Next-Generation Light Sources: Free Electron Laser Research

Milestone Experiment Achieved

More than 2,400 scientists come to the Lab's National Synchrotron Light Source (NSLS) each year from across America and around the world. They can testify that this user facility is an unqualified success at what it does: converting energy from a stored electron beam into intense beams of light. These beams of light, ranging from infrared and ultraviolet through x-rays, are used to examine the structure and function of a host of materials.

While synchrotrons have proven to be an invaluable tool, they lack the coherent power available from con-

... experimental results which demonstrate the marriage of the energy reach of accelerators with the finesse of lasers.

ventional laser systems, which in turn lack the energy range of storage rings. This gap between lasers and accelerators was bridged by a BNL/Argonne National Laboratory (ANL) team with the first demonstration of a high gain harmonic generation (HGHG) free electron laser (FEL) at the BNL accelerator test facility (ATF).

In August of 1999, the team described the experimental results which demonstrate the marriage of the energy reach of accelerators with the finesse of lasers.

The proof-of-principle experiment led by Li-Hua Yu of the NSLS was a first step toward development of a new approach to generate very intense coherent hard x-rays. In a coherent source, all elements radiate in synchronism. By analogy, a chorus led by a conductor is coherent; an uncoordinated group of singers, incoherent.

Two Central Concepts

There are two central concepts in the experiment. First is to impose the properties of the laser on the electron beam by "seeding," so the start-up signal is coherent. The second is the

> "The important result . . . shows dramatically the potential benefits of a laser-seeded free electron laser."

realization that the multiples of the laser frequencies (harmonics) can be generated and amplified in the FEL, which shifts the properties of the laser (such as its stability) to higher frequencies.

Another important feature of the HGHG configuration is that it can be achieved in a "single-pass" device, which means that, unlike conventional lasers, it does not require high efficiency mirrors. This will be crucial to projecting high performance laser characteristics into x-ray sources of the future.

Groundwork

Said Yu, "To be able to do this experiment required many people and (continued on page 3)



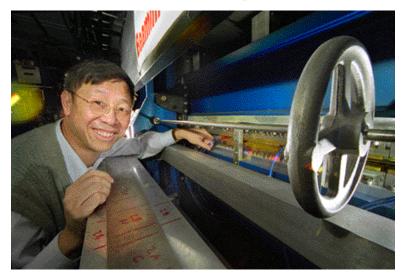
700 | 600 | H640 Oursut | 400 | 300 | SASE Culput (x107) | 100 | 5100 | 5200 | 5300 | 5400 | Wavelength [nm]

The team on the experiment for the high gain harmonic generation free electron laser included: (from left) Erik Johnson, Bill Graves, Bob Malone, Igor Pogorelsky, Marcus Babzien, Li Hua Yu, Xijie Wang, Lou DiMauro, John Skaritka, Marc Montemagno, Bill Cahill, Bob Harrington, Ilan Ben-Zvi, Sam Krinsky, and Mike Lehecka, all of BNL. Not present were: (from BNL) Jeffrey Aspenleiter, Bill Bambina, Michael Caruso, Walter DeBoer, Pete DeToll, Adnan Doyuran, Rodger Hubbard, Sorin Pop, George Rakowsky, Bob Scheuerer, Don Shea, Lorraine Solomon, Mal Tardd, Martin Woodle, and Vitaly Yakimenko; from Argonne National Laboratory: Sandra Biedron, John Galayda, Efim Gluskin, John Jagger, Vadim Sajaev, and Issac Vasserman.

These data (left) demonstrate the striking difference between High Gain Harmonic Generation (HGHG) and Self Amplified Spontaneous Emission (SASE) Free Electron Laser (FEL) experiments conducted on the same equipment. The graph plots power (in arbitrary units) against wavelength (in nanometers) and shows that the energy spread of the HGHG FEL is much smaller and the overall gain higher. The SASE result is multiplied by one million (106) to be on the same scale as the HGHG result. The SASE experiment could achieve the same power level if the amplifier were three times longer, but the energy spread would still be greater than that of the HGHG device.

351st Brookhaven Lecture

Li-Hua Yu Talks About Milestone Experiment



To describe and explain the breakthrough research leading to the "High Gain Harmonic Generation Free Electron Laser Results," Li-Hua Yu, National Synchrotron Light Source (NSLS) Department, will give the 351st Brookhaven Lecture, on Wednesday, January 19, at 4 p.m. in Berkner Hall.

Yu will be introduced by NSLS Deputy Chair and Free Electron Laser Manager Sam Krinsky.

Yu, who led the proof-of-principle experiment at the Accelerator Test Facility (see accompanying story), joined BNL in 1982. His research on various topics including free electron lasers and closed orbit feedback system for the storage rings. He received his Ph.D. in physics from the State University of New York at Stony Brook in 1984 and since then has been working at NSLS.

Refreshments will be offered before and after the lecture. To join the lecturer at dinner at a restaurant off site that evening, contact Kathy Lovero, Ext. 7188, by noon on that day.

RHIC Start-Up Delayed

The start-up of the Relativistic Heavy Ion Collider (RHIC), BNL's newest and largest accelerator, will be delayed by three months and is now scheduled to begin in February. The first experimental run is planned in May, after detailed systems tests.

The delay is primarily due to repairs of deformed beam pipe bellows at certain locations around the ring. During last summer's commissioning run, the beam in the Blue Ring had to be steered around an obstruction. This obstruction turned out to be a piece of bent metal sheathing inside a bellows connection between adjacent beam-tube sections.

Upon inspection, technicians (continued on page 2)

New DOE Initiative



Brookhaven Bulletin January 14, 2000

RHIC (cont' d)

Upon inspection, technicians found that this was the result of distortions that occurred during high-pressure testing of parallel running tubes, which carry liquid helium to cool the superconducting magnets. The deformities were diagnosed as a systemic problem around both the Yellow and Blue Rings, and so an extensive repair job was undertaken.

Thomas Ludlam, Deputy Associate Director for High Energy and Nuclear Physics, said that such a delay is not unusual, given the complexity of the machine.

The \$600 million RHIC construction project began in 1991 and was completed last summer. Designed to recreate under laboratory conditions the state of the Universe just after the Big Bang, RHIC is expected to enable about 1,000 physicists from worldwide to do experiments to explore matter as it existed at the beginning of time.

While the delays may cut the collider's first experimental run from 28 to 25 weeks, Satoshi Ozaki, Associate Laboratory Director for RHIC, said that a final decision on this has not yet been made.

The RHIC team will start cooling down the machine at the beginning of February, with the goal of beginning ion collisions in March or April, and experiments in May.

"With a great many of the commissioning goals accomplished during last summer's run, and all known deficiencies of the system remedied, we are very optimistic that we will achieve colliding beams and be ready for data-taking fairly quickly this spring," Ozaki said.

RHIC's start-up problems have been addressed swiftly. Since September, about 200 of the bellows have been replaced and their connections braced and other modifications made to ensure safe and reliable operations.

For example, technicians replaced 56 valves in the refrigerator and added additional filters to trap contamination from returned gas. Also to be installed before start-up are approximately 100 power supply units, which adjust magnet strength at beam intersections. The power supplies have been delayed because the manufacturer had not met the RHIC design specifications.

Meanwhile, RHIC has been ahead of schedule in meeting environmental standards, as it is the first DOE Office of Science project and the first Long Island-based facility to be registered to the International Standardization Organization 14001 Environmental Management System.

ISO 14001 is an internationally recognized standard that provides a framework for defining and preventing potential environmental impacts, and for monitoring, communicating and improving performance

Ludlam concluded, "The extended shutdown has provided the experimenters with a window of opportunity for installation, testing and tuning of components that will make this year's running potentially much more effective than it would have been had we started, as originally planned, in November or December of last year. In terms of physics output, this could well offset the delayed start-up."

— Diane Greenberg

BNLers, Be Your Own Boss — With Help From DOE



Around the sign for the new DOE Small Business Development Center (SBDC) are: (from left) Judith McEvoy, Director, SUNY Stony Brook SBDC; Tim Drawridge, DOE Contract Specialist; Michelle Stark, Business Advisor, DOE Brookhaven Group (BG) SBDC; Jeffrey Waxweiter, CEO, APACE, Inc. of Hauppauge; Lucille Wesnofske, Associate Director, SUNY Stony Brook SBDC; & Robert Gordon, Director, Business Management Division, DOEBG.

To be one's own boss tops many people's wish list. If starting your own business is your goal, this opportunity for expert assistance could be for you.

A partnership between the Department of Energy (DOE) and New York State has established a Small Business Development Center (SBDC) on BNL's site at the DOE Brookhaven Group. The SBDC provides a range of services to existing and emerging small businesses. It also is a first-of-a-kind at a DOE site.

"This center, with all it has to offer, will be a great benefit to the community, BNL and DOE," said Robert Gordon, Director of DOE's Business Management Division at BNL. "By assisting new and existing small business firms, this new Center contributes to the growth of small business on Long Island. And, BNL will have more potential supply sources."

At the SBDC, a wide range of products and services awaits the business community — business plan development and small business start-up assistance, organizational structuring,

Since its inception, the Stony Brook Center has assisted over 7,500 clients, achieved over \$91 million in economic impact, created more than 2,057 jobs, and saved more than 700 existing jobs.

financial planning, loan information assistance, and access to public and private capital sources, as well as training programs (workshops and seminars). The Center maintains a comprehensive library, provides referrals to consultants and service providers, offers export assistance, and is linked by computer to the other 20 SBDCs across the state. Introductions to DOE and other federal agency purchasing organizations are also provided. This makes BNL an ideal location for the Center.

"BNL plays a significant role in the regional economy as a purchaser of supplies and is a leader in working with small business," Gordon said. "Now it can also be a mentor for emerging businesses."

In 1999, more than 65 percent of BNL's contracts were awarded to small businesses. Also in 1999, BNL's Small

& Small Disadvantaged Businesses (SSDB) program in what is now the Procurement & Property Management Division received a DOE national award for success in creating small business opportunities. BNL has several programs that were created for small businesses. For example, BNL's SSDB Liaison Officer has an open-door policy to assist small, small disadvantaged, and womenowned businesses to become viable. Also, the Technical Assistance Program in the Office of Economic Development & Technology Transfer offers a unique opportunity to businesses needing to solve technical problems. Under this free program, BNL provides its staff expertise to a business for up to a week. Also, the Cooperative Research & Development Agreement (CRADA) program in the Technology Transfer Office enables BNL to enter into partnerships with industry to work on projects that are of mutual benefit.

The new DOE Center's doors opened in November, and its counselors have been meeting almost continually with individuals from the community and from BNL. Interests vary — some clients explore the potential for self-employment and others seek funding opportunities.

The new DOE SBDC office is a satellite of a larger SBDC program located at the State University of New York at Stony Brook, under the auspices of the Office of the Vice President for Economic Development, Yacov Shamash. The Stony Brook Center has been in existence for over 12 years, employing seven full-time professional advisors and two support staff. In addition, a full-time advisor is located at the Long Island University satellite office in Southampton. Since its inception, the Stony Brook Center has assisted over 7,500 clients, achieved over \$91 million in economic impact, created more than 2,057 jobs, and saved more than 700 existing jobs.

"We are hopeful for similar success at the newest SBDC site," said Gordon.

The DOE SBDC is currently staffed with one advisor who provides one-on-one, confidential counseling for the growth of a business. The Center is open weekdays, except Thursday, 8:30 a.m. to 4 p.m. All visits are free. The Center is housed within the DOE Building 464 on 53 Bell Avenue. For information, call 631-344-2393 or e-mail sbdcdoe@bnl.gov. Walk-ins are welcome, but appointments are recommended to ensure that ample time is put aside to assist you.

Microcomputer Club Java Presentation

On Thursday, January 20, the BERA Microcomputer Club will sponsor a presentation by Dave Stampf, who programs in Java for the Relativistic Heavy Ion Collider and the Advanced Technology, Applied Science, and Biology Departments.

Stampf will talk on "Java — Fun at the Cutting Edge of Programming," in Berkner Hall, Room C, from noon to 1 p.m. All are invited, bring your lunch.

For more information, contact Club President Steven Stein, Ext. 5694, or visit http://www.bnlmcc.bnl.gov.

Omnipoint Demo 1/18

Omnipoint Communications will be in Berkner Hall on Tuesday, January 18, 10 a.m.-2:30 p.m., with special rates for BNLers buying digital PCS wireless services on Omnipoint's GSM network.

Service plans include free caller ID, voice mail, SMS messaging, and FOX News headlines. Plans range from \$15.99 monthly with free phone, to 40 free minutes at \$17.99 monthly, or to 250 minutes, with unlimited weekend calling for the year of the contract at \$27.99 monthly. Call Richard Gall at (631) 343-5900.

Noon Recital January 26, Ensemble Performs Early Scottish Tunes



At noon in Berkner Hall on Wednesday, January 26, the Orpheus Caledonius ensemble will perform a collection of 18th-century Scottish tunes. The musicians are directed by Rachel Begley, recorder; and include Jennifer Griesbach, harpsichord; Motomi Igarashi, viol; and Christopher Morrongiello, lute.

Popular tunes in Scotland at that time evidence crosscurrents of both folk and classical music. A study in contrasts, from the most plaintive of ballads to the most raucous of dances, the program will include works by Barsanti, Bremner, Gow, Oswald, and Thomson.

Orpheus Caledonius is a new ensemble of some of the most exciting emerging players of early music. Director Begley, a New York-based English recorder virtuoso, assembled the group from colleagues from Canada, Japan and the US. The group's diverse instrumentation — with wind, bowed and plucked instruments, together with a keyboard — provides an ever-changing tapestry of sound.

Noon recitals are free and open to the public. Bring a lunch and come and go as you please.

Brookhaven Bulletin January 14, 2000

Experiment

(cont'd)

specialized equipment coming together at the right time."

The ground was prepared by the theoretical work of Yu and Sam Krinsky (see L.H. Yu, Phys. Rev. A. 44, 517B, 1991). By 1989, it had became clear that FELs could generate intense radiation at deep ultraviolet (DUV) and even shorter wavelengths.

Yu recalled that interaction with the Chemistry Department's Louis DiMauro and Michael White showed that the intense UV radiation would have significant applications in many fields. This stimulated much interest from potential users and machine builders, resulting in several national review committees which endorsed investments in FEL research and development for short-wavelength FELs.

'At the same time," continued Yu, "Ilan Ben-Zvi and his ATF team developed the high brightness electron beam that would be required for such an FEL.

It had become clear by that time, Yu said, that a proof-of-principle experiment should be conducted in the infrared region before proceeding to an ultraviolet (UV) FEL. Such a smallscale experiment could demonstrate the essential physics. With the high power carbon dioxide laser of the ATF to provide the seed source, the parameters of the experiment were quickly established. The collaboration then called venerable equipment out of retirement and built some new hardware to complete the experiment successfully.

The next step in the development of high gain harmonic generation will take place at the DUV FEL facility managed by Erik Johnson.

According to NSLS Chairman Michael Hart, "The important result reported by Yu and his collaborators shows dramatically the potential benefits of a laser-seeded FEL, as contrasted with the self-amplified spontaneous emission approach, or SASE, which BNL has explored and is being pursued at other laboratories."

The SASE approach does not use a seed laser or harmonics, and the beam it produces does not have the quality that the seed laser provides (see diagram on page 1).

"The challenge will be to see if the HGHG technique can be extended into the hard x-ray range, in the development of a practical, next-generation source of x-ray light," summed up Hart. "Investigation of this question will be the cornerstone of our continued effort to develop FEL science and technology.

For a description of the experiment and how previously used instrumentation was rebuilt with a new NSLS dispersive magnet for this occasion. attend the 351st Brookhaven Lecture (see page 1); see also the lead article in the NSLS Newsletter, November 1999, http://www.nsls.bnl.gov/Pubs/ NewsLtrs.html; and the ATF Web page, http://www.nsls.bnl.gov/Acc Test/AEHG.html.

BROOKHANEN

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On the World Wide Web, the Brookhaven Bulletin is located at www.pubaf.bnl.gov/bulletin.html. A Weekly Calendar listing scientific and technical seminars and lectures is found at www.pubaf.bnl.gov/calendar.html.

United Way, Best Year Ever!



t a breakfast celebrating the con-A clusion of this year's United Way campaign on January 7, Campaign Chair Patti Bender of the Plant Engineering (PE) Division and Lab Director Jack Marburger revealed the final tally: \$130,722 — topping the goal by more than \$20,000 and making this years' campaign the most successful in BNL history:

- · Pledges and contributions from 22 percent of employees accounted for \$118,955 of the total.
- Contributions from 35 alumni, retirees and others added \$2,866 more. Several new programs had significant impact as well:
- A Chinese Auction/Holiday Raffle, held under the direction of Gail Brown, Department of Applied Science, raised \$1,621 in just 2 days.
- Fifty-six BNLers worked a total of 173 hours as volunteers at soup kitchens, food pantries and local hos-
 - · In addition to the value of this

volunteer work, BSA compensated these workers' time by donating \$3,640 to the campaign.

 And, because the program was so successful, Marburger and Brian Sack, Assistent Laboratory Director for Finance & Administration agreed to an additional BSA matching donation of

One of the Lab's best success stories came from PE. Last year, contri-

\$130,722 — topping the goal by more than \$20,000

butions from 7.1 percent of the 384 PE employees provided \$3,522 for the United Way. This year, participation rose to 33.2 percent of PE, garnering \$12,261 for the service agencies needed by so many Long Islanders.

Said Bender, "PE management and IBEW Local 2230 leadership worked



Above, Joe Buscemi (left), President, IBEW Local 2230, congratulates Eugene Barrow of the Plant Engineering (PE) Division on his first-prize raffle win. At left (from left): Joe Buscemi, Ed Murphy, PE Manager; Bob Aikman, PE, thirdprize winner; Patti Bender, this year's Campaign Chair; and Tirre Farmer, last year's Chair. together to increase our division's participation this year. It made a big

With support from Joe Buscemi, IBEW Local 2230 President, Ed Murphy, PE Manager, held a party and raffle with prizes donated by BSA for all PE employees who had contributed to the campaign financially or by volunteering their services. The first prize of a color TV/VCR was won by Eugene Barrow, and Bob Aikman won a CD player (see photos above).

"It was tremendously gratifying to participate in such an outstanding campaign," said Marburger. And speaking on behalf of BSA, he said, "We are prepared to do it again next year.'

Next year's chair will be Beth Blevins, Director's Office, who cochaired this year's campaign. She will be joined by Susan Monteleone, Department of Advanced Technology, who will head the campaign in 2002, as well as Brown. - Karen McNulty

Arrivals & Departures

Arrivals

Stanko Brankovic	. Appl. Science	
Sailesh Chopra	Physics	
William C. Elliott	Biology	
Thomas L. Kash	Medical	
Xin Li	Chemistry	
Saskia Mioduszewski	Physics	
Marvin A. Schofield	. Appl. Science	
Departures		

Mulki R. Bhat Adv. Technology Paul J. Klotz Appl. Science

Bowling

Red & Green League – January 4 R. Deem 269/266/202/737 scratch series, E. Larson 258/253/223/734 scratch, R. Mulderig Jr. 257/246/215/718 scratch, R. Mulderig Sr. 245/ 208/639 scratch, M. Meier 225/213/633 scratch, J. Meier 225/212/628 scratch, J. Griffin 224/203/ 609 scratch, J. McCaffrey 213

Purple & White League - January 6 B. Mullany 209/198, J. Meier 208/191, P. Wynkoop 200/193, J. McCarthy 224, G. Mehl 215, C. Rooney 202, K. Riker 200, P. Callegari 197/184, M. Picinich 197/177, P. Kennedy 196, Johnson 181, M. Addessi 181, M. G. Meier 175, K. Dilgen 174, L. Simes 171

Defensive Driving

The training group of the Safety & Health Services Division will offer a sixhour defensive driving course on Saturday, January 29, 9 a.m.-3:30 p.m., in Berkner Hall, Room B.

The course will be taught by a Metropolitan Life instructor and is open to BNL, BSA and DOE employees, BNL facilityusers, and their families, at a cost of \$23 per person. Completing the course gives a 10-percent discount on vehicle collision and liability insurance for three years.

To register, send a check made out to Empire Safety Council, in care of Scott Zambelli, P.O. Box 670, Mount Sinai, NY 11766. All checks must be received by Friday, January 21. So that your registration can be confirmed, include your phone number with your name. For more information, call Zambelli at 249-3000, Ext. 5877 (*not* the on-site Ext. 5877).

IBEW Meeting

Local 2230, IBEW, will hold its regular monthly meeting on Monday, January 24, at 6 p.m. in the Knights of Columbus Hall, Railroad Avenue, Patchogue. There will be a meeting for shift workers at 3 p.m. at the union office. The agenda includes regular business, committee reports and the president's report.

Holiday Notes

In observance of Martin Luther King's birthday, the Lab will be closed on Monday, January 17. There will be no Bulletin on Friday, January 21.

In addition, the Research Library and the on-site offices of the Teachers Federal Credit Union and the **United States Postal Service** will be closed on Monday, 1/17. The swimming pool and gymnasium will keep normal weekend hours but close on Monday.

The Cafeteria will provide weekend service Saturday-Monday, 1/15-17, 7:30 a.m.-2 p.m. daily. The **Brook**haven Center is closed on Saturdays, and will be closed on Sunday, 1/16, but dinner service will resume on Monday, 1/17, 5-9 p.m.

Softball Captains

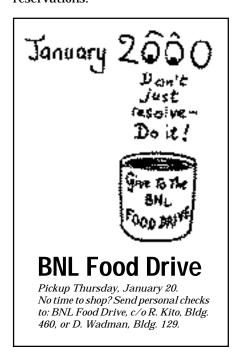
A meeting for BERA Softball League Captains will be held at noon on Wednesday, February 2, in Berkner Hall, Room C. To run or nominate someone for the League Board, you must attend the meeting.

All teams planning to play this season should have at least one representative present. Bring preliminary rosters so that a league structure can be determined. Any new team will be placed in the League by the Board.

For more information, e-mail softball@bnl.gov.

BERA Ski Trip

The first BERA-sponsored ski trip of 2000 is scheduled for Wednesday, February 16, to Camelback. Save the date - more information will be forthcoming. Call Andrea Dehler, Ext. 3347, or Bob Marascia, Ext. 7779 for prereservations.



Volleyball

League standings as of January 7

•	_		
Open Leagu	e A	Mixed Leagu	e 2
Drill.&Excav. Co.	24-6	Safe Sets	30-0
Shank, Carry & Throw	v 16-14	Spiked Jello	24-12
Far Side	12-18	Up-Setters	24-1
Death Volley	8-22	Inside Out	25-1
Open Leagu	e B	Nuts & Bolts Group Sets	7-20 6-27
Late Entry	20-10	Setups	4-29
Bumpin Uglies	19-11	эстирэ	4-23
3.6 3 370 7.4			

Monday Nite Live 15-15 **Mixed League 3** 6-24 Six Samurai The Stars Upton Ups

Mixed League 1 18-6 I Want Your Sets 19-5 Net Setters 12-12 Set to Kill 16-8 NWO 8-16 Scared Hitless 7-17 Networkers 7-17 **Rude Dogs** 6-18 Butlers 5-19

22-2

Sign Up for Dance Lessons

Mambo Number 5 Versus Mambo I

Mambo Number 5

- what? the latest dance craze.
- who? almost anyone can learn it
- when? until another dance sweeps the nation
- why? because it is fun and everyone does it!
- why not? remember the macarena?

Mambo I

- what? one of the dance classes to be offered by the BNL Dance Club.
- who? BNLers, family and friends can register.
- when? classes start Wednesday, February 2.
 why? because it is fun and everyone at social
- and family events will envy you!
 why not? two left feet are no excuse (not for nothing, the macarena is a samba, which was and will be taught again).

The BNL Dance Club is offering eight weeks of one-hour dance lessons for beginners and newcomers on Wednesdays, starting February 2.

At 5:30 p.m. American rumba and waltz I will be taught, while at 7:30 p.m. instruction on American mambo and West Coast swing I will be offered (West Coast swing is a jazzy combination of East Coast swing and Latin hustle). Continuing members may also sign up for the 6:30 p.m. American swing and International jive review I & II class. The instructors are Giny Rae and Peter Sciurca of Dance Magic in Smithtown.

The cost is \$25 per person. To register with a partner before the first class, send a check payable to the BNL Dance Club to Marsha Belford, club president, Bldg. 134. To be put on a waiting list for a partner, those signing up without a partner must also send a check before the first class. If a partner is found, then you may register; if not, then your check will be refunded. Partners may be found as late as the first day of class.

Yoga Practice

Starting on Wednesday, January 19, on behalf of the BERA Indo American Society, Organizer Smita Sathe will resume leading yoga practice sessions in the main room of the Recreation Building in the apartment area, on Wednesdays, 12:10-12:50 p.m.

A typical session will comprise breathing exercises, Sun salutation, Asanas (postures) and relaxation.

Wear any loose outfit and bring a thick mat or blanket.

Those interested should call Sathe, Ext. 3924. The sessions are free, but openings will be limited due to the space requirement.

and FELs. Immediate projects in ment of laser systems for use with pump-probe experiments on the N Requires a Ph.D. in chemistry or p in short pulse laser systems (pa

Placement Notices

The Lab's placement policy is to select the bestqualified candidate for an available position. Candidates are considered in the following order: (1) present employees within the department/division and/or appropriate bargaining unit, with preference for those within the immediate work group; (2) present employees within the Laboratory; and (3) outside applicants. In keeping with the Affirmative Action Plan, selections are made without regard to age, race, color, religion, national origin, sex, disability or veteran status. Each week, the Human Resources Division lists new place ment notices, first, so employees may request consideration for themselves, and, second, for open recruitment. Because of the priority policy stated above, each listing does not necessarily represent an opportunity for all people. Except when operational needs require otherwise, positions will be open for one week after publication. For more information, contact the Employment Manager, Ext. 2882; call the JOBLINE, Ext. 7744 (344-7744), for a complete list of all job openings; use a TDD system to access job information by calling (516) 344-6018; or access current job openings on the World Wide Web at http://www.bnl.gov/JOBS/

LABORATORY RECRUITMENT - Opportunities for

NS8244. DEPUTY BUSINESS OPERATIONS MANAGER - Requires a bachelor's degree in a business discipline, advanced degree preferred. Extensive department administrative experience, which should include the management of overall financial performance, coordination of program funding, and project financial reporting and control is required. Excellent written and oral communication skills, computer literacy and PeopleSoft skills are necessary; prior supervisory experience is also required. AS&T Directorate/Business Operations Office.

OPEN RECRUITMENT - Opportunities for Laboratory Employees and Outside Candidates.

MK8820. CHAIR, MEDICAL DEPARTMENT - Will assume line management responsibility for Department. Research covers a wide range of topics, including a clinical neuroscience program that uses imaging technologies to investigate the effects of drugs and aging in the human brain, a cancer research program that focuses on the development of new tools for tumor detection and characterization and on the development of new forms of radiation therapy, a radiation biology program that focuses on cell damage and on the effects of heavy ion particles on nervous tissue, and a radiopharmaceutical and radioisotope program. This research takes advantage of the unique facilities at BNL that include imaging capabilities (PET, MRI, SPECT), the National Synchrotron Light Source, the Alternating Gradient Synchrotron, a Whole Body Counting Facility and a Medical Research Reactor. The Department manages a large animal facility and an outpatient Clinical Research Center. Scientists are trained in nuclear medicine, psychiatry, neurology, radiation oncology, pharmacology, biophysics, chemistry and radiobiology. We seek candidates with an international reputation who have the breadth and scope to promote and stimulate research across the range of activities. The successful candidate must have the ability to communicate effectively with our scientists and staff, our research sponsors, and the public, and facilitate cordial relationships with the neighboring Medical Centers, with which we collaborate. Director's Office.

MK8447. SCIENTIST - to work in the Experimental Systems Group developing an experimental program combining "conventional" laser technology with accelerator based light sources, including storage rings

and FELs. Immediate projects include the development of laser systems for use with the DUV-FEL and pump-probe experiments on the NSLS storage rings. Requires a Ph.D. in chemistry or physics, experience in short pulse laser systems (particularly Ti:Sapp), optical technology and diagnostics, and broad scientific interest and proven track record of working successfully in cross-disciplinary teams. Under the direction of E. Johnson. National Synchrotron Light Source Department.

MK8799. POSTDOCTORAL RESEARCH ASSOCIATE - to study the structure of lipid-protein monolayers and multilayers at air-water interface (Langmuir films) using synchrotron x-ray scattering techniques. Principal areas of investigation include the structure and phase behavior of membrane proteins and mixed monolayer systems. Work will be carried out at the National Synchrotron Light Source (BNL) and the Advanced Photon Source (ANL). Position involves close cooperation between the Physics and Biology Departments at BNL. Requires a Ph.D. in physics, chemistry or biology and experience in Langmuir film techniques, biochemistry and x-ray techniques. Under the direction of B. Ocko and D. Gibbs. Physics Department.

MK8268. POSTDOCTORAL RESEARCH ASSOCIATE - to work in the Environmental and Systems Engineering Division. Projects involve the human-system integration aspects of nuclear power plant control-rooms and ship-bridge displays in collaboration with the US Nuclear Regulatory Commission and the American Bureau of Shipping. Requires a Ph.D. in human factors, psychology or related field, research capabilities for research planning, experimental design, test planning, performance measurement, and data analysis. Candidates should have a primary interest and experience in human-system interfaces and the influences of organizational factors on system performance and reliability. In addition good report writing and presentation skills are required. Under the direction of J. Higgins. Department of Advanced Technology.

MK8269. POSTDOCTORAL RESEARCH ASSOCI-ATE - to be involved in research related to the validation of seismic calculational methods for nuclear power plant components. Current activities include comparing the results of various analysis methods with data from large-scale tests of reinforced conires and piping systems program is expected to involve the development of user subroutines for commercial computer codes and/or the development of original computer analysis software. Requires a Ph.D. in civil, structural or mechanical engineering with experience in nonlinear finite element analysis of steel and reinforced concrete structures or components, seismic and dynamic analysis, computer code development and probabilistic based analysis methods desirable. Under the direction of J. Taylor. Department of Advanced Technology.

NS8521. PROJECT PLANNING POSITION - Requires a BS or equivalent in an appropriate field, and ten year' experience in project planning and controls, working with an earned value systems, preparing detailed cost estimates and annual work packages. Excellent communication and analytical skills are critical. Requires the ability to establish and maintain cost baselines, develop cost and labor plans, perform variance and trend analysis and be proficient in the development and use of spreadsheets and graphics. A working knowledge of Excel, Primavera and MPM is desired. Collider-Accelerator Department.

97 CHEVYTAHOE LS - 4-dr., 99.5k mi., clean, \$20,500. 878-2626 or pager 0512.

96 ZX7R MOTORCYCLE - lime green/purple/white, 3k mi., never dropped, all stock. \$5,000. 758-2038.

96 HYUNDAI ACCENT - 2-dr., 5-spd., a/c, am/fm/cass., 62k mi., excel. cond., \$4,000. Susan, Fxt 5149

96 YAMAHA BANCHEE - FMT pipes, good cond.,

Indian Classical Dance, January 22

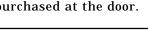
The BERA Indo-American Association (IAA) will sponsor an Indian classical dance recital on Saturday, January 22, at 4 p.m. in Berkner Hall. Danseuse Archana Joglekar-Mulye, a well-known Indian film and television actress, will perform the enchanting Kathak for those in attendance.

Kathak originated in the temples of Northern India more than 500 years ago. Dancers enact stories from Indian mythology and, today, contemporary society.

One of the most prominent dance styles of India, Kathak features fast, rhythmic and intricate footwork, emphasized by the

tiny bells tied around the dancer's ankle.

VIP tickets for this event are \$25. Tickets for IAA members are \$9, nonmembers pay \$10. Full-time students and senior citizens pay \$5, children under five are free. For tickets or more information, contact: Achyut or Geeta Topé, 345-2677; Koumudi Pandya, Ext. 7734; Dhruba Ghimiray, Ext. 3849; or Srinivasan Iyer, 928-5319. Tickets may also be purchased at the door.



\$3,400 neg. MaryEllen, 941-1174.

good cond., \$4,500. George, Ext. 4033. 91 HONDA ACCORD LX - a/t, a/c, full power, new tires & belts, mint cond., \$4,800. Janet, Ext. 4049 or 744-

94 DODGE CARAVAN - a/c, a/t, am/fm/cass., 85k mi.,

& beits, mint cond., \$4,800. Janet, Ext. 4049 or 744-3087.

91 TOYOTA TERCEL - 2-dr., a/c, radio, 100k mi., excel. cond. \$2,850 neg. Ext. 5065.

90 MITSUBISHI - a/t, p/w, p/d, 130k hwy. mi., excel. cond., \$2,500 neg. Ming, Ext. 3773.
90 OLDS SILHOUETTE - blue, 6-cyl., 7 bucket

seats, all power, 84k orig. mi., \$4,900. Devinder, Ext. 4985.

90 PONTIAC FIREBIRD FORMULA - white w/blue stripe, 305 TPI, 3" exhaust, 16" ROH wheels, runs well, \$4,500 neg. Frank, 452-9123.

89 HONDA LXI COUPE - 2-dr., a/t, a/c, p/w, p/s, p/l, c/c, am/fm/CD, 177k mi., \$3,000. Johnny, Ext. 5175.
88 HONDA CIVIC LX - 4-dr., a/t, p/w, p/l, p/s, CD player, 134k mi., good cond., \$1,400. Jim, 924-7374.
86 ISUZU TROOPER - 4wd, \$1,200 neg. Mike, Ext. 2960.

85 CHEVY SUBURBAN - 2wd, 350 cu. in., a/t, a/c, new paint, 97k mi., runs well, \$3,000. John, Ext. 2021. SNOW TIRES - 2, Goodyear Town & Country, 205/75R14, good cond., \$60. Frank, Ext. 4220.

Furnishings & Appliances

BED - light oak, queen-sized platform frame, mirrored, lighted, storage headboard, excel. cond., ask. \$300. Donna. 874-3992.

BEDROOM FURNITURE - triple dresser, walnut, mirror, 4 drawer chest, \$200; vanity, girl's, mirror, seat, \$15; child's, dresser, nightstand, desk, chest, \$100. 928-0297. BOOKCASE - tall, oak, 4 shelves, leaded glass drs., excel. cond. 331-1387 after 5 p.m.

DINETTE TABLE - 4 chairs, 2 leaves, 1 mo. old, orig. \$425, ask. \$250 obo. Linda, Ext. 7187 or 874-2675

eves.

GAS RANGE - Frigidaire, almond, 8 mos. old, excel.

cond., orig. \$450, ask. \$200. Kurt, 395-8382. LIVING ROOM SET - Ethan Allen, hutch, 40" x 78", \$250; end table, 22" x 28", \$60; couch, 7', \$100; chair, \$35; range hood, \$20; night table, \$20, more. Mickey, Ext. 7908.

Tools, House & Garden

BAY WINDOW - Andersen, 6' x 6', new, complete, cost \$1,525, sell \$1,300. Jerry, 399-6457.

GENERATOR - Generac, 8kW, safety panel for house elec. interface, 5 gal. auto-feed aux. gas tank, \$425. 473-6546.

GENERATOR - Onan Emerald, RV type, 4kW, 120v., 1,800 rpm., elec. start & fuel pump, new \$1,500. Ext. 4556 or pager 0512.

GENERATOR - 2,600W, 120V, single phase, WWII collector's item, manuals, new parts for engine overhaul, \$300. Gordon, 477-2269. SNOW BLOWER - Yardman, 6 h.p., 24", 2-stage, \$50.

Ralph, Ext. 2180.

THERMOSTAT - Honeywell MagicStat 30, program-

mable, digital, heat, cool, new, \$25. Chris, Ext. 2492.

Sports, Hobbies & Pets

BICYCLE - girl's, Magna Maui, 20", good cond., \$20. Rich, Ext. 5741.

BICYCLE - Trek 1220, road, 62 cm. frame (for tall rider), SPD pedals, orig. \$900, ask. \$650. Phil, Ext.

COMPOUND BOW - Hoyt Rebel XT, 55-70lb. draw weight, 65% let-off, excel. cond., extras, \$50. Don, 929-6571.

LABRADOR PUPPIES - AKC reg., parents on premises, black, m/f, vet. checked w/shots, avail. 1/7. Mike, Ext. 4028 or 924-5231 eves.

NORDIC TRACK - ski machine, \$50. Chris, Ext. 2492. POOL TABLE - bumper pool w/all accs., turns into card table, excel. cond., \$75. 331-1387 after 5 p.m. TELESCOPE - children's, Tasco, 150 power, 50 mm. objective lens, metal tripod, space & moon maps, new, in box. 286-5897.

Audio, Video & Computers

COMPUTER - IBM PS/2 Model 25, color, lots of software, \$50. Chris, Ext. 2492.

LASER DISC PLAYER - Pioneer, 14 discs, ask. \$250. Nancy, Ext. 5132.

NINTENDO - orig., 2 controllers, 7 games, 1 gun, \$25. Rich, Ext. 5741.

ORGAN - antique, Mason & Hamlin, pressurized air supply, \$150. Eric, 286-9721.

PRINTER - Epson LQ-850, dot matrix, \$75; Caviar 2340 HD, 340 MB, \$15; CD ROM, NEC, SCSI, 3x, internal, \$10; Win 95 upgrade, \$5. Ext. 2521.

PRINTER - Epson, 24 pin, dot matrixs, letter quality printing, excel. cond., \$50. Don, 929-6571 after 6 p.m. WEBTV UNIT - connect to internet, send/receive email via TV, remote, keyboard, cables, instructions, \$75. 286-5897.

Miscellaneous

CRIB MATTRESSES - Simmons, protective cover, new cond., orig. \$119/ea., ask. \$35/ea. Ext. 5191 or 208-2910.

MINK JACKET - waist length, size 10-12, good quality, excel. cond., ask. \$300; IBM typewriter w/table, \$50; exercise bike, \$25. Donna, 874-3992.

STOVE - wood or coal, airtight, good cond., \$50. 744-3203.

TICKETS - FootLoose, NYC, 1/29, 8 p.m., Sec. R, mezz., Row F 101-102, \$100 or trade for another date. Ext. 3868 or 727-7227.

TICKETS - 2, Rent, 1/22, matinee, \$90. Tom, Ext. 7707.

Yard & Garage Sales

TAG SALE - contents of home, contemporary tables, lamps, mirrors, pictures, credenza, curio shelf, by appt. only. Bill, 924-6940.

Car Pools

STONY BROOK - Setauket/Lake Grove, near Rt.347. Ext. 5080.

Wanted

CLOCK - old, not working, mechanically complete, for student to practice repair skills. Steve, Ext. 4475. DOG CRATE - large. Don, 821-3320.

 $\ensuremath{\mathsf{EXPERT}}$ - in on-line auctions, inc. photos of items to sell. Connie, 821-0104.

GRAND AM SE - 2 driver's side drs. 298-5758.

SHOP TOOLS - welder, lathe, any machinist tools, more. George, Ext. 2708 or 399-8649.

SKIERS - to Windham, 2/3, \$48 inc. bus & lift ticket, send payment to Augie Hoffman, Bldg. 510A.

SLIDE PROJECTOR - working cond. Marty, Ext. 3749 or 286-5897.

TOY TRAINS - old, Lionel, etc., very liberal prices paid, will pickup. Jerry, 281-5667.

WEDGWOOD EDME CHINA - other white china or ironstone. Ext. 5408.

WHEELCHAIR - light, folding, portable, foot rest preffered. Don, Ext. 7237 or 929-6571 after 6 p.m.

On-Site Service

WANTED GAS-PUMP ATTENDANT - at on-site service station, Upton Industries, Inc. Billy or Eddie, Ext.

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