wavelength electromagnetic radiation.

CAP encourages these types of experiments to be performed at the ATF by outside users and initiates collaboration with industry. In addition to published results from the three ATF experiments completed to date, seven students have obtained their graduate degrees from work done at the ATF, and another eight Ph.D. students are progressing with thesis work there.

During an 11-month shutdown that concluded last December, "We basically rebuilt the entire ATF to increase the beam's energy and brightness, improve its stability and reduce the 'baby-sitting' needed to keep the machine going," explains Ben-Zvi.

Measurements made this March established that the ATF holds the world's brightness record for electron linacs: a normalized root mean square emittance of 1.1 millimeter milliradians at a peak current of 60 amperes.

This record was achieved as a re-



Ilan Ben-Zvi (left) and Kenneth Batchelor, on either side of the new beam line in the experimental hall of the Accelerator Test Facility.

sult of upgrades performed during the shutdown to the ATF's injection system, which generates and preaccelerates electrons before injecting them into the linac itself.

On the heels of this record, work was completed in early April on the last beam line to be installed at the end of the linac, and the first experiment on that beam line, an inverse FEL accelerator experiment will begin this summer.

Beam Begins With Electron Gun

The high-brightness and high-current electron beam used in ATF experiments begins with a laser-photocathode RF electron gun.

An electron gun is a device that produces electrons in either a continuous stream or intermittent bunches. Everyday electron guns, such as the one found within a television set, use what is called a thermionic cathode, a

photocathode. It is a light-sensitive metal disk that, when exposed to suitable electromagnetic radiation from a laser, emits electrons from its surface, and these electrons are then accelerated by a very high intensity radio-frequency (rf) electric field.

The ATF's electron gun has been so successful in generating high-brightness and high-current electrons that it has been copied "at least a dozen times by laboratories around the world doing accelerator research," says Kenneth Batchelor, NSLS, who is the ATF's Technical Manager and one of the gun's primary developers.

In fact, a higher energy, 10-MeV version of the ATF's electron gun is being built with Northrop Grumman to be the heart of the Chemistry Department's Pulse Radiolysis Facility, which is now under construction beside Bldg. 555.

Nd:YAG Laser Rebuilt

The ATF gun fires electrons when 10-picosecond-long pulses of ultraviolet light from the ATF's neodymium-yttrium-aluminum-garnet (Nd:YAG) gas laser illuminates the copper sur-

(continued on page 2)

Highlights of the Lab's 1993 Environmental Monitoring Report



Photo on the cover of the 1993 Site Environmental Report.

BNL's Safety and Environmental Protection Division (SEP) issues a site environmental report every year. The report is produced principally by SEP staff, with contributions from the Office of Environmental Restoration. The following are highlights from the recently released 1993 report:

What does the report include?

Devoted to BNL's activities to monitor the environment, the report is over 200 pages long and includes the following information:

- Results from measurements of radionuclides and chemicals in the air, surface water, groundwater, soil, fish and vegetation around BNL.
- Description of how BNL complies with various federal, state and local environmental regulations.
- Assessment of BNL's impact on the environment.

Why is the report published?

BNL's Site Environmental Report has been published annually since

1971. Prior to that, summary reports were published periodically, starting with BNL's establishment in 1947. Publication of the report serves to:

- Document the results of the environmental monitoring program.
- Formally advise federal state and local regulators as well as the public of BNL's impact on the environment.
- Comply with U.S. Department of Energy regulations.

What does it say?

BNL measures small but detectable radiological and non-radiological releases from the Laboratory to the environment. In brief, if a person were living at the site boundary, routinely eating fish caught in the nearby Peconic River and drinking well water from the area, the impact to that individual from BNL's operations would be a small increase in radiation dose.

For 1993, that hypothetical person would have received a maximum of 1 millirem. This represents about a 1per-

(continued on page 2)

New Directions for Plastics Recycling



Even with plastics recycling flourishing all over the nation, tons of plastic still go to landfills and junkyards each year as part of durable goods — cars, appliances and the like. To help find new technologies that could increase the rate at which those "hidden" plastics are recycled, a group of 23 industry representatives and academic researchers met at BNL on March 9 and 10 for the Plastics Recycling Workshop. The participants also prepared a draft proposal on such technologies for the National Center for Manufacturing Sciences (NCMS), a consortium of 180 competitiveness-minded manufacturers that organized the workshop along with the Long Island Research Institute (LIRI). Shown drafting the proposal at one workshop session are: (clockwise, from left) Annette Ketner, NCMS; Noel Malone, Eastman Company; Adam Dowd, a BNL Science and Engineering Research Semester student from the Georgia Institute of Technology; William Ferretti, New York State Department of Economic Development; Pete Ritzcoven, U.S. Department of Energy; Joanne Wortman, LIRI; Edward Kaplan, BNL Department of Advanced Technology (DAT); Paul Kalb, DAT, who has developed a way to use recycled polyethylene plastic to encapsulate hazardous waste; John Sullivan, Ford Motor Company; and Arnie Kelson, AT&T.

14 BNL Sons & Daughters Win AUI Scholarships

In the 30th year of the program, 15 sons and daughters of BNL employees have been awarded AUI Trustee Scholarships. Each AUI Scholar is a high school senior who will receive \$2,500 per year for up to four years of study at the college or university of his or her choice.



Emily Fitzpatrick, daughter of Robert Fitzpatrick, Department of Advanced Technology, lives in Mt. Sinai and attends Mt. Sinai High School. She will major in biology as a pre-med student at either Pennsylvania State University, in the Scholars Program, or Rensselaer Polytechnic Institute.

Vijay Francis is the son of Arokiasamy Francis, Department of Applied Science. He lives in Middle Island and goes to Longwood High School. At Cornell University, he will study engineering.



Dana Le Vine is the daughter of Micheal Le Vine, Physics Department. Residing in Port Jefferson, she will graduate from Earl L. Vandermeulen High School. She will probably attend Yale University, most likely to major in biochemistry.



Pia Mukherji, daughter of Swapna Mukherji, Plant Engineering Division, is a senior at Half Hollow Hills High School East and lives in Dix Hills. At Brown University or Swarthmore College, she will major in linguistics.



Miriam Frank, daughter of James Frank, Physics Department, is a resident of Setauket. A senior at Ward Melville High School, she will go to Brandeis University, where she will major in neuroscience.



Debleena Sengupta is the daughter of Subhash Sengupta, Safety & Environmental Protection Division. A senior at Ward Melville High School, she resides in South Setauket. She will attend either Columbia University, Massachusetts Institute of Technology or New York University, and she plans to study chemistry.

Marisa Higgins, is the daughter of James Higgins, Department of Advanced Technology. Attending Rocky Point High School, she lives in Rocky Point. She will study ethology at either Boston College, Loyola College, Notre Dame University or Syracuse University.



Nicholas Soukas is the son of Anastasios Soukas, Alternating Gradient Synchrotron Department. He lives in Port Jefferson and goes to Earl L. Vandermeulen High School. To study either geochemistry or geophysics, he will attend the University of Pennsylvania or Yale University.



Joanna Kalb, daughter of Paul Kalb, Department of Advanced Technology, is a resident of Wading River, and she goes to Shoreham-Wading River High School. She will major in biology and society in the School of Human Ecology at Cornell University.

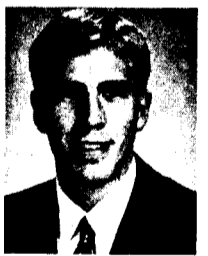


Neil Srivastava, son of Suresh Srivastava, Medical Department, lives in Setauket and attends Ward Melville High School. He will major in either biology or chemistry, probably as a Samuel Morse Scholar at New York University.

Vinay Krishna, is the son of C.R. Krishna, Department of Applied Science. A resident of Mt. Sinai, he goes to Mt. Sinai High School. He plans to study physics, but he is undecided on which college he will attend.



Yunjia Tang is the daughter of Yongnian Tang, National Synchrotron Light Source Department. A resident of Centereach, she goes to Ward Melville High School. She will enter the Scholars for Medicine program at the State University of New York at Stony Brook.



Alan Lemley, son of James Lemley, Department of Advanced Technology, lives in Miller Place and goes to Miller Place High School. He will probably major in biological engineering, either at Cornell University, Dartmouth College, Rensselaer Polytechnic Institute or Williams College.



Nina Tannenbaum, daughter of Michael Tannenbaum, Physics Department, lives in Belle Terre and goes to Earl L. Vandermeulen High School. She will attend Columbia University, where she will probably pursue international studies.

The First Awards, 30 Years Ago

The first AUI Trustee Scholarships were given in May 1965 to ten children of BNL employees, each of whom received up to \$900 per year, applicable against college expenses and renewable for an additional three years or until requirements for the bachelor's degree were completed.

Thirty years ago, the area surrounding BNL was much less populated and developed, and six of the local high schools from which the present scholarship recipients will graduate did not yet exist — Longwood, Miller Place, Mt. Sinai, Rocky Point, Shoreham-Wading River and Ward Melville. Thus, the six boys and four girls all hailed from but three high schools: seven went to Earl L. Vandermeulen in Port Jefferson; two attended Bellport High School; and one went to Carle Place High School.

1993 Report

(cont'd.)

cent increase in the radiation dose that a person receives from natural background radiation as a result of residing in Suffolk County, and is 0.2 percent of the radiation dose allowed by New York State for the general public.

Who gets the report?

The BNL Site Environmental Report is available to any interested individual. Because BNL is regulated by Suffolk County, New York State (NYS), the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy (DOE), BNL's site environmental report is routinely distributed to the following regulatory groups, as well as to elected officials at the local, county and state levels:

- Suffolk County Department of Health Services
- NYS Department of Health
- NYS Department of Environmental Conservation
- NYS Department of Labor
- EPA Office of Radiological Safety
- EPA Office of Radiological Programs
- DOE Office of Environmental Guidance and Compliance
- DOE Office of Environmental Audit
- DOE Office of National Environmental Policy Act Project Assistance

For a copy of the 1993 Site Environmental Report, contact the Public Affairs Office, Ext. 2345.

Solaris Training

For the month of July, the Computing & Communications Division is scheduling two Solaris system-administration classes, which will be taught by an instructor from Sun Microsystems.

Each 30-hour class will run for two weeks, either mornings or afternoons. The training fee for each class is \$1,050 per participant.

For information and to register, call Ed McFadden, Ext. 4188, or e-mail mcfadde1@BNL.gov. by Friday, May 5.

described in *Physical Review Letters*. Also published in *Physical Review Letters* were results from a study of the Smith-Purcell effect, which is relevant to laser acceleration and the generation of coherent light, led by John Walsh of Dartmouth College.

Concludes Ben-Zvi, "The sign above the doorway of the ATF says, 'Welcome to the Future' because experiments done here are blazing trails for future high-energy accelerators and short wavelength, coherent light sources." — Marsha Belford

ATF

(cont'd.)

face of the photocathode. This results in a peak beam current of 50-100 amperes from an area only 1 square millimeter in size.

As part of the ATF upgrade, the 10-picosecond, 10-millijoule Nd:YAG laser was completely rebuilt, according to a new and original design for these type of lasers developed by former BNLer Alan Fisher and Marcus Babzien, NSLS. As a result, major improvements in this laser's pulse amplitude, timing and pointing stability have been achieved.

Also, the arrangement of optical system that delivers the laser light to the photocathode was reconfigured by Triveni Srinivasan-Rao, Instrumentation Division. This new arrangement has enhanced the quantum efficiency of the copper photocathode, so that it now holds the record at 0.04 percent.

The main concentration of research at the ATF into novel ways of produc-

ing intense, coherent short-wavelength electromagnetic radiation is on free-electron lasers (FELs) because, "It is thought that FELs will be the next generation light sources," explains Ben-Zvi. "So the research at the ATF to determine which FEL will be the best candidate is extremely relevant to the synchrotron-radiation field in general, and BNL and the NSLS in particular."

In fact, the NSLS has proposed the construction of a deep ultraviolet free-electron laser. It would be the focal point of a new user facility, to be used as a probe for chemistry, surface science, solid-state physics, biology and materials science. Thus, research and development on short-wavelength FELs at the ATF are being performed for proof of principles.

Following the inverse FEL experiment on the new beam line, a high-gain, harmonic generation FEL, which is a longer-wavelength model of the deep-ultraviolet FEL proposed by the

NSLS, will be performed.

Another FEL experiment, one involving a magnetic device called a micro-undulator, with the extremely short period of 8.8 millimeters, will be done on another beam line; also on this line, results from a pulsed micro-undulator built at the Massachusetts Institute of Technology will be compared to those of a BNL-built superconducting micro-undulator.

Pursuing Laser Acceleration

Research into new methods of accelerating high-brightness electron beams is being pursued at the ATF in conjunction with its 50-picosecond, 20-gigawatt CO₂ laser, which can be synchronized to within one picosecond of the electron beam pulses.

The first experiment carried out with the CO₂ laser was a test of inverse Cerenkov acceleration by Wayne Kimura of STI Optics, which achieved record acceleration of 3.7 million electron volts over 12 centimeters and was

Basketball League's New Scholarship Fund To Benefit From Basketball Game and Dance

The BERA Basketball League is establishing a memorial scholarship fund for former BNL employee Robert L. Rowley, who died of a heart attack at age 45 last September 14. Fund-raising efforts will begin next month with two events: a basketball game and a dance.

Robert Rowley worked at BNL for 26 years, first as a technician in the Physics Department and finally as a tool and instrument maker in the Central Shops Division. In his spare time, Rowley had been a member of the BERA softball and basketball teams, and he had refereed in the BERA Basketball League for several seasons. A community leader in North Bellport, Rowley is also remembered as a founding member of the Concerned Citizens for a Better North Bellport civic group.

"Bob's friends, coworkers and teammates want to pay tribute to him for his caring spirit and his contributions to his hometown of North Bellport," said Dwayne Eleazer, Plant Engineering Division, who is one of the initiators of the memorial scholarship. "So the Basketball League is sponsoring two events to raise money for two scholarships intended for high school students who



Robert Rowley

are promising athletes and community activists."

The first event is a basketball game to be held at Bellport High School on Friday, May 19, at 7 p.m. In this "All-Star Basketball Game and Slam Dunk Contest," the Brookhaven Lab All-Stars will compete with the Bellport Alumni All-Stars. Tickets, at \$3 for adults and \$1 for children 12 and under, may be purchased at the door.

The second event is a dance and buffet at BNL's Brookhaven Center on Friday, May 26, from 6 p.m. to midnight. The ticket price of \$25 includes an open bar and buffet, as well as music by deejay Eddie Taylor from BNL's Computing & Communications Division. Tickets must be ordered by May 16 from Brian Mayo, Ext. 7713, or from the BERA Sales Office, any weekday, between 9 a.m. and 1:30 p.m. For more information, call the BERA Sales Office, Ext. 3347.

If you wish to make a donation to the scholarship fund, send a check made out to the BERA Basketball League to BERA, Bldg. 185.

CPR for Adults

One-session, adult cardiopulmonary resuscitation courses will be offered on site from 6 to 9 p.m. on the following dates by the Health Promotion Program of the Occupational Medicine Clinic: Thursday, May 4; Monday, May 15; Thursday, June 1; and Monday, June 12.

The cost is \$22.50 per person, and the courses are open to all employees, guests and their families. To register, contact Health Promotion Specialist Mary Wood, Ext. 5923, Bldg. 490.

Racquetball Dinner

The BERA Racquetball Club end-of-season dinner will be held at 7 p.m. on Friday, April 28, at the Sea Basin Restaurant, Route 25A, Rocky Point. The cost for members is \$8 per person; for guests, \$18. Make reservations no later than Monday, April 24. Call Janet Tempel, Ext. 4049, or Lois Marascia, Ext. 3315, for reservations or information. Forward checks to Lisa Blevins, Bldg. 134A.



Professional Secretaries Week*
April 23-29
Professional Secretaries Day*
Wednesday, April 26

*Created by Professional Secretaries International in 1952 to recognize secretarial achievements and to show the tremendous potential of the secretarial career.

Bowling

Red and Green League

R. Mulderig Sr. did it again — six months to the day, he bowled another 300! Followed by a 227/204/731 scratch series! Congratulations, Ron!

J. Cuccia Jr. 263/201/653 scratch, R. Mulderig Jr. 247/235/677 scratch, J. Griffin 246/225/206/677 scratch, R. Wiseman, 239/214/635 scratch, R. Raynis 237, B. Giuliano 237/236/655 scratch, J. Goode 226/224/634 scratch, H. Arnesen 225/202/621 scratch, R. Eggert 224/605 scratch, K. Asselta 208, J. Cuccia Sr. 201, G. Weresnick 201, H. Dawson 200.

Purple and White League

M. Meier 244/224/183/651 scratch series, J. Butler 238/214/617 scratch, E. Sperry IV 237/204/617 scratch, J. Biamonte 214, M. DiMaiuta 203/200, S. DiMaiuta 202/194/192, K. Batchelor 200, A. Warkentien 199/195, E. Sperry III 196, B. Belligan 194/180, P. Callegari 194, Doug Fisher 193, G. Munoz 193, C. MacDougal 192, K. Botts 191, M. G. Meier 189, N. Besemer 188, S. Smith 182/177, G. Irving 181, S. Frei 180, J. McCarthy 180, E. Zukowski 180, P. Bounauito 179, M. Addressi 175, J. Addressi converted the 5/7 split.

Amateur Radio

Meeting Notice

The Amateur Radio Club will next meet at noon on Thursday, April 27, in the lounge of the Recreation Building. All Lab employees, guests and licensed amateur-radio operators are invited to attend. For more information, contact Chris Neuberger, Ext. 4160, or Nick Franco, Ext. 5467.

License Course

The BNL Amateur Radio Club is sponsoring a free Technician License course, to be held during lunchtime once a week for six consecutive weeks, in Bldg. 1005. The course will end with an FCC examination; the test fee is \$5.90 per person, which will be collected the day of the exam. No Morse code is required.

Register with Nick Franco, Ext. 5467, or e-mail to franco@BNL.gov. Walk-ins will be accepted only for the exam.

IBEW Meeting

Local 2230, IBEW, will hold its regular monthly meeting on Monday, April 24, at 6 p.m., in the Knights of Columbus Hall, Railroad Avenue, Patchogue. On the agenda will be regular business, committee reports and the president's report.

Basketball

Championship Game on April 13

Magic 66		Mustangs 55	
Troy Mayo	27	Rich Domenech	11
Terry Buck	19	Lars Furenlid	11
Mitch Williams	10	Greg Mack	10
Pat Browne	6	Charlie Edwards	8
Ray Jackson	2	Wayne Cummings	6
Dennis Ryan	2	Jamie Sims	5
		Bill Gunther	2
		Steve Springston	2
Three-point shots: Williams (2), Buck (2), Domenech (2), Sims.			

Celebrate the 5th on the 6th!

May 5th is the anniversary of the day in 1862 when the Mexican national army under General Porfirio Diaz defeated French troops at the city of Puebla. The French soldiers had been sent to Mexico by Emperor Napoleon III, first to conquer the Mexican capital, Mexico City, and then all of Latin America. So the Mexican victory during the Battle of May 5th is commemorated annually by the holiday Cinco de Mayo — and, this year, you can celebrate on site!

The BNL Ballroom, Latin & Swing Dance Club will celebrate the 5th on the 6th — at its belated Cinco de Mayo Dance, on Saturday, May 6, from 7 p.m. to midnight, in the Brookhaven Center.

Beginning at 7 p.m., complimen-

tary hot and cold hors d'oeuvres will be available, including fajitas, nachos grande, buffalo wings and spring vegetable crudites. A full cash bar, featuring Mexican beers and Margaritas, will be open from 7 p.m. to 11 p.m.

Latin, ballroom and swing dancing gets under way at 8 p.m. until midnight, provided by deejay Robert Beers. At 10:30 p.m., desserts and coffee and tea will be served.

Tickets are \$15 per person, but must be purchased soon, as only 50 are left. They are available from:

- Rudy Alforque, Ext. 4733, Bldg. 817
- Don Litcher, Ext. 7587, Bldg. 515
- Betty Organek, Ext. 3164, Bldg. 355
- Dick Savage, Ext. 4640, Bldg. 120
- Gail Schuman, Ext. 7985, Bldg. 421
- Lucian Wielopolski, Ext. 3656, Bldg. 490

Cafeteria Menu

Monday, April 24	
Soup: Autumn harvest	.90/1.20
A la Carte: Grilled flank steak	3.95
Lite: Vegetable & roquefort zucchini	3.85
Deli: Pastrami	3.20
Grill: Ratatouille skewers over rice	3.30
Tuesday, April 25	
Soup: Hot & sour	.90/1.20
A la Carte: Turkey w/cranberry biscuits	3.65
Lite: Haddock w/tomatoes & ginger	3.85
Deli: Top round of beef	3.20
Grill: Turkey tortilla	3.30
Wednesday, April 26	
Soup: Beef w/barley	.90/1.20
Display Cooking: Oriental stir-fry	4.75
Deli: Dijon pork loin w/apple compote	3.20
Grill: Filet of fish	3.30
Thursday, April 27	
Soup: Chicken gumbo	.90/1.20
A la Carte: Beef stew	3.85
Lite: Burrito w/cheddar & guacamole	2.95
Deli: Jamaican jerk-rubbed lamb	3.20
Grill: Turkey chili in a tortilla	3.30
Friday, April 28	
Soup: Tomato & pinto bean	.90/1.20
A la Carte: Seafood & vegetable scampi	3.95
Lite: Chablis chicken w/tarragon	3.95
Deli: Corned beef & cabbage	3.20
Grill: BBQ beef quesadilla	3.30

Volleyball

Playoff Results

Open League, Finals: G-Team 0, The Men & Me 3.

League 1, Finals: Koopas 3, Rude Dogs 1.

League 2, Semifinals: Mon. Night Live 3, Nuts & Bolts 1; Fossils 3, Netwits 1.

League 3, Semifinals: Upton Ups 3, Silver Bullets 1; Take Five 3, High Volley'em 1.

Volleyball Party

The Volleyball League will hold its annual end-of-season party on Friday, May 19, from 6 to 11 p.m. in the Recreation Building, with music by deejay Lou starting at 7 p.m. The party will be catered with a hot & cold buffet, and soda, beer and wine will be provided. The cost per person is \$16, if tickets are purchased by Monday, May 15; or \$19, if bought after May 15.

For tickets, contact team captains or Terry Sullivan, Bldg. 830, Ext. 2840; Ken Sutter, Bldg. 480, Ext. 4514; or Ron Webster, Bldg. 526, Ext. 2845.

Captains' Meeting

The end-of-the-season captains' meeting will be held at noon on Wednesday, April 26, in the conference room of Bldg. 426. The first order of business is the election of officers for the 1995-96 season, so submit nominations for president, vice president, secretary, treasurer or referee manager to Rick Wagener, Bldg. 426, wagener@bnl.gov; or Terry Sullivan, Bldg. 830, sulliva1@bnl.gov. by April 24.

The second order of business is obtaining suggestions for improving the league rules or constitution, e.g., finding solutions to the understaffed referee rosters.

BROOKHAVEN BULLETIN

Published weekly by the Public Affairs Office for the employees of BROOKHAVEN NATIONAL LABORATORY

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Upton NY 11973-5000
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The Brookhaven Bulletin is printed on paper containing at least 50 percent recycled materials, with 10 percent post-consumer waste. It can be recycled.



Welcome Our Daughters to Work

Today is the last day that BNL employees and guests can register their 9-to-15-year-old daughters to participate in Take Our Daughters to Work Day next Thursday, April 27. For the day's schedule or a registration form, contact Susan Foster, Ext. 2888.

Foster, who heads the Lab committee planning the day's events, encourages all employees to get involved. So does the Ms. Foundation, which organizes this nationwide event and says: "You — and every employee — stand to be a mentor to girls. So . . . everyone girls meet should be prepared to explain what they do, how they got there, and why their work is meaningful. . . . Girls want honest answers about what works and what doesn't. Just remember to speak in language geared to kids. Hearing directly from you . . . will prepare girls for — and excite them about — what lies ahead."

