BROOKHAVEN BULLETIN
Vol. 49 - No. 27 July 14, 1995
BROOKHAVEN NATIONAL LABORATORY

Physicists Find First Evidence for Surface Layering in Liquid Metal

Until last year, surface-induced layering in liquid metals had been predicted by theory, but never observed. Then, as reported in *Physical Review Letters* on May 29, 1995, BNL physicists and their collaborators from Harvard University and Israel's Bar-Ilan University measured the phenomenon of surface layering in liquid mercury, in an experiment at Brookhaven's National Synchrotron Light Source (NSLS).

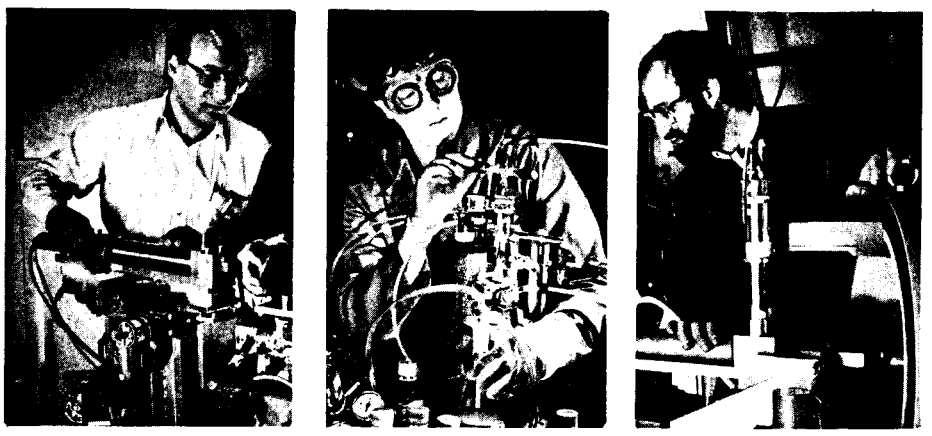
"All liquids are generally difficult to study because there is no obvious structure to probe," said Harvard physicist Peter Pershan, who has been a pioneer in the study of liquid surfaces. "We started at the Light Source about ten years ago with simple fluids. The discovery of surface layering in liquid mercury is a milestone in our fundamental understanding of liquids."

In contrast to solid surfaces, very little is known about the surfaces of liquid metals. Scientists do know, however, that, within the bulk of a liquid metal, the atoms are arranged randomly. Meanwhile, at the surface, the atoms form discrete layers.

BNL Physicist Olaf Magnussen suggested visualizing surface layering in terms of a popular piece of playground equipment — a clear plastic house filled with colored balls. "Looking from the outside," he explained, "you can see a layer of balls pressed against the rigid walls. If you could see deeper into the pile of balls, however, you would see that the layering gradually diminishes until the balls are arranged randomly."

The same phenomenon is found with metal atoms, which are one hundred million times smaller than the colored balls. As BNL Physicist Benjamin Ocko said, "In liquid metals, the high surface tension serves as the rigid wall. This forces the surface area to be as small as possible. So that's why liquids form drops."

Ocko added that the high surface tension also smooths out microscopic waves on the surface. Ordinary liquids, such as water, have much lower surface tensions and, consequently, rougher surfaces — preventing precise measurements of surface layering.



At the NSLS, physicists (from left) Moshe Deutsch, Olaf Magnussen and Benjamin Ocko study surface layering in liquid metals.

The researchers' experiment with liquid mercury measured x-rays being reflected, or diffracted, from the liquid surfaces. In doing this, the scientists faced two main problems: First, surface layering is only evident at high angles, where the reflected intensity is weak; second, the liquid sample could not be tilted as in conventional x-ray diffraction experiments.

The high-angle problem was overcome by taking advantage of the NSLS' intense, highly collimated x-rays, while the second problem was solved with specialized optics that tilted the x-ray beam instead of the liquid sample.

Though the mercury experiment was conducted to confirm the basic physics theory, the scientists are applying what they have learned to related research on using liquid metals as substrates for organic films.

Physicist Moshe Deutsch, Bar-Ilan University, said that thin layers of organic materials — often just one molecule thick — are of interest for various technological applications, such as chemical sensors. For example, organic films on mercury can be used to detect ultralow levels of cadmium, for environmental monitoring.

Another area where a basic understanding of fundamental properties of liquid metals can be important is conventional fabrication involving soldering, welding and casting, said Pershan.

This research is supported by the U.S. Department of Energy's Office of Energy Research. — Mona S. Rowe

Light Source Sheds Light On Layers

Much of the research done at BNL's National Synchrotron Light Source (NSLS) is concerned with the study of physical properties of materials. These tales of two experiments show how researchers are using the NSLS to look at two types of layers: the naturally occurring layer of atoms that forms at the surface of a liquid metal and the manmade layers — hundreds of atoms thick — in a new type of thin-film battery.

Merdon Heads Diversity Office

Reflecting BNL's commitment to achieving equal employment opportunity and diversity in the workplace, effective July 1, the Lab restructured its approach to such issues, appointing a new head for the office that addresses them and renaming the two organizations responsible for those programs.

Lorraine Merdon has joined BNL as the new Manager of the Diversity Office, formerly the Office of Equal Opportunity, with the responsibility of shaping the direction of the new office and its programs. In that position, she also serves as Assistant Manager of the Human Resources (HR) Division, previously the Personnel Division.

Lorraine Merdon

The Diversity Office is an organizational unit of HR, with access to the division's resources and input into the entire employment process.

In announcing the changes, Laboratory Director Nicholas Samios said, "Brookhaven must provide an environment where individual differences are valued and respected, and where there is equality of opportunity without regard to sex, race, color, religion, age, national origin, veteran status or disability."

Added Robert D'Angio, HR Man-

(continued on page 3)

Next Week: *Sambamurti Memorial Lecture*
(see story on page 2).

Researchers Charged Up About Better Battery: With NSLS, They Watch It Work

In the 1990s, everyone knows what happens when a battery runs out of juice: The screen on your laptop goes blank; your cellular goes scratchy; your electric vehicle crawls to a stop. But what does the battery really *look* like when it's completely discharged?

Until now, it was only possible to explain the chemical reactions that happen when a battery runs down.

Recently, however, a team of Brookhaven researchers announced that, using a high-intensity x-ray beam at beam line X22 of the National Synchrotron Light Source (NSLS), they could actually *watch* an experimental battery *work* — at the atomic level — by looking at the crystalline structure of the battery as it was charged and discharged.

Myron Strongin, a solid-state physicist in the Physics Department, explained the significance of the team's achievement: "As far as I know, this is the first time anyone has actually looked at the structure of a battery while it's acting like a battery."

King Arthur's Sword

Drawing on expertise evolved over more than 15 years of work at the Lab, the team of researchers is developing a thin-film nickel metal-hydride (NiMH) battery. Conceivably, a thin-film battery could be designed into an integrated circuit, as a built-in battery to power a micromachine — a microscopic electric motor with a tiny set of gears — or a small electronic device.

Analyzing the properties of the thin-film nickel metal-hydride battery are: (front, from left) Gideon Reisfeld, Tom Thurston, both of BNL's Physics Department; Najeh Jisrawi, Birzeit University; and (rear) Mark Ruckmann, Physics. **— Photos on this page by Roger Stoutenburgh**

According to solid-state physicist Mark Ruckman, also of Physics, who is working with Strongin on the project, a thin-film battery could also be built on to the back of a photovoltaic cell — for a single, flat panel that collects energy, and then stores it.

Now — with contributions from team member Najeh Jisrawi, of Birzeit University in the West Bank, in collaboration with Ben Ocko and Tom Thurston, both of the Physics Department's X-Ray Scattering Group — the team of scientists has learned how to use the NSLS to take a closer look at what is actually happening

(continued on page 2)

Sambamurti Memorial Lecture

A Look at the Top Quark and Beyond

Earlier this year, two teams of high-energy physicists working at the Tevatron at Fermi National Accelerator Laboratory simultaneously announced the discovery of the top quark, also known as the truth quark. But, the real truth of the matter is, this discovery is just the beginning of another quest: Now physicists wonder why their model of the existence and interaction of these fundamental particles of matter is so "top"-heavy.

In the fourth Aditya Sambamurti Memorial Lecture, one of the top dogs in the search for the top quark, Brian Winer, of the University of Rochester, will explain how his research team, the Collider Detector at Fermilab (CDF), made its acclaimed discovery. His talk, "Top Quark and Beyond," will be held Monday, July 17, at 1:30 p.m., in the Physics Seminar Room, Bldg. 510.

Leader of the CDF Top Quark Analysis Group, Winer will also describe how the quark fits into the Standard Model — a theory that predicts the existence and interaction of quarks in the universe. He will also discuss future directions for research, as suggested by the discovery of the top quark.

Winer says he will orient his talk toward a less technical audience, so that summer students and non-physicists can follow the exciting scientific developments that led to the discovery of the top quark. "The lecture will be directed at the level of a *Scientific American* audience," said Winer.

Brian Winer

The top quark has been sought since its partner, the bottom quark, was discovered in 1977. The top quark was found to have a surprisingly large mass, some 176 billion electron volts (GeV) by one team's estimate, and 199 GeV by the other's. Now physicists are trying to understand why the top quark is so heavy.

Physicists have now identified all three pairs of quarks predicted by the Standard Model: up and down, charm and strange, and top and bottom. Up and down quarks — the elementary particles that protons and neutrons are composed of — are the only quarks commonly found in nature. The top quark, by contrast, is so massive that it could only be found using a high-energy particle accelerator, in this case the 1.8-trillion-electron-volt Tevatron — currently the world's highest-energy collider.

In his talk, Winer will tell how CDF detected top quarks produced by colliding protons and antiprotons in the Tevatron at high energies. He will also tell how another Fermilab-based research team, DZero, simultaneously arrived at the top quark, with a concordant estimation of the elusive particle's mass.

Winer received his B.S. in physics from Michigan State University in 1986, and his Ph.D. in physics from the University of California, Berkeley in 1990. Since 1991, he has worked as a postdoctoral researcher at the University of Rochester and will become an assistant professor at Columbia University in January 1996. Winer has worked on CDF since 1988, when he was a Ph.D. student at Berkeley.

The Sambamurti Memorial Lecture was established to commemorate Aditya Sambamurti, a young BNL physicist who made many significant research contributions to the Lab before succumbing to cancer in 1992 at age 31. Each year, an outstanding young physicist whose professional interests overlap those of Sambamurti is selected by a BNL Physics committee to deliver the lecture.

— Brad Keoun

Coming Up

Suzanne Morris, a research geneticist in the Division of Genetic Toxicology at the U.S. Food and Drug Administration's National Center for Toxicological Research in Jefferson, Arkansas, will give the next BWIS Seminar, jointly sponsored with the Medical Department. Titled "Programmed Cell Death (Apoptosis) and the Response to DNA-Damaging Agents in Human Lymphoblastoid Cells" the seminar will be held on Wednesday, July 26, at 1:30 p.m. in the large conference room of Medical, Bldg. 490.

Equipment Demo

On Tuesday, July 18, from 11 a.m. to 2 p.m. in Berkner Hall, Scientific Devices East will display and demonstrate instruments from several companies, including: Kipp & Zonen programmable multipen data-acquisition recording systems and laboratory chart recorders; Boonton Electronics rf power meters & millivoltmeters, modulation analyzers/meters and rf peak-power meters; EIP Microwave microwave-frequency counters, VXI synthesizers and frequency counters; Marconi-Kikusui lab power supplies and electronic loads; Wandel & Goltermann electromagnetic field radiation-measurement monitors and meters; and Mitsubishi large-screen, high-resolution display monitors.

Note to Employees:

Attendance at lectures, meetings and other special programs held during normal working hours is subject to supervisory concurrence.

Better Battery (cont'd.)

when a thin-film NiMH battery works. The NSLS — a source of light as much as 10,000 times brighter than conventional laboratory-generated beams — allows researchers to see how the anode of the experimental battery changes as hydrogen atoms are cycled in and out of its crystal lattice.

"Having the NSLS is like having King Arthur's sword," says Ruckman. "No matter what you do, you're still going to win."

Like Layers in a Cake

The anode of the thin-film NiMH battery consists of thin metal films stacked on a substrate base — like layers in a cake (see diagram). When the battery is discharged, there is a net transfer of hydrogen from the battery's anode to its cathode, a compound of nickel-oxyhydroxide (NiOOH). When the battery is recharged, the transfer of hydrogen is reversed.

Early on, the research team specified the design of the NiMH battery anode: The anode had to be resistant to oxidation and still work as a fast sponge to absorb the hydrogen atoms deep into the material.

But, instead of using a single metal for the anode, researchers found they could use a combination of metals — a layer of palladium stacked on a layer of niobium — to get the properties they desired.

Palladium, which, like gold and platinum, does not corrode, dissociates the hydrogen into single atoms; niobium, meanwhile, a highly corrosive metal, stores hydrogen in ratios as high as 1:2. That way the two metals work together to form a corrosion-resistant material that readily absorbs hydrogen.

Atomic Engineering

The properties of hydrogen uptake in compound metal layers were discovered at Brookhaven over a decade ago. When hydrogen atoms enter the crystal of the thin-film metal anode, the material forms a "solid solution" — with hydrogen effectively "dissolved" inside the metal.

Normally, when a metal absorbs a significant amount of hydrogen, the material enters the "hydride" phase. It then turns brittle and becomes easy to fracture.

However, according to Strongin, resistivity and volumetric phase measurements of the metal anode reveal that the layered combination of niobium and palladium can absorb more hydrogen in a non-hydride phase than conventional theory would predict. In fact, Strongin says the battery is still called a nickel metal-*hydride* battery only to comply with standard battery notation.

Knowing such anomalies exist at the atomic level, researchers can more easily tailor the properties of the artificial materials they are building. "What we're actually doing," says battery expert Harold Wiesmann, a material scientist in the Department of Applied Science (DAS), "is atomic engineering."

Those Infernal, Internal Strains

These scientists, including two students from the State University of New York (SUNY) at Stony Brook, carefully monitor the processes used to build the thin films. Each layer of metal is less than one millionth of one millimeter thick; therefore, slight impurities, such as oxygen bubbles in the niobium-palladium interface, can cause serious flaws in the finished product.

So — with the assistance of postdoc Gideon Reisfeld, of the Physics Department — the team of researchers has developed a computer routine to control the processes used to build the thin films. The computer makes the thin films more convenient to build, and significantly reduces the number of impurities present in the material.

Still, Strongin and his colleagues worry that, when hydrogen enters the metal, the material will be subjected to such incredible internal strains that the material will flake, peel or pop right off the substrate. What's more, the team believes it may take as many as 50 multilayers of niobium and palladium to build an adequate thin-film battery; and, according to Strongin, additional film layers tend to compound these internal strains.

That's why it's so important to use the NSLS to watch what happens to the physical structure of the materials in the battery as it is charged and discharged.

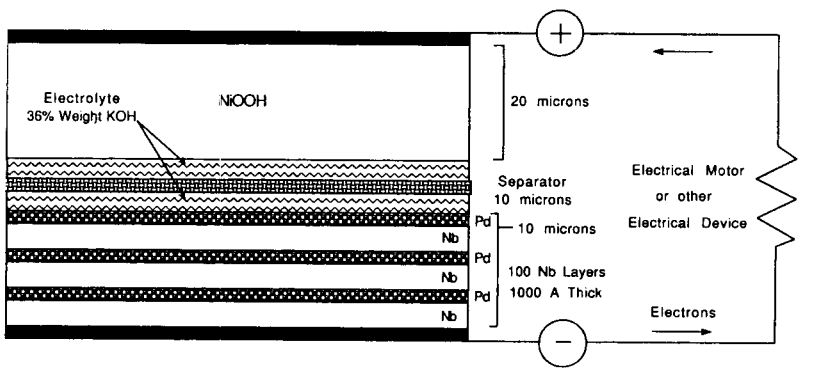
Ruckman emphasizes that, given present technology, these batteries are not commercially viable, because the anode materials — niobium and palladium — are so expensive. But, if researchers can find alternative materials — such as alloys of nickel, or some other abundant element — that duplicate the characteristics of niobium and palladium, then the cost of the NiMH thin-film batteries will come down significantly.

Separately, to investigate thin-film advanced battery materials further, BNL last year signed a Cooperative Research and Development Agreement (CRADA) with Ovonic Battery Company, a subsidiary of Energy Conversion Devices, Inc. (ECD), Troy, Michigan. Ovonic currently licenses the conventional NiMH technology used in most of the world's currently manufactured NiMH batteries.

Working with Strongin, Ruckman and Wiesmann on the thin-film batteries are: Francis Loeb, Ocko, Reisfeld and Thurston, all of the Physics Department; Evelyn Gallego and Yefim Gorelik, both of SUNY at Stony Brook; Jisrawi; and Kwo Young and Mike Fetcenko, of ECD. The group has also benefitted from the expertise of Brookhaven researchers James Reilly and James McBreen, of DAS.

— Brad Keoun

Anatomy of a Battery



BNL thin-film multilayer nickel metal-hydride battery.

— Drawing by Harold Wiesmann

A battery cell has two electrodes: one positive (cathode) and one negative (anode). These electrodes are separated by an electrolyte, which conducts charged ions, but not free electrons.

So, when the two electrodes are connected by an external electric circuit that conducts free electrons, a chemical reaction between the two materials can occur.

As the chemical reaction begins, the material in the anode separates into free electrons and charged ions. Then, while charged ions flow through the electrolyte toward the cathode, free electrons flow through the external circuit. This flow of free electrons constitutes an electric current, which is used to power a motor or other electrical device.

A rechargeable battery is designed so that the chemical reaction is reversible: Once the battery has been discharged, the electric current can be reversed to recharge the battery. — B.K.

In Memoriam

T. Keith Glennan, President of Associated Universities, Inc. (AUI), from 1965 to 1968, died on April 11 after a stroke. He was 89.

After starting as an engineer and then manager in the motion-picture industry, Glennan forged a varied and distinguished career, which, in addition to his AUI Presidency, included serving as: Director of the Navy Underwater Sound Laboratory during World War II; President and Board Member of Case Institute of Technology, Cleveland, 1942-65, continuing on the board when Case merged with Case Western Reserve University in 1967; Commissioner of the Atomic Energy Commission, 1950-52; the first Administrator of the National Aeronautics and Space Administration, 1958-61; and U.S. representative to the International Atomic Energy Agency in Vienna, 1970-73.

T. Keith Glennan

As AUI President, Glennan recognized the value of Washington, D.C., as a location for the AUI corporate office, and was instrumental in moving it from New York City to the nation's capital. There, noted the AUI Board of Trustees in condolences to Glennan's widow, Ruth Haslup Adams Glennan, and her family, "he warmly lent his national prestige in support of Brookhaven National Laboratory and the National Radio Astronomy Observatory."

Said Gerald Tape, AUI past President, 1962-63 and 1969-80, and former BNL Deputy Director, 1951-62, "Few individuals starting with an engineering degree have contributed to so many diverse fields of endeavor as did Keith Glennan. Whatever his position, his commitment was total. In each mission he undertook, his objective was to make a difference, to make a positive contribution in a short time. When he had achieved his goal, he moved on, but continued with his strong support to make a difference."

Glennan, who graduated from Yale University in 1927, later received 16 honorary degrees. The U.S. Medal for Merit, the NASA Distinguished Service Medal, the State Department Distinguished Honor Award and the Henry DeWolf Smyth International Statesman Award were among his honors.

In addition to his wife of 63 years, Glennan is survived by four children, nine grandchildren and several great-grandchildren.

Brain Imaging

Men and women 20 years old and older are needed to participate in brain-imaging studies. A fee will be paid.

Supervisory approval is required. Contact Naomi Pappas, Ext. 2694, for more information.

BROOKHAVEN BULLETIN

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

ANITA COHEN, Editor
MARSHA BELFORD, Assistant Editor

Bldg. 134, P.O. Box 5000
Upton NY 11973-5000
Tel. (516) 282-2345; Fax (516) 282-3368

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

Inside Info

Mary White, who is Manager of the Brookhaven Training Office, became Acting Head of the Information Services Division (ISD) on June 30, replacing former ISD Manager **Diane Mirvis**, who has left the Laboratory.

Announcing White's appointment, Deputy Director **Martin Blume** said, "Mary has had extensive experience with information-related services in the Personnel Division and also in the Training Office. She will work closely with **Jack Laurie** to keep the Division on its present positive path pending a search for a permanent Division Head/Manager. Mary will have strong support from all members of the Division and Laboratory management."

Blume also thanked Mirvis "for the outstanding job she has done both at ISD and in the former Technical Information Division. Since she came to the Lab, she has brought us into the modern information age, and we wish her well in her new position at Bell Atlantic."

Mary White came to BNL in 1984, as Training and Development Administrator in the then Personnel Division. Prior to that, she had been involved with various aspects of training and recruitment in department store retailing, where she rose to Corporate Director of Training for Gimbels, New York.

In 1992, White took the helm of the new BNL Training Office, which was created to establish consistent standards for the Laboratory's training program. While she is Acting Head of ISD, White will also retain her responsibility for the Training Office.

Swimarathon '95 — Sign Up ASAP

Teams, individual swimmers and helpers are needed at the Lab pool on Saturday, July 22, for Swimarathon '95, sponsored by the Brookhaven Employees Recreation Association (BERA) to benefit the Long Island Division of the American Cancer Society (ACS).

The reward for doing a job well swum for this good cause will not only be a good feeling, but also a commemorative, limited-edition ACS Swimarathon '95 T-shirt.

During Swimarathon '95, individual swimmers and department, division or club teams are needed to put in as many laps as they can between 8 a.m. and 9 p.m. — with rests allowed between sets of laps. The swimmers' sponsors make a flat pledge or a per-mile pledge, which totals up to a tax-deductible contribution to the ACS.

Besides sponsored swimmers, helpers are needed to check in the swimmers, count their laps, and assist with entertainment and refreshments. So sign up as soon as possible, using the forms available at the pool, Bldg. 478; the BERA Sales Office, Berkner Hall; or the Recreation Office, Bldg. 185.

Pool Reserved 7/22

During Swimarathon '95, the BNL pool, Bldg. 478, will be reserved for participants in this charity event. While BERA regrets any inconvenience that this may cause, the organizers invite all who want to swim that day to participate in Swimarathon '95.

Diversity Office (cont'd.)

ager, "Having the Diversity Office as part of the Human Resources Division will provide a better focused approach to the whole idea of achieving workforce diversity."

Merdon comes to BNL from Dime Savings Bank of New York, where she headed Employee Relations, a department within Human Resources, for the company's 3,500 employees. A native of Queens, she holds a bachelor's degree from the State University of New York at Old Westbury and a graduate certificate in Human Resources from Adelphi University.

As a Long Islander involved in human resources, Merdon said, "I had heard that BNL is a place that's very employee-friendly. Some employee programs and policies here are far superior to those in other places." Now, she continued, she hopes to maintain and revitalize many of the Lab's programs having to do with equal employment, affirmative action and diversity, and perhaps to introduce some that she used at Dime.

In light of recent Supreme Court actions and media attention regarding affirmative action, Merdon reminded BNLers that most of the Diversity Office's programs and objectives are still valid and vital.

The office has three main objectives, she said. The first is ensuring equal employment opportunity for all employees regardless of race, color, religion, gender, age, national origin, disability or veteran status.

The second, responsibility for the Lab's compliance with affirmative action regulations, includes action-oriented programs designed to overcome past discrimination toward certain classes of people: women, minorities, people with disabilities and Vietnam veterans.

Lastly, the office develops diversity programs to foster better understanding among employees by recognizing and respecting individual differences and using these differences to create a cohesive work environment.

Merdon said she is impressed with BNL's dedication to diversity issues and wants to learn more about the Lab's culture by meeting employees and management staff. This, she said, will help her develop programs that are specific to BNL's needs.

As Diversity Office manager, Merdon's duties also include reviewing and recommending personnel policies and procedures that will ensure a diverse and talented work force. In addition, BNL's Women's Program Coordinator, now Vicki McLane, will report to her, and the roles and responsibilities of other groups relating to equal opportunity will soon be reviewed.

Merdon would like to get to know BNLers and respond to their concerns. To reach her, call Ext. 3318 or visit the Diversity Office in the east wing of Bldg. 185. — Kara Villamil

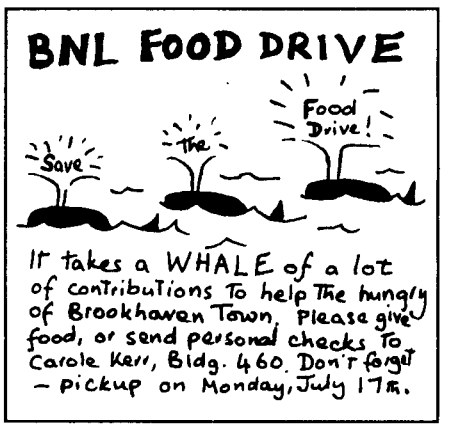
Catch the Spirit

Seats remain available for the BERA-sponsored Spirit of New York cruise around Manhattan Island, on Saturday, July 29.

The bus to the boat will leave the Brookhaven Center at 10 a.m. In addition to cruising past the Statue of Liberty, Ellis Island, South Street Seaport and other sights while your view is narrated, a buffet lunch of salads, entrees, side dishes and desserts will be served. After lunch, the waitresses and waiters will shed their aprons to put on a show, and a live band will be on board as well.

After the cruise, participants will have two hours of free time in the city to browse 5th Avenue, including Trump Plaza and Central Park. The bus will return to BNL around 7 p.m.

The cost for the cruise and round-trip transportation to the city is $59 per person. Paid reservations are being taken at the BERA Sales Office in Berkner Hall, Monday through Friday, 9 a.m.-1:30 p.m. For more information, call Andrea Dehler, Ext. 3347, or M. Kay Dellimore, Ext. 2873.



Arrivals & Departures

Arrivals

Charles W. Baldwin.....RHIC
Lorraine C. Merdon....Human Resources
Elio Vescovo.....NSLS

Departures

Lipo Birstein.....Saf. & Env. Prot.
Stefan Boettcher.....Physics
Michael J. Carroll.....Physics
Frank J. Chandler.....Sup. & Mat'l.
Carl Gardner.....Cent. Shops
Doreen M. Harris.....Reactor
Wanshun Jiang.....AGS
Harold W. Marshall.....Biology
Diane C. Mirvis.....Info. Serv. Div.
Robert J. Papoular.....Physics
Sol Pearlstein.....Adv. Tech.
Matthew M. Recchia.....RHIC
Kathleen Ryan.....Adv. Tech.
John G. Skora.....Chemistry
Madeline R. Stawski.....Plant Eng.

Remember: Precertify Hospital Stays

All active employees and those who retired after December 31, 1991, and who have Connecticut General Medical Insurance coverage are reminded to obtain hospital precertification from Intracorp. This precertification is mandatory for a one-or-more-night's stay in the hospital, but not for ambulatory surgery — procedures for which patients are admitted to and released from the hospital the same day.

If an employee, retiree or family member fails to notify Intracorp regarding precertification or emergency hospital admission, medical insurance benefits will be reduced to cover 50 percent of the amounts otherwise payable, with a maximum penalty of $500.

Expectant mothers *must* call Intracorp before the end of their first trimester to precertify their maternity hospital admission. They or a family member *must* also call within 24 hours following admission into the hospital for the delivery.

For hospital preadmission certification, call Intracorp at 1 (800) 772-3261 before admission to the hospital or within 48 hours of an emergency admission. Employees and retirees should advise their families of the precertification requirement, so, in case of an emergency, they can make the required telephone call to Intracorp.

For a medical insurance ID card listing the Intracorp telephone number, or for more information, call the Human Resources Division, Ext. 2877.

Summer Aerobics

The next session of aerobic dance and stretch classes has already begun, and will continue for seven more weeks until the end of the summer. Aerobic dance classes are held on Tuesdays and Thursdays at 5:15 p.m. in the Recreation Building in the apartment area, and stretch classes are held there on Wednesdays at 5:15 p.m. The cost is $24 for each session of seven classes of any kind. For more information, call Pat Flood, Ext. 7886, or Kara Villamil, Ext. 5658.

Tread Carefully

The Safety Shoe Office, located in Bldg. T-88, will be closed, due to vacation, on July 17, 18, 20, 24 & 25.

Microsoft Training

Training in Microsoft Projects will be offered on August 15 & 17; classes in Microsoft Access will be held on August 22 & 24. Both series will run from 8:30 a.m. to 4 p.m. each day, and the training fee is $200 per person.

The classes will meet in the PC Training Room, Bldg. 515, Computing & Communications Division. To register, send an ILR to Pam Mansfield, Bldg. 515, by July 28. For more information, call Ext. 7286 or e-mail pam1@bnl.gov.

Atlantic City Trip

A few seats remain for the next BERA-sponsored, one-day trip to Bally's Grand Hotel and Casino on the boardwalk in Atlantic City, on Saturday, August 19. The initial cost will be $22, but the hotel-casino will give a $6 coin return.

The bus will leave the Brookhaven Center at 8 a.m. and return at about 11 p.m. If requested, there will be a stop at the LIE exit 63 park and ride.

Buy tickets now at the BERA Sales Office, weekdays, 9 a.m. to 1:30 p.m. For more information, call Andrea Dehler, Ext. 3347, or Kay Dellimore, Ext. 2873.

Softball

Standings as of June 30

League E1	
Blue Jays	8-1
System	7-2
Phoubars	6-3
Jerky Boys	6-3
Six Pax	4-5
Titans	4-5
Up & Atom	1-8
CCD	0-9

League E2	
Big Sticks	6-1
Lights Out	5-2
Hy Tech	5-2
Contaminators	5-2
Hammerheads	4-3
Phase Out	4-3
Scram	3-3
Sure Fire	3-4
Bombers	2-5
Out of Control	2-5
Feds	1-5
Medical	1-6

League M1	
Goodtimers	5-0
Sting Rays	4-1
Gour-Mets	5-3
Parke Avenue	2-3
Personnelities	2-4
Snakebites	3-5
Strike Force	1-6

League M2	
Skeleton Crew	4-1
OER-Wellheads	4-2
No Names	3-2
What's on 2nd	3-2
Varmints	2-3
Ground Hogs	2-4
Stray Cats	1-3

Scoring Notice

If winning teams do not submit score sheets to their League representatives, unreported scores will be recorded as losses for both teams.

Cafeteria Menu

Monday, July 17	
Soup: Black bean & cilantro	.90/1.20
A la Carte: Turkey à la king	3.85
Lite: Baked flounder julienne	3.95
Deli: Turkey w/stuffing	3.20
Grill: Spicy wings w/bleu cheese	3.30
Tuesday, July 18	
Soup: Cream of broccoli	.90/1.20
A la Carte: Meatloaf w/mushroom sauce	3.85
Lite: Baked chicken w/cranberry glaze	3.95
Deli: Pork loin	3.20
Grill: Western omelet	3.30
Wednesday, July 19	
Soup: Chicken gumbo	.90/1.20
Display Cooking: Cajun foods	4.75
Deli: Roast beef w/mashed potatoes	3.20
Grill: Swordfish teriyaki	3.30
Thursday, July 20	
Soup: Country vegetable	.90/1.20
A la Carte: Country ham w/redeye gravy	3.95
Lite: Baked cod w/peach pepper sauce	3.95
Deli: Corned beef w/boiled potatoes	3.20
Grill: Tex Mex taco bar	3.30
Friday, July 21	
Soup: Manhattan clam chowder	.90/1.20
A la Carte: Stir-fry beef	3.95
Lite: Stir-fry chicken	3.95
Deli: Baked ham & beans	3.20

Classified Advertisements

Placement Notices

The Laboratory's placement policy is to select the best-qualified candidate for an available position. Consideration is given to candidates 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, handicap or veteran status.

Each week, the Personnel Division lists new placement notices. The purpose of these listings is, first, to give employees an opportunity to request consideration for themselves through Personnel, and second, for general recruiting under 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, or call the JOBLINE, Ext. 7744 (282-7744), for a complete listing of all openings.

Current job openings can also be accessed via the BNL Home Page on the World Wide Web. Outside users should open "http://www.bnl.gov/bnl.html", then select "Scientific Personnel Office" for scientific staff openings or "Employment Opportunities" or "BNL Personnel Office" for all other vacancies.

OPEN RECRUITMENT - Opportunities for Laboratory employees and outside candidates.

NS 0570. PHYSICS ASSOCIATE POSITION - Requires BS, MS desirable, in physics or a related field, or the equivalent experience. Background in high-power pulsed power supplies, digital electronics, computer controls and programming, as well as laboratory test and measurement techniques, is desirable. Primary duties, as part of a rotating shift team, will include the operation and troubleshooting of the AGS/RHIC accelerator complex for the experimental physics program. RHIC Project.

Motor Vehicles & Supplies

93 SUNBIRD - passive alarm, ABS, p/l, am/fm, w/tape deck, ac, a/t, tilt wheel, $6,300. Harris, 758-7911.

93 TOYOTA CAMRY LE - a/t, all power, 43k mi., green w/gold pkg., Blaupunkt CD, mint cond., $13,000. Paul, 289-9152.

92 MERCURY GRAND MARQUIS LS - 40k mi., fully loaded, gray, alarm, rear air susp., mint cond., $11,900. Carter, Ext. 7599 or 654-8683.

92 CAMRY LE - white, 41k mi., ext. warr., well maint., all records, excel. cond., $11,500. 399-6367.

90 T-BIRD - 72k mi., white w/ burgundy int., excel. cond., $6,900. 654-5510, leave message.

89 HONDA CRX - 5-spd., silver, ac, 45 mpg, excel. cond., $4,800. John, Ext. 7671 or 765-1299.

89 FORD ESCORT LX - dark blue, 85k mi., ac, am/fm cass., good cond., $3,500. Sonia, Ext. 5341, leave message.

89 CHEVY CORSICA - 4-dr., 4-cyl., ac, a/t, cruise, tilt, high mi., excel. cond., $3,100. Carlos, Ext. 2614.

88 VW SCIROCCO - white, sport coupe, 16-valve, 5-spd., 73k mi., ac, p/w, sunroof, stereo, ground effects, tinted windows, $4,800. Rich, 929-8514.

88 COROLLA - 4-dr. sedan, 5-spd., ac, 88k mi., excel. cond., $4,200. Joel, Ext. 5038.

88 OLDS FIRENZA - a/t, full power, cruise, ac, 4-dr., 90k mi., excel. cond., $2,300. Arnie, Ext. 2606.

87 FORD TEMPO 4x4 - 4-dr. sedan, full power, new tire, maint. well, 86k mi., clean, excel. cond., must sell, asking $3,900. Ext. 2683 or 751-2469.

87 CUTLASS CIERA - 4-dr., ac, am/fm tape, p/s, p/b, 91k mi., excel. cond., $2,000. Ext. 3499.

87 MAZDA B2000 - long bed, 70k mi., clean, $2,300 firm. Ray, 878-2543.

86 CHRYSLER LASER XT - a/t, turbo 4, red/black, T-top, fm stereo cass., leather int., all power, 79k mi., needs work, $2,095 neg. Chris, 924-6940 after 7 p.m.

86 PONTIAC FIREBIRD - V-8, black, 5-spd., good running cond., body in v.g. shape, asking $1,500. Pete, Ext. 2879.

86 NISSAN PICKUP - new tires, brakes & muffler, 90k mi, $1,500. George, Ext. 5288.

86 HONDA CIVIC - h/b, 5-spd., am/fm cass., sunroof, extras. Kevin, Ext. 2963 or 744-0871.

86 FIREBIRD - black, T-top, alum. rims, alarm, ac, cass., a/t, windows, dependable, $3,000. Greg, Ext. 1024.

85 FORD RANGER 4x4 - cap, rebuilt trans., 2.8L, new tires, $2,500; '74 Ford E-300, 302 eng., rebuilt a/t, $1,000. Peter, Ext. 5105 or 399-2813 after 5 p.m.

85 MERCURY COUGAR - runs well, needs tranny, $1,200 neg.; '84 Pontiac Firebird TransAm, 5-spd., 5.0 liter eng., $2,400. Nicole or Rich, 744-4816.

85 CHEVY MONTE CARLO - new tires, trans., exhaust, brakes & starter, runs well, looks good, asking $2,000. Phil, Ext. 4421 or 758-8428.

85 TOYOTA CAMRY - m/t, 5-spd., 4-dr., ac, 130k mi., new muffler, runs well, looks good, asking $1,900. Ext. 4342 or 924-3066.

85 RENAULT - m/t, runs well, needs work, could be used for parts, asking $500. Robyn, Ext. 2680.

84 CHEVY C-20 - w/11½' Coachman slide-on camper, fully equipped, both ac, plus fg cap, excel., $8,000. Hank, 472-0553.

84 CADILLAC ELDORADO - low mi., clean, runs excel., reasonable. 585-8590.

84 FORD MUSTANG - conv., V-6, am/fm cass., a/t, beige w/tan top, like new cond., $4,500 or best offer. 286-3231.

83 RX7 - red, 5-spd., new exhaust, am/fm stereo cass. w/Blaupunkt EQ, v.g. cond., needs struts, $2,000. Rich, Ext. 7160/2012.

83 DODGE PICKUP - m/t, slant-6, D-150, ½-ton, cap, 8' bed, extras, $1,500. Ernie, 727-2861.

83 FORD FAIRMONT - gray, 4-dr., p/b, p/s, rebuilt a/t, new parts, $450. Mitch, Ext. 4212 or 821-9028.

83 PONTIAC FIREBIRD SE - V-6, black, just tuned & inspected, many new parts, good cond., $650 or best offer. Ext. 4242.

83 CADILLAC DEVILLE 4100 - sedan, motor runs well, trans. needs work, $300. Rich, Ext. 3354 or 589-9103.

82 HONDA ACCORD - 4-dr., 4-cyl., a/t, p/s, cruise, rust, 133k mi., runs well, $800. Jerry, 928-3932.

82 PONTIAC GRAND PRIX - p/w, p/l, p/trunk, T-top, 82k mi., clean, runs well, asking $1,800. Ext. 3255.

80 SUZUKI 850L - 12k, new Metzlers tank, bag, windshield, gar., excel., $1,000. Dan, Ext. 4095.

71 VW KARMAN GHIA - coupe, orig. owner, immac. trophy winner, 64k orig. mi., orig. cond., $5,400 firm. Rich, 929-8514.

71 LTD - conv., red w/black top, very low mi., mint orig. cond., consistent show winner, $11,500 neg. 888-5201.

71 MERCEDES BENZ 220 - $500. Ext. 2934 or 744-2816.

55 CHEVY - 2-dr. sedan, model 210, project car, lots of parts, restoration started, $5,000 neg. Ken Asselta, Ext. 5110.

PORSCHE 912E - silver, new clutch, upper engine rebuilt, 76k mi., only 2,000 built, good cond., asking $7,000. 944-7811.

BUMPER - rear-step, new, brackets attached, for Fords, adapt other pickups. Ron, 878-4089 eves.

TIRES - 4, radials, P195/75R14, $60. 878-1617.

AIR FILTERS - AFL-52, Sears/Lee brand, new, $10/4. Susan, Ext. 7647.

CAP - for Chevy S10, good cond., $200 or best offer; rims, 14", alum., $100 or best offer. Jesus, Ext. 4879 or 286-5403.

Boats & Marine Supplies

50' CT41 TA CHIAO - 1981 Ketch, Perkins 4.154 diesel, 62-h.p., fg, hull w/teak int. & decks, 7 sails, $89,000. 928-1020.

33' NAUTALINE HOUSEBOAT - 1969, rebuilt 318 Chrysler engine, Dana o.d., fg, v.g. cond., $9,500. Tirre, Ext. 3288 or 281-0360.

19' BOAT - fg, 115-h.p. Johnson, good for fishing or waterskiing, Galv. trailer, $2,100. Jim, Ext. 3372 or 821-0250.

17' FOLBOT KAYAK - 2-person, lots of storage space, $400; paddles, floats. Nick, Ext. 2490.

17' SILVERLINE - 60-h.p. Merc., good cond., w/ trailer, $1,500; 17' Renken, 120-h.p. i/o w/trailer, v.g. cond., $2,800. Ext. 7625.

16' GLASTRON - 1968, navy top, w/1979, 2k-lb. capacity Shoreline trailer, both good cond., $450. John, Ext. 3422 or 929-4101.

11½' VINTA WINDSURF BOARD - 3 matching sails, 4.5, 5.5, 6.5, $550. Darryl, Ext. 7892.

AQUASPORT 22-2 - 1972, center console, 1979 175-h.p. Evin., E-Z loader trailer, p/w, $3,900; o.b., 1983, 90-h.p. Merc.,$1,300. 654-5510, leave message.

Furnishings & Appliances

AIR CONDITIONER - G.E., 5,000-Btu, good cond., $45. Ben, 929-6984.

AIR CONDITIONER - 6,000- Btu, Sharp, new, $350 neg. Kopp, 289-0567 after 6 p.m.

BEDROOM - This End Up bunk bed set w/dresser & shelf, mattresses not incl., ask. $550. 924-2298 eves.

CRIB - Simmons, oak, mattress included, excel. cond., $75. John, Ext. 3422 or 929-4101.

CRIB - Simmons, w/mattress, white, excel. cond., $100. Bob, Ext. 1034 or 341-1034.

DRY SINK - pine, 38"w X 34"h, good cond., $75. Gerry, 447-6528.

Yard & Garage Sales

E. PATCHOGUE - Fri. 7/14, Sat. 7/15, 10 a.m.-3 p.m., household items, tools, bric-a-brac. 43 Neptune Ave.

SHIRLEY - Sat. 7/15, 9 a.m.-5 p.m., several families, 452 River Road.

Car Pools

COMMACK - start or join an 8:30-5:00 nonsmoking car pool, Mayfair. Conrad, Ext. 4754.

EAST SETAUKET - van pool, save gas & the environment. Bob, Ext. 2270.

FRESH MEADOWS, QUEENS - or reasonable vicinity, temporary ride needed, car or van pool, from 7/17-7/31. Mike, (718) 479-9053.

LIE EXIT 36 - 4th person needed. John, Ext. 5181.

Wanted

APARTMENT - young couple looking to rent, within 30 min. of Lab, 1-2 bdrms., reasonable, needed by 9/1, nonsmokers, no pets. Mike, 281-6498.

APARTMENT OR HOUSE - to rent, 2-3 bdrm., SWRSD, on/after 8/1. Don, Ext. 7237 or 744-2921 after 5:30.

APARTMENT MATE - female, Lake Pointe Village on Rt. 25, 2-bdrm., share kit., l/r, bath, $325/mo. + ½ elec., avail. after 7/20. Hong, Ext. 3370 or 924-9435.

BARN - or garage for storage. Tim, Ext. 4297.

CYCLETRONS - MC Club reunion, Fri. 7/14, noon at BNL Gazebo, all welcome. Frank Dusek, Ext. 2022, or Dave Derryberry, Ext. 4289.

DRAWING TABLE - Anco-type, all wood, A-frame stand, 23"x31" size; gas-powered rototiller, mini-size. John, Ext. 7671.

GUITAR - acoustic, beginner w/case & accessories. Rich, Ext. 7527.

HOMES FOR BNL VISITORS/GUESTS - furn. apt., condos or houses, short-term rentals. Marie, Ext. 4489.

HOUSE TO RENT - 2-3 bdrms., SWRSD pref., nonsmokers, no pets. Jeong-Hun Lee, Ext. 3889.

HOUSE TO SIT - free, experienced, reliable, any period after 7/14. Jack, Ext. 2412.

NORDIC TRACK - exercise machine. Mark, Ext. 3812.

PARTNER - for 30' sailboat in Mt. Sinai. Al, Ext. 7699.

PEOPLE - to join Christian fellowship for a barbeque outside the Rec. Bldg. on 7/20 at noon. Pete, Ext. 3297 by 7/17.

PEOPLE - New York Yankee bus trip from Lab, 7/20, $38 per person, incl. transp., admission, food & beverage. Ron, Ext. 4144.

VACUUM TUBES - EL34, 6CA7, GL6, 12AX7, old tube tester, etc. David, Ext. 5211.

WHEELCHAIR CARRIER RACK - for rear bumper of car. Joe, Ext. 2898.

On-Site Service

GETTY STATION - gas prices reduced starting Mon. 7/17: regular $1.27^{9}, plus $1.33^{9}, premium $1.29^{9}. Bill Widmer, Ext. 4034.

Services

*Services are listed in the first **Bulletin** of every month as a courtesy to BNL employees. They are neither screened nor recommended by the **Bulletin**. Services forms are available in the **Bulletin** lobby, Bldg. 134.*

ALTERATIONS - reasonable prices, hemlines, shortenings, etc., 25 yrs. exp. Nina, 281-6240 after 5 p.m.

ART LESSONS - looking to have a little extra fun this summer? any age, all mediums. Jennifer, 289-9193.

BABY-SITTER - recent high school graduate looking for summer job, exp. w/children, Smithaven Mall area. Samantha, 588-4882.

BRICKWORK - masonry, patios, walks, swimming pools, retaining walls, landscaping ties, Belgium block, 25 yrs. exp., Lab disc. Tony, 698-9274.

BRIDAL - handcrafted and custom-made headpieces, table arrangements, dolls, bears, bunnies, shoes, also shower and attendant's gifts. 395-0584 eves.

CARPENTRY - doors and windows hung, closet organizers, trim, decks, storage sheds, etc., small jobs and repairs a specialty. Gerry, 981-4518.

CHILD CARE - by licensed, loving mother, impeccable refs. provided by BNL employees, close to Lab. Robin, 345-0298.

CHILD CARE - mature, responsible mother will care for your child along w/2-yr.-old daughter, ages 2-5 pref., Wading River. Mary 929-8613.

CHILD CARE - conscientious, caring mom will care for your child in my Ridge home, meals and snacks provided. Cindy, 744-4816.

CHIMNEY - caps, fireplace, wood & oil flue sweeping, custom-made stainless steel caps for all chimneys, Lab disc. Mike, 821-5526.

CLEANING - exp. couple seeking office cleaning jobs, responsible and thorough, reas. rates. 475-8242.

COMPUTERS - installations, repairs, tutoring, reasonable rates, in your home. Steve, 698-5260.

DECKS - custom, carpentry repairs, expert leak repairs, painting done by BNL employees, 15% off for BNL workers. Chris, 399-7493.

FINANCIAL - evaluation of your life insurance program, or retirement planning for pension maximization, tax savings. Rich, 744-4816.

HOME IMPROVEMENT - carpentry, drywall, spackling, painting, plumbing, ceramic tile, electrical, free estimates, Lab disc. Don, 744-2921 ater 5:30 p.m.

HOME IMPROVEMENTS - extensions, dormers, decks, kitchens, baths, siding, lic. & insured, refs. Chris, 286-1348.

HOUSE CLEANING - vacuum, dust, floors, bathrooms, kitchens, etc., no job is too small, honest, responsible. Jenny, 345-5325.

HOUSE PLANS - drafting for new or alterations, NYS approved. Rich, 929-8514.

ITALIAN - lessons/conversation, all levels. 821-1435.

JEWELER - special orders, repairs, honest, affordable, no job too large or small. Kelly, 821-5239.

KAYAK LESSONS - coastal touring, river playboats, $85/5 hrs., equip. supplied, intro to kayaking, $30/2 hrs. Ernie, 281-7873.

LAND CLEARING - trees/stumps/brush removed, topsoil graded and raked w/450 loader, $70/hr. Tom Muller, 878-1060.

LANDSCAPING - free estimates for grass cutting, cleanups, etc., low prices. Jesus, 286-5403.

LAWN SPRINKLERS - automatic, free estimates, professional layouts, repairs, alterations, additions, prompt courteous service. 928-7042.

LOCKSMITH - sales & service, 10% Lab discount, keys cut during lunch. Pete, 399-2813 after 5 p.m.

MAIL BOXES - custom-made, many colors & designs, free lettering, free catalog, Lab discount, house & post mailboxes avail. Mike, 821-5526.

MAINTENANCE - home & yard, complete home care. 878-1178.

MOTHER'S HELPER - baby-sitter, exp. college student avail. M-F days, occasional eves., refs. Heather, 928-5796.

PAINTED FINISHES - prof., marbelizing, ragging, sponging, combing. graining, murals on floors, walls, ceilings & trim. Philip, 286-1348.

PAINTING - int./ext., tape, spackle, sheetrock, wallpaper stain, powerwash, ins., refs. James, 399-4912.

PAINTING - wallpaper hanging, lic. & ins., free est., BNL disc. Bob, 331-4336.

PAINTING - wallpaper hanging specialist, painting, int./ext., free estimates, 20 yrs. exp. John, 277-3805.

PARTY TENTS - we set up & take down, many sizes & combinations. Fred Kuehl, 588-2268.

PARTY TENT - 20'x30' w/side curtains, we set up and take down, $250/38 hrs. 321-2889.

PIANO LESSONS - for children & adults, exp. w/ young beginners. Jun, 473-8406 eves.

PIANO LESSONS - all levels, Shoreham/Wading River area. Patti, 929-8277.

PINSTRIPING, LETTERING, AIRBRUSH - auto, motorcycle & sea vehicles, signs, murals, window splashes, clothing, helmets. Gary, 549-9113.

PLUMBING & HEATING ALTERATIONS - repair work by retired BNL employee. Jim Morris, 472-1205.

POWER WASHING - decks, houses, cedar restorations, free est., licensed & ins. Bob, 331-4336.

ROOFING - roof replacement/renovations licensed & insured, Lab discount, reasonable. 544-5042.

ROOFING - siding, repairs, clean up, all faucets & home care. Geo. 878-1178.

SCUBA LESSONS - NAUI-certified instruction, classes now forming, private or group. Rex, 929-3235.

SHEETROCKING - and spackling, call for free estimate. Kevin, 567-6621.

SKIN CARE & BEAUTY CONSULTANT - nail care, facials, men's line, body care, free first-time facials. Barbara Jean, 929-3235.

SPACKLER - no job too small, expert workmanship. Vinnie, 821-8556.

VIDEOGRAPHER - capture those precious moments on video, will tape weddings, parties, all occasions. Larry, 281-7240.

WINDOW CLEANING - all work squeaky clean, reliable, courteous service, free est. Frank, 289-4759.

Ads left out of this issue due to lack of space need not be resubmitted to appear in the next issue.