BROOKHAVEN BULLETIN
Vol. 38 - No. 25 June 22, 1984
BROOKHAVEN NATIONAL LABORATORY

Working on a Low-Cost Solar Cell

Scientists in the Department of Applied Science are now testing their new design of a two-chamber system for making amorphous silicon solar cells at very high deposition rates. They hope to show that cells with conversion efficiencies in the 8-10% range can be deposited in a time as short as five minutes. That would be a major step toward putting amorphous silicon into the photovoltaic marketplace.

A Discovery With Promise

Amorphous silicon was discovered only within the last decade, but already, it has been shown to have enormous potential for providing low-cost solar power. Because of that, it seems the most likely candidate to succeed crystalline silicon, which is the current material used in photovoltaics, the conversion of light into electricity.

Amorphous silicon has several advantages over crystalline silicon. Because of its irregular structure (hence the descriptive tag "amorphous"), it absorbs much more sunlight than regular-structured crystalline silicon. In fact, less than one micrometer of amorphous silicon is needed to absorb most of the sunlight, as compared to 300 micrometers of crystalline silicon. Also, crystalline silicon solar cells are so expensive to make that they have a payback period of about 20 years, which is not economical.

Recognizing the promise of amorphous silicon, a BNL research group was formed in the Division of Metallurgy and Materials Science about five years ago to study it. The group now includes scientists Peter Vanier, Frank Kampas, Reed Corderman, Gopalan Rajeswaran, and technician Frank Thomsen. As attractive as it looks now, amorphous silicon is a new material, and there are many unknowns. Says Kampas, "To learn more of the science behind amorphous silicon and the way it behaves, we concentrate on its basic properties and on the techniques for depositing it in thin layers. In the long run, that information is more useful, because if you understand the basics, you have a better chance of making exactly what you want."

For the past five years, with funding from DOE's Solar Energy Research Institute, the group has been perfecting its techniques for making solar cells, trying to cut down the deposition time and still achieve reasonable efficiencies. Their first solar cells were made in a one-chamber deposition system, and each took hours to make. With improvements in the process, the time was gradually cut down to 30 minutes for a 6.3% efficient cell and five minutes for a 5.6% efficient cell.

At higher and higher deposition rates, it becomes more difficult to make a solar cell. The new two-chamber machine was designed to produce cells with much more precise control and reproducibility.

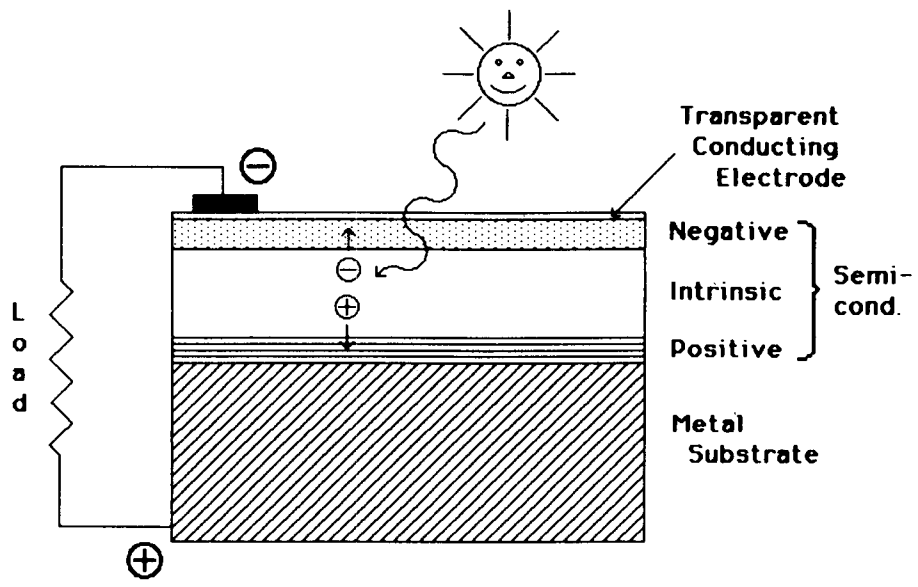
Construction of a Solar Cell

To understand the advantage of a two-chamber system, one has to know how a solar cell is constructed. A solar cell is like a Dagwood sandwich (see diagram). At the bottom is a substrate of stainless steel or glass, then a layer of amorphous silicon doped with boron to attract positive charges, next a layer of pure amorphous silicon, then amorphous silicon doped with phosphorus to attract negative charges, then a film of indium oxide to cut down on reflection, and finally an aluminum grid on top.

The negative and positive layers produce an electric field across the middle, pure layer. Light absorbed by the cell generates mobile electrons, which carry the energy of the light. The electrons are driven to the surface of the cell by the electric field and the aluminum grid collects the current, which flows into an external circuit to power a fan, a lightbulb, or any other electrical load. A return wire from the load to the substrate completes the circuit.

A major difficulty in making a solar cell is keeping the dopants from traveling beyond their layers into the pure layer during the deposition process. That kind of cross-contamination destroys the electric field.

How does a solar cell work ?



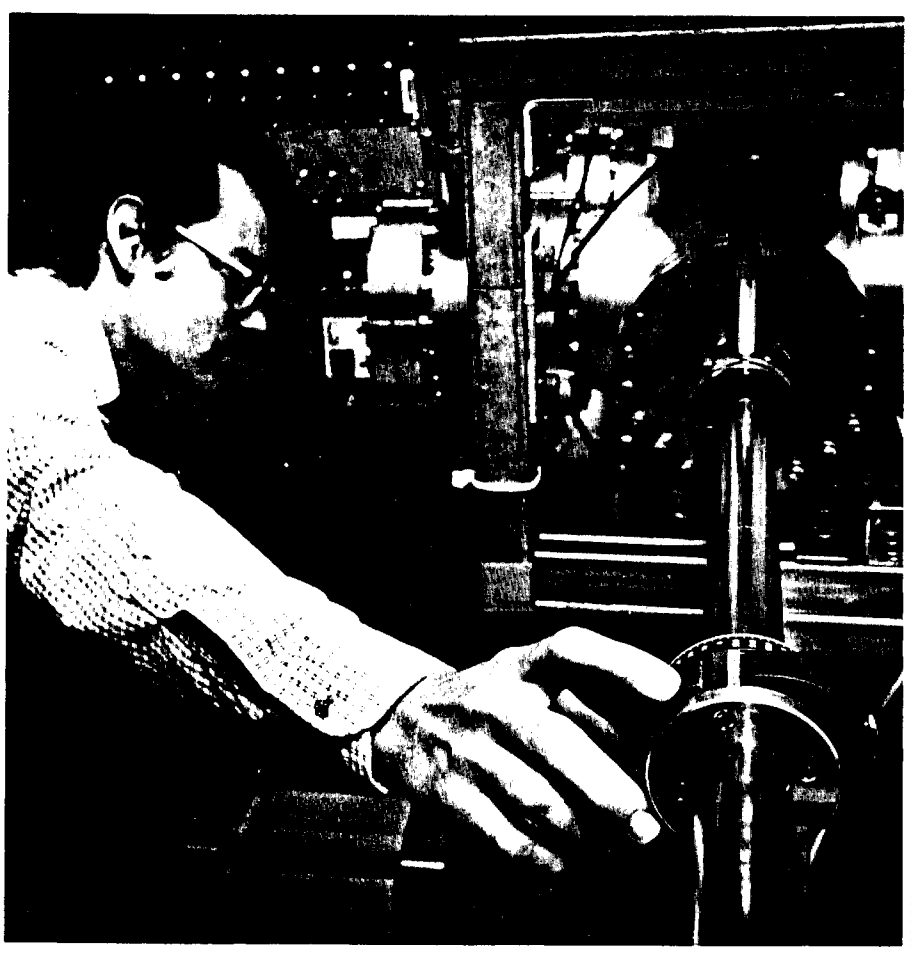
Two-Chamber System

The two-chamber system keeps the dopants separate from the pure layer because all the doping is done in one chamber, and the second chamber is reserved for depositing pure amorphous silicon. A complex system of pumps, valves and seals allows each chamber to be independently evacuated and filled with appropriate gases.

The unique two-chamber design came from Kampas, who reasoned that the doped layers would not be adversely affected by trace amounts of each other. By depositing both types of doped layers in a single chamber, a third chamber was avoided.

The problem of how to transfer substrates from one chamber to another was solved by Vanier, who designed a rod that is withdrawn during the deposition of each layer (so the chambers can be isolated by a valve) and reinserted into the substrate holder when the valve is reopened.

(Continued on page 2)



Alex Reben

Peter Vanier, DAS, transfers the substrate of a solar cell from one chamber to another, in a new two-chamber deposition system recently developed for the study of amorphous silicon photovoltaic devices.

High School Teachers Start Summer Research

Seven high school teachers from Nassau and Suffolk counties could tell you how they will be spending their summers for the next three years. These instructors are taking part in a new program at BNL which offers some of the area's outstanding high school math and science teachers a chance to do research.

Under funding by the Department of Energy and Associated Universities, Inc., the Laboratory will offer research opportunities to the instructors that are related to their educational background and teaching responsibilities. The teachers will perform eight to ten weeks of research for three consecutive summers with a weekly stipend for living and travel expenses. The purpose of the program is two-fold, says its initiator Donald Metz: "It rewards good teachers and gives them an opportunity to do research."

These seven teachers were chosen from 69 applicants by a five-member committee composed of three BNL scientists and two representatives from the Board of Cooperative Educational Services. The selections were based on the applicants' classroom teaching ability, development of math or science programs, participation in extra-curricular student activities, continued professional advancement and active involvement in professional societies.

The teachers selected for the program will begin the first week of July. They include: Roderic Beaulieu, math teacher from Garden City Sr. High School, who will work with Ron Peierls in the Applied Mathematics Department on computerized information systems; Barbara Bergman, a science teacher from Garden City Sr. High School, who will work with John Bennett in the Biology Department on the molecular biology of plant diseases; Paul Calcanes, a science teacher from Herricks Sr. High School in New Hyde Park, who will collaborate with Craig Thorn in the Physics Department to build magnets for the Laser Electron Gamma Source at the National Synchroton Light Source; and Carl Campbell, a chemistry teacher from Bay Shore High School, who will work with Manny Hillman in the Department of Applied Science on either ferrocene or boron chemistry.

As well, Chirakal Krishnan, a science teacher from East Islip High School, will work with Norman Sutin in the Chemistry Department on the photochemistry of metal complexes; Kathleen Smith, a science teacher from St. Mary's Girls High School in Manhasset, will study the possibility of chromosome damage due to overhead power lines with Daniel Benz in the Medical Department; and Vincent Sydlanski, a science teacher from West Hollow Jr. High School in Melville, will assist Jan Naidu in the Safety and Environmental Protection Division on environmental monitoring of industrial hygiene activities.

Metz hopes to see more teachers placed in similar programs by other laboratories and industries in the future. "These high school teachers will collaborate with top scientists, perform advanced research and have access to well-equipped facilities," says Metz. "Teachers are not exposed to such research opportunities within the limits of a high school, and programs such as the one offered at BNL will benefit the instructors, the students and, ultimately, the community."

— Sally Sargent

Inside Info

Vincent R. O'Leary, Associate Director for Administration, has been named president of St. Charles Hospital and Rehabilitation Center in Port Jefferson. O'Leary has been a member of the St. Charles Board of Trustees for seven years and will now serve as its chairman.

Eugene Findl, Sr. Research Engineer, Department of Applied Science, has been named Division Director Elect of the Biomedical Sciences Division, Instrument Society of America. Findl has been a Senior Member of ISA since 1968..

Patents Awarded

Examination of samples of superconductors used in prototype magnets disclosed cracks in the solder. This led to the hypothesis that low eddy current losses were related to the formation of the cracks. Based on this hypothesis, efforts were made to develop methods for producing controlled cracking of the solder. As a result, two separate methods were developed.

U.S. Patent #4,426,550 was issued to **Thomas Luhman**, a former BNL employee, and **Masaki Suenaga**, Department of Applied Science, for inventing an improved multiwire conductor of the type which is mechanically stabilized by a tin-based solder filler. The invention relates to a braided ribbon-type superconductor having low eddy current losses, and to a method for manufacturing such a superconductor.

A solder-filled conductor is heated to a temperature above its melting point for a period long enough to allow a substantial amount of copper to be dissolved from the wires comprising the conductor. The copper forms the brittle intermetallic compound Cu_5Sn_6 with tin in the solder. After cooling, the conductor is flexed, causing a random cracking of the solder, thereby increasing the interwire resistance of the conductor.

The second BNL invention relating to a multiwire conductor was worked on jointly by **Thomas Luhman**, and **Carl Klamut**, Department of Applied Science. They were issued U.S. Patent #4,431,862. This invention provides for a ribbon-type superconductor having a moderately increased interwire resistance so as to reduce eddy current losses in the superconductor while retaining substantial mechanical stability.

A solder-filled conductor is heated to a temperature sufficient to make the solder brittle, but below the melting point of the solder. While still hot, the conductor is flexed, causing the solder to separate from the wires comprising the conductor, thereby increasing the interwire resistance. In one application, the conductor may be heated to a temperature above the eutectic temperature of the solder so that a controlled amount of solder is removed.

Arrivals & Departures

Arrivals

Robert N. Best ..... NSLS
Dan M. Ilberg ..... DNE
Cyril J. Pinto ..... Plant Eng.

Departures

This list includes all employees who have terminated from the Laboratory, including retirees:

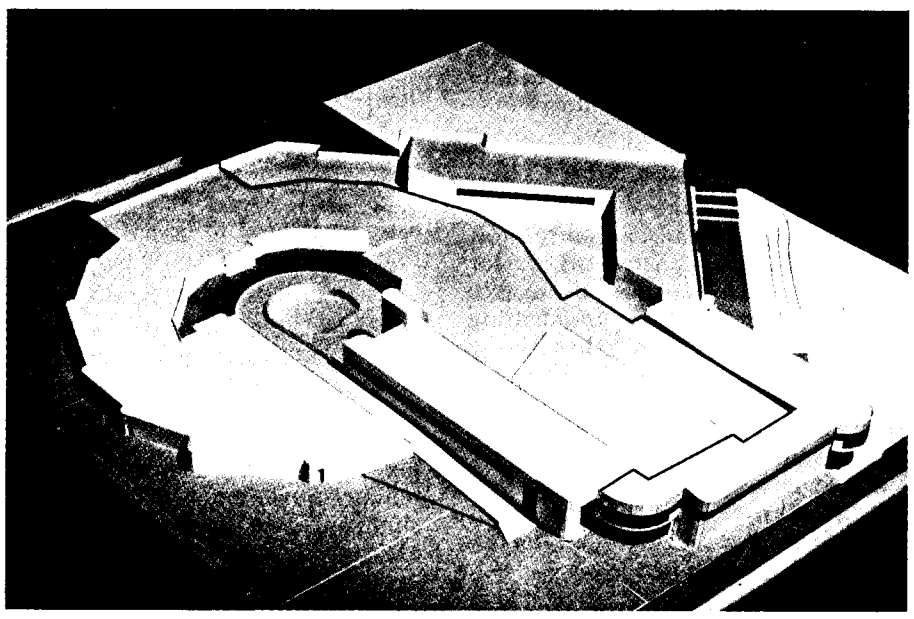
Corrine H. Ince ..... Personnel

Gould Lecture

Stephen Jay Gould, Alexander Agassiz Professor of Zoology at Harvard, will give the 30th AUI Distinguished Lecture on Thursday, June 28, at 8:30 p.m. He will speak on "Pattern and Non-Pattern in the History of Life."

Alex Reben

"Understated elegance" is how one observer described the new NSLS sign. Until this past April, building 725 could only be identified as "the big white building next to the railroad tracks at the end of Brookhaven Avenue," unless you were close enough to read the white National Synchrotron Light Source decal on the glass front doors. The new 22ft. × 4ft. sign was designed by plant engineer Roger Bailey out of acrylic stucco, a resilient combination of plaster and styrofoam. The unique size and style of the sign was selected to complement the impressive appearance of the NSLS building. A similar design using this same material is also being considered for a main entrance BNL sign.



Mort Rosen

Phase II... it's not another movie sequel, but rather the title of a three-year $19.7 million NSLS expansion project that is now well into the design stage. The first story of the 52,000 square foot two-story addition (outlined in the photo) will expand the VUV and X-ray experimental floors, provide new laboratory space, and include the installation of six highly advanced beam lines. The second story will provide offices and work space to assemble most of the NSLS staff under one roof. Currently the NSLS personnel are spread in seven different buildings throughout the Lab. Groundbreaking is expected to take place in the spring of 1985 with building construction completed in approximately one year.

Solar Cell (Cont'd)

The transfer mechanism was built in the DAS machine shops by James Shields, Rolf Stark and Henry Henck, under the direction of Warren Johnson. Frank Thomsen assembled the vacuum system and gas injection manifold using purchased components. The arduous task of optimizing the cell structure is being done by Rajeswaran, who performs two depositions on an average day, resulting in about 40 test cells. The concentrations of the dopants, the thicknesses of the layers, the temperature of the substrates, the pressure of the gases, and the power density of the radio frequency glow discharge must all be varied to improve the cell's performance.

The group has also kept up its basic research on gas purities, gas discharge reactions and optical and electrical properties of individual layers, to learn more about the fundamental process of deposition. That work is funded by DOE's Office of Basic Energy Sciences, Division of Materials Sciences. As the researchers gain more understanding of the basics, they can speed up the process without decreasing the efficiency of their solar cells.

Single or Multiple Chambers?

If the two-chamber system works as well as expected, they think it will set an example for other U.S. researchers. Japan is the only country manufacturing amorphous silicon cells for sale, and companies there have already built systems with three or more chambers. Says Vanier, "Mass production multi-chamber systems cost many millions of dollars. While we are only making small samples for research purposes, our two-chamber system shows industry the advantage they can get from multiple chambers."

Adds Kampas, "There are some researchers who still prefer single chamber systems. We don't agree. In a single chamber system, you might get one cell that works very well. But it's hard to duplicate. In single-chamber systems, the dopants don't go away for up to seven runs. Some researchers even take apart their single chamber and wash it with acid after each deposition. This is not very practical. In our two-chamber system, we save time, we have better control over the deposition and, therefore, we have more reproducibility."

The group's long-range goal is to make amorphous silicon solar cells with a consistent 8-10% efficiency at high deposition rates. Cells like that are estimated to have a payback period of only two to three years, which will certainly open the market for this new material. — Mona S. Rowe

Equipment Demo

Mahmond Ghavi of **Nuclear Data, Inc.,** will discuss advancements in whole body counting technology on Tuesday, June 26, at 1:30 p.m. in Bldg. 535A Conference Room. A discussion and equipment demonstration will follow the seminar.

Inhibiting Computer Intruders

Unauthorized access to computers is a national problem and Brookhaven has had its share of computer intruders. Something had to be done about the problem, but how to do it without seriously disturbing legitimate research?

A simple suggestion would be to restrict telephone access to BNL computers to those calling from on-site telephones. But many legitimate users access the computers from off-site phones, both BNL staff working at home and collaborators calling from other institutions.

To solve the problem, a special group of telephone lines are being allocated through which all outside dialup access will be routed, and to which a new telephone number will be assigned. The lines formerly used for telephone access will be converted to treatment VII, that is, they can only be accessed from on-site phones. (This will only apply to interactive access; remote batch users will not be affected).

To use the outside lines, users must obtain a user identification code number by registering with the Applied Mathematics Department. This number, together with a callback number, is stored in the system. The user dials the access number, keys in the user identification code and hangs up. The system then calls back the user at the registered number and access is complete.

Two of the most common questions raised are: What if I'm travelling and need to be called back at a different number? What if I don't have a touchtone phone to key in my user identification number? Both problems can be solved. Since 90% of those using the BNL computers from off site usually use the same telephone each time, it is more convenient to have that number registered. But, if desired, the user can arrange to key in the number to be called back each time the system is accessed.

If a user does not have touchtone service, keypads are on the market which can be plugged in to allow a touchtone signal to be sent from a rotary phone line. The Lab will be purchasing a quantity of these items for Lab-wide use. They will be distributed through Applied Math, and an announcement will be made in the Bulletin when they are available.

When the users are registered, the keypads in place and the new lines installed, the system will go into operation. This is expected to be about July 1. Users who have questions about the access requirements, should contact Ralph Trondle at Applied Math on Ext. 4171. As he says, "There are always unforeseen problems when a new procedure is put into effect. Anyone who has a particular problem should get in touch with us and we will try to find a way around it."

Discussion Group On Nuclear Arms

Anthony Fainberg will talk about "Life as a Congressional Fellow" at the next meeting of the Discussion Group on Nuclear Arms, at noon on Friday, June 29, Room B, Berkner Hall. Fainberg, originally a high energy physicist, has, for the last several years been working in DNE, as a physicist with the Technical Support Organization for nuclear safeguards. In 1983 he was selected for the American Physical Society's Congressional Fellow Program, and has spent the past year working in a Congressman's office in Washington, D.C.

BROOKHAVEN BULLETIN

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Diners Note

The cafeteria will be closed on Saturday, June 23. On that day, snack bar service will be available from 9 a.m. to 2 p.m. at the Brookhaven Center.

Cafeteria Menu

Week Ending June 29

Monday, June 25

Cream of mushroom soup	(cup)	.65
	(bowl)	.85
Beef stroganoff on wide egg noodles		2.00
Breaded pork chop w/1 veg. & applesauce		2.00
Hot Deli: Pastrami	(bread)	1.95
	(roll)	2.10

Tuesday, June 26

Beef barley soup	(cup)	.65
	(bowl)	.85
Oven baked chicken quarter & 1 veg. w/mushroom sauce		1.90
Oven baked chicken half & 1 veg.		2.85
Ham & noodle au gratin w/1 veg.		1.85
Hot Deli: Veal patty Parmesan	(bread)	1.95
	(roll)	2.10

Wednesday, June 27

Canadian cheese chowder	(cup)	.65
	(bowl)	.85
Beef & broccoli stir fry on rice pilaf		2.00
Barbecued spare ribs & 1 veg.		1.95
Hot Deli: Breaded chicken cutlet	(bread)	2.00
	(roll)	2.15

Thursday, June 28

Minestrone soup	(cup)	.65
	(bowl)	.85

4th of July Special

1/2 lb. Braised Swiss steak jardinere w/onions, choice of 2 veg., mashed potatoes, corn on the cob, baked beans & holiday cake 3.99

Hot Deli: Italian style meatball hero 2.00

Friday, June 29

Seafood chowder	(cup)	.65
	(bowl)	.85
Chinese pepper steak on rice		2.00
Tuna noodle casserole & 1 veg.		1.85
Hot Deli: Breaded fish fillet	(bread)	1.90
	(roll)	2.05

IBEW Meeting

Local 2230, IBEW, will hold its regular monthly meeting on June 28 at 6 p.m. in the Knights of Columbus Hall, Railroad Ave., Patchogue. There will also be an afternoon meeting at 2 p.m. for shift workers in the Union office at 31 Oak Street, Patchogue. On the agenda will be regular business, committee reports, the president's report and election results.

WIS Meeting

Joanna Fowler, Chemistry Department, will speak at 6:30 p.m. on Tuesday, June 26, at a joint WIS-AWIS dinner meeting in Room A, Berkner Hall. Her topic will be "Short-Lived Radiotracers for Visualizing Brain Biochemistry in Action." Dinner through the cafeteria line at 5:30 p.m. will precede the talk.

Triathlon Update

Ron Wittlock, Applied Math, one of the BNL triathletes reported upon in the May 11 Bulletin, finished first among men age 45 to 49, and 36th of the nearly 300 finishers in the Montauk Triathlon on Sunday, June 17.

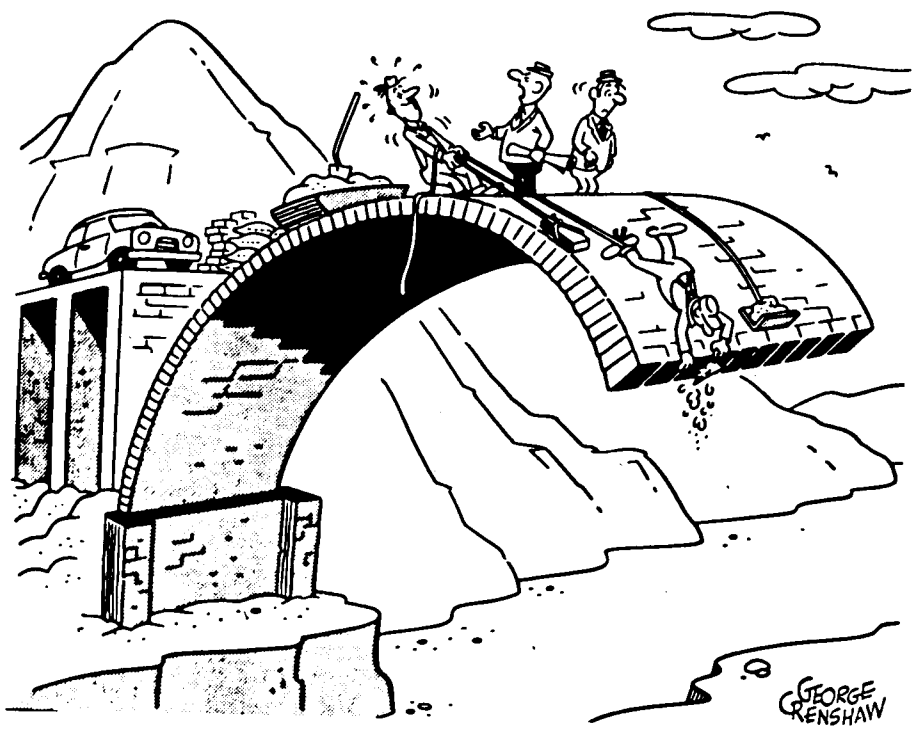
Wittlock completed the one mile swim in 30 minutes, 37 seconds and was 75th out of the water. He bicycled the 21.5 mile course in 1hr:2min:34sec. and moved up to 38th. Wittlock ran the 6.6 mile run in 45min:55sec. His overall time, including transitions from sport to sport, was 2hrs:24min:9sec.

Pat Cahill, Safeguards & Emergency Services, performed the swim in 39 min., the bike in 1hr:30min. and the run in 1hr:10 min. Her final time was 3hrs:31min.

Tom Clifford, Applied Math, finished 150th overall in under three hours.

Doug Humphrey

A guided tour of the Exhibit Center (above) is one of the highlights of the Lab's free Sunday tours. Included also are slide shows and a guided bus tour of the Lab site. This Sunday, June 24, a visit to the Medical Research Center has been added as a special feature. The Center is currently conducting research on osteoporosis, a crippling bone disorder affecting many older women. On display will be the Lab's Whole Body Counter, a nuclear medicine facility used to measure the amount of calcium in the bones. A slide-illustrated talk on osteoporosis will be given at 12, 1 and 3 p.m. in Berkner Hall. Visitors may arrive any time between 10 a.m. and 3 p.m. The Sunday tours will continue through the end of September, except for Labor Day weekend.



"MAY I ASK WHERE YOU STUDIED ENGINEERING?"

BERA News

Swimming Pool

Summer Schedule
(Starting July 2)

Monday through Thursday
11:00 am to 1:30 pm employees only
1:30 pm to 3:00 pm children's lessons
3:00 pm to 9:30 pm employees/families/guests

Friday
11:00 am to 1:30 pm employees only
1:30 pm to 3:00 pm children's lessons
3:00 pm to 4:30 pm children's pool special
4:00 pm to 9:30 pm employees/families/guest

Saturday & Sunday
1:00 pm to 6:00 pm employees/families/guests

Entrance Fees

Daily Admissions:
$1.25 employee
$1.25 family member
$1.75 guest

Season Tickets: (valid to September 2) $23.00 individual
$33.00 family

Season tickets are sold at the pool during open hours to employees and immediate family members. Tickets are not pro-rated. Pool is closed on all Lab holidays.

Sponsoring employees are responsible for their guests during the entire time they are on site.

Tennis

All courts will be reserved on Saturday, June 23, from 9 a.m. — noon, for team tennis between BNL and Shoreham-Wading River.

The annual tournament consisting of five events (mixed, m & w singles, m & w doubles) will begin the weekend of July 21. On this weekend and that of July 28, the tournament will take priority over all other play. Players may sign up at the BERA Sales Office from June 25 — July 10. The draw will be posted by July 12 at the Sales Office and at courtside. Competitors are encouraged to play first-round matches as soon as the draw is posted. The tournament is open to Lab employees and spouses, and the entry fee is $2.00 per person, per event, payable at sign-up.

Those interested in playing doubles but who are without partners, should sign up anyway. The Tennis Committee will try to find partners.

Softball

Games for week of June 11

League I
Moles 11 - Ice pops 10
Phoubars 17 - Big Sticks 9
Blue Jays 12 - Six Pax 9
Ravens 13 - Renames 3
Makeup of rained out games:
Six Pax 12 - Ravens 1

League II
Medical 10 - Titans 8
Magnuts 17 - Faze II 2
Dirty Sox 8 - Scram 6
Random Errors vs Lights Out
No score reported
Makeup of rained out games:
Scram (won) - Random Errors (lost)
Faze II 19 - Medical 10

League III
No Names 13 - E-Z Riders 6
Survivors 11 - The Source 6
Farm Team (won) - Nads (lost)

League IV
Turkeys 7 - Septembers 6
Mole-Esters 11 - Kids-R-Us 7
Underalls vs. TNT
No score reported
Makeup of postponed game:
Turkeys 9 -.Rids-R-Us 7

League V
Erasers 10 - Space Kadets 9
Mudville Sluggers vs. Who Cares
No score reported
Foul-Ups vs. No Feedback
No score reported

Swim Lessons

Registration applications are now being accepted for children's swimming lessons which will begin on Monday, July 2. Each child will be scheduled for one lesson a week during the eight-week program.

Applications are available at the Recreation Office, the BERA Sales Office and the Swimming Pool during open hours.

Classified Advertisements

Placement Notices

The Laboratory's placement policy is to select the best-qualified candidate for an available position, with consideration given to candidates in the following order of priority: (1) present employees within the department, with preference to those within the immediate work group; (2) present employees within the Laboratory as a whole; and (3) outside applicants. In keeping with the Affirmative Action plan, selection decisions are made without regard to age, race, color, religion, national origin, sex, handicap or veteran status.

Each week, the Personnel Office lists new personnel placement requisitions. The purpose of these listings is, first, to provide open placement information on all non-scientific staff positions; second, to give employees an opportunity to request consideration for themselves through Personnel; and, finally, for general recruiting purposes. Because of the priority preference policy stated above, each listing does not necessarily represent an opportunity for all candidates. As a guide to readers, the listings are grouped according to the anticipated area of recruitment.

Except when operational needs require otherwise, positions will remain open for one week following publication date.

For further information regarding a placement listing, contact the Personnel Placement Supervisor, Ext. 2882.

LABORATORY RECRUITMENT - Opportunities for Laboratory employees only.

2079. TECHNICAL POSITION - Requires AAS degree in mechanical technology or equivalent and five years' technician shop experience. Must be able to work from drawings and sketches with little supervision. Familiarity with rf power generation and transmission line equipment is mandatory. National Synchrotron Light Source Department.

OPEN RECRUITMENT - Opportunities for Laboratory employees and outside applicants.

2080. Requires AAS degree or equivalent experience to construct developmental radiation detectors. Knowledge of precision laboratory techniques and the construction of fine wire electrodes necessary. Background in construction of multiwire proportional chambers and in clean room and vacuum practices preferred. Working knowledge of electronics and test equipment desirable. Instrumentation Divsion.

2081. TECHNICAL POSITION - Requires an AAS degree in a technical field or equivalent and extensive experience in particle accelerator related techniques, i.e. ion source development, high vacuum technology, electronics, diagnostic equipment, thin film technology, construction and magnet testing. Will be responsible for the development and construction of experimental equipment on the Tandem — AGS Heavy Ion Transfer Line. Physics Department.

Autos & Auto Supplies

72 MAVERICK - 6 cyl., auto., $250. 661-6078 eves.

79 KAWASAKI 750 - twin, 5 spd., 8,500 mi., $1,400. Mark, Ext. 4028 or 734-7561.

82 MERCURY LN7 - 4 cyl., auto, sunroof, 33,000 mi., excel. cond., p/s, p/b, $5,400. Ext. 3293 or 744-4261.

72 MG MIDGET - convertible, metallic blue, new paint, top, cover, good mech., must be seen. Fred, Ext. 7947 or 588-2268 after 5:30 p.m.

71 COMET - 302 cu., auto., needs muffler & alternator, $225. Jim, 878-8984 after 2:30 p.m.

75 TOYOTA COROLLA - good mech. cond., body rusted, $400. 744-2461.

76 COROLLA WAGON - 5 spd., clean, good transportation, trailer hitch, radio, a/c, $1,450. 286-0259.

72 KARMAN GHIA - excel. cond., $2,500 firm. 286-8921 after 6 p.m.

TRAVEL TRAILER - 18', self contained, new tires, sleeps 5, awning, $3,500. 473-3438 after 6 p.m.

74 BUICK CENTURY 360 - 2 dr. sedan, brown, p/b, p/s, runs well, $500; trailer hitch for Buick, 70-75 models, best offer. Roman, Ext. 3751 or 399-3659 eves.

78 VOLARE WAGON - p/s, p/b, a/c, am/fm, rack, immaculate cond., orig. owner. Ext. 2587 or 589-5755.

72 TRAILER - Coachman, 24', tandem wheels, sleeps 6, bunk house, refrig., stove, oven, hot water, ducted heat, center bath, $3,950. 744-3284 eves.

81 BUICK SKYLARK LTD - 4 dr., V6, a/c, p/b, p/s, p/w, auto., am/fm stereo, orig. owner, midnight blue, mint cond., must see to appreciate, $4,990 neg. 286-4652 after 7 p.m. (all day wkends).

TIRES - (4), 16", 8 lug rims, mounted, balanced, Steeltex radials for Ford. $325. Leon, Ext. 2973.

TIRE CARRIER - front bumper, $5. Al, Ext. 7588.

72 OLDS 98 - a/c, p/s, high mi., runs excel., 4 new tires, many new parts, rusted, must see, asking $620. Marian, Ext. 3999 or 282-3175 eves.

78 PLYMOUTH HORIZON - 48,000 mi., $2,400. Krystyna, Ext. 2485 or 3241 eves.

79 FIAT - 124, Spyder 2000, convertible, 5 spd., am/fm stereo, low mi., asking $3,950. Ext. 5182 or 924-5513.

78 RABBIT - good cond., 4 spd., a/c, radio, $1,750. Susumu, Ext. 3878 or 924-4438 eves.

TRAVEL TRAILER - tandem axle, 21', sleeps 6, 4 new tires, 30 lb., gas cyls., 8 x 12, add-a-rm; Puch moped, maxi, Class B, w/extras, $375. 363-6845.

77 MERCURY MARQUIS BROUGHAM - all power, a/c, cruise control, am/fm, CB radio, $2,000. Lorraine, 548-3885.

82 KAWASAKI - 1,000 cc, 2,000 mi., very clean, many extras, must see to believe, $2,500. Ext. 3533.

73 TOYOTA COROLLA WAGON - 1976 Volare wagon, new brakes, muffler, battery, U joints, starter, motor, alternator, needs tires, has body rust. Kay, Ext. 3592.

68 APACHE CAMPER - sleeps 6, ice box, good cond., $550. 878-2577.

76 MAZDA - 4 cyl., 4 spd., excel. mech. cond., $950. 277-1129 eves.

78 HONDA HAWK - 400 cc, 9K mi., garaged, like new, $550. Christa, Ext. 3397 or 884-7333 after 6 p.m.

71 PLYMOUTH SWINGER - 6 cyl., 2 dr., good cond., $650. Ext. 4188 or 363-5170.

80 TOYOTA CELICA - 5 spd., a/c, am/fm cassette, sunroof, $5,250 or best offer. Ext. 5024 or 369-0478.

71 PONTIAC GRANDVILLE - 4 dr., auto., V8, good running cond., $545. Ext. 3855 or 689-9718.

75 HONDA MOTORCYCLE - CB200T, excel. cond., hardly used, great gas, $450. Ext. 2705 or 286-2964 eves.

79 CHEVY MALIBU - auto., a/c, excel. running cond., $2,500. 744-8659.

77 CONTINENTAL MARK V - p/s, p/b, p/w, orig. owner, 52,000 mi., midnight blue, $5,600. 363-6406.

78 HONDA CIVIC - 4 spd., no rust, asking $2,750. 286-2265 after 7 p.m.

74 VW CAMP MOBILE - rebuilt engine, 8,000 mi., built in extras, snows, some rust, runs well, $3,000. 352-0163 after 6 p.m.

68 FORD FAIRLANE 500 - station wagon, a/t, p/s, p/b, $400. G. Strickland, Ext. 4487 or 363-6908.

HONDA MOTORCYCLE - 200 cc, good cond., windshield & fairing, asking $500. Kristin, Ext. 3372 or 744-6287.

76 HONDA MOTORCYCLE - CB200T, good cond. Marj, 924-4502.

77 OLDS CUTLASS SUPREME - new paint, tires, brakes, battery, excel. cond. 363-7032.

79 FORD WAGON - LTD Squire, no rust or dents, full power, a/c, rack, am/fm, V8, hitch, p/dr. locks, mint cond., $4,300. 744-1429.

GM DELCO STEREO RADIO - am/fm, excel. cond., $75; 1970 Beetle, runs very well, rebuilt engine, many new items, snows on rims, $750. Suresh, Ext. 4459 or 751-2095.

81 HARLEY DAVIDSON - 1,000 cc, Sportster, very low mi., like new. 929-3455.

74 MUSTANG - 4 spd., 6 cyl., fair cond. 744-6668 after 6 p.m.

72 VW VAN - good body, runs, needs engine work, $300 or best offer. Mark, Ext. 2159 or 924-3669.

72 VOLVO - 4 dr., under 50,000 mi.; Rolls-Royce hood for VW bug. 475-2873.

78 FORD MUSTANG - 4 spd., 65K, very good cond., $2,700. Boyce, Ext. 3734 or 744-7849.

75 DODGE MOTOR HOME - sleeps 6, $8,900 neg. 475-1548.

53 CHEVY SEDAN - 56,000 mi., clean, must see, asking $2,500. Joe, 727-2493 after 6 p.m.

Boats & Marine Supplies

MERCURY OUTBOARD - 90 HP, 1982, leftover, bought new 7/21/83, only 15 hrs. w/tach & controls, factory warranty, mint, $2,800. 286-1358.

11' SEA SNARK - excel. cond., easy to handle, good starting sailboat, asking $315. Tom, 744-5709.

15' SEASPRITE - 1982, 1983 35 HP Johnson, 1983 Shoreline trailer, asking $3,800. 331-9424.

15' FIBERGLASS BOAT - w/25 HP Johnson, very good cond., $1,000. Ext. 3604 or 878-0516 after 5:30 p.m.

30' OWENS TWIN - 185 HP, sleeps 6, electric anchor, many extras. 654-8622 or 289-1537 after 6 p.m.

18' LARSON - 65 HP, Mercury trailer, $1,095. Ext. 2434 or 475-8710.

21' INTERNATIONAL - glass, I/O, extras, trailer, in water, $3,800. Ext. 4188, 472-2750 or 363-5170.

MERCURY OUTBOARD - 150 HP, just rebuilt, controls, & tanks, all like new. Ext. 3301 or 775-5745 eves.

9-1/2' OLYMPUS - day sailer, fiberglass, nylon sail, $100. Glenn, Ext. 3336 or 472-1419.

6 GALLON TANKS - Evinrude-Johnson, good cond., $10 ea. Bill, Ext. 3848 or 281-6498.

22' MACGREGOR - 1981 sailboat, 4.5 HP Mercury, main, jib, sleeps 5, barely used, trailer, extras, mint., $7,200. Mickey, Ext. 3082.

15' BOW RIDER WINNER - 40 HP, galv. trailer, excel. cond., $1,400. 281-5827.

16' GLASS BOAT - w/40 HP Evinrude, runs well, $500. Ext. 4188 or 363-5170.

Miscellaneous

TELESCOPE - Tasco Model 19T, 320 power, very good cond. Ext. 7112 or 472-1922.

GIRL'S BICYCLE - small, banana seat, good cond., $25; am/fm auto cassette stereo, new cond., $30. Dick, Ext. 2911.

JBL MONITOR SPEAKERS - 8 ohm, excel. cond., new $900 sell for $600. 369-2414.

MODEM - for IBM-PC, internal mount, anchor model VI, 300 baud, software included, $150. Marwin, Ext. 2215.

LAWNSWEEPER - Sears, 25", very good cond., $20. 475-4787 after 6 p.m.

TOASTER-OVEN - polaroid w/flash; vacuum tubes; tube tester; VTVM; water pump, U-pick, $20 each. 878-6676.

WOMAN'S GOLF CLUBS - Spalding w/new bag, 2 woods, 5 irons, $60; nylon backpack, like new, $20; Sears Video Arcade w/11 games, joysticks & paddles, like new, $85. Bob, Ext. 4201.

WELDER - Sears Craftsman, good cond., 220 line, $250. Tony, Ext. 4605 or 281-0336 after 8 p.m.

CASEMENT WINDOWS - heavy duty, aluminum screens, various sizes, $20 ea. Niels, Ext. 4124.

RAILROAD TIES - (12), 6" x 6" x 8', brand new, $100. 289-5420 after 4 p.m.

STEREO - Fisher table model, 8-track, 2 speakers, excel. cond., $65. Carol, Ext. 2896 or 475-8640.

WHEEL HORSE TRACTOR - 8 HP, a/t, 36" mower, dozer blade, Kohler cast/iron engine, runs, needs work, $350. J. Agostine, Ext. 2050.

ATARI 2600 CARTRIDGES - $5-15 ea.; console dust cover, $15. Richie, Ext. 2175 or 734-7342.

WOMAN'S BICYCLE - 10 spd., Vista, good cond., Ext. 7112 or 472-1922.

LOBSTER POTS - standard size, 6 for $65; red upholstered swivel chair, $35; Bontempi electric organ, single keyboard w/bench & music books, $125. 286-8517.

RECORD PLAYER - turn of the century Pathé vibrating cone w/records, $300; Edison records, $10 ea. 744-0960.

LAWN MOWER - 1 yr. old, 22 in., $100; (18) assorted flower pots, $10; aquarium accessories, $10 takes all; upright freezer, 15 cu. ft.; canning and freezing containers; adult wooden crutches; umbrella type clothesline. Ext. 7509 or 924-0569.

J-3 CUB - 1946, completely restored, 90 hrs. since major, $11,500. 298-4309 after 6 p.m.

HOSTESS CHAIR - blue & white strip w/gold & maroon pinstripe, $45. Ext. 3357.

WATER SOFTENER - Kenmore, 3 yrs old, $100; Mark 10 glass lined tank, $25; Sears pump, $25. Anna, 281-4202.

G.E. RANGE TOP - used, $15. Ext. 2050.

POOL LADDER - 2-step, stainless steel, for in the ground pool, $20. Ext. 4680.

AIR CONDITIONER - window, good working cond.; double size frame, boxspring & headboard, $20. Ext. 3180.

COFFEE TABLE - new, never used, oval, colonial type, $75. 589-0643.

DIAMOND RING - beautiful Marquis, 2 baguettes, total 1.0 pt., appaised at $3,125, asking $2,400. Mary Ann, 286-2435.

WATER PURIFIER SYSTEM - Mark 50; Sears glassline water tank, 42 gals; Sears shallow pump, $100 for all. Katherine, 281-8021.

DEEP WELL PUMP - Gould, 3/4 HP, G.E. motor, 115/230 volts, $60. 281-8943.

COLONIAL PIECES - maple rocking chair; lamp; painting; planter; hi-rise bed, all reasonable. Jody, Ext. 2907 or 654-9094 after 5:30 p.m.

BACKPACKER'S PUP TENT - excel. cond., netting, 9 lbs., $9. Sue, Ext. 3675.

ADORABLE BABY BUNNIES - $5 ea. John, Ext. 3675 or 924-3528 after 5 p.m.

HIKING BOOTS - women's size 7-1/2, vibram sole, leather upper, cost $70, now $20; Pappagallo shoes, 2-1/2" heel, size 7, never worn, orig. $60, now $25. Ext. 7196 or 286-2505.

WALL UNIT - teak veneer, w/drop-lid desk, 3 drawers, 3 shelves, $100; campaign chest, 42" wide x 30" high x 16" deep, $20; unfinished pine, 4-drawer chest, $15; dinette table, 40" diam., 18" extension, waterproof laminated surface. Peter, Ext. 3535.

POOL - 15' x 30', all aluminum, minus liner, accessories incl., $395 as is. Walt, 698-0576.

POOL FILTER - w/1 HP motor, excel. cond., 6 functions, $125. 475-6938.

TYPING TABLE - excel. cond., $10; sharpener, for reel type lawn mowers, $125. 289-0413.

PACHYSANDRAS - $5, flat of 50; firewood, 1 cord, 16", split, $100. John, 924-6809 after 6 p.m.

STRAWBERRIES - pick your own, top quality, large, juicy, on weed-free patch in Center Moriches. Barbara or Chris, 878-0621.

CALLIGRAPHY - done by experienced calligrapher, no job too small, poems, invitations, certificates. 924-3243 eves.

GARDEN HERB PLANTS - culinary & old-time, over 40 varieties, for June delivery. 924-0092.

MOWER - 20" rotary, gas w/side discharge, grass bag, used as spare mower, $35. George, Ext. 4227 or 751-0894 eves.

ROSS ROOTFEEDER - w/fertilizer cartridge, new, unused, cost $18, sell for $12. Nancy, Ext. 5274 or 281-2767 eves.

REFRIGERATOR - Hotpoint, 14 cu. ft., gold, manual defrost, $60. Ext. 7225.

TRADITIONAL LIVING ROOM - sofa, 2 side chairs, end tables, lamps, glass table, curio, $650. 821-0080.

19" COLOR TV - GE, brand new, $289. Ed, Ext. 2897.

ATARI 850 - interface module, original, w/manual & misc. software, make offer. Doug, Ext. 7521 or 924-3669.

WASHING MACHINE - excel. cond., $275. 331-4641.

SUITCASES - Airway, 29", 26", tan, $50; encyclopedia, 27 volumes, like new, $50. 821-00E80.

WINDOW AIR CONDITIONER - Emerson, quiet, cool, 8,000 BTU, $85. 265-0501.

FISHING ROD - Olympic, 9', w/Mitchell salt water reel, asking $35. Glenn, Ext. 3336 or 472-1419.

BICYCLE - 10 spd., needs work, make offer; tent, 7' Rd., $55. 363-7032.

CABBAGE PATCH KIDS - 1 girl, blonde hair, pig tails, 1 boy, bald, brand new, $50 ea. 924-6688.

SUITCASE - Samsonite, yellow, 24" x 19", $40. Lou, Ext. 4364.

CHILD'S BIG WHEEL - pottie trainer, both $10. 751-2095.

WHEELCHAIR - excel. cond.; walker; 4 prong cane, make offer. 744-8659.

PORTABLE TAPE DECK - Groundig Tk-46, reel to reel, 110/220 V, stereo, 3 spd., needs some work, $50. Suresh, Ext. 4459 or 751-2095.

WING BACK CHAIR - brown flowered print, like new cond., $100. Louisa, Ext. 4207 or 286-0466.

DOUBLE CASSETTE STEREO RECORDER - auto program, locate & pause, high-speed dububing, 4-band radio, almost new, $195. Ext. 2225.

Free

FEMALE KITTEN - approx. 3 mos. old, gentle, needs good home, white & gold w/brown spots. John, Ext. 3292 or 286-1348.

IRISH SETTER - 9 yrs. old, good health, playful friendly, good w/children, wants a good home. 929-6506 after 5 p.m.

KITTENS - very cute, avail. now. Barbara, 878-4285 after 5 p.m.

Yard Sale

BLUE POINT - 6/23, 9-4:30 p.m, 4 families, Paumanake Rd.

Car Pools

COMMACK - would like to start a car pool. Bonnie, Ext. 2876.

BELLPORT - individuals needed to increase 2 person carpool, 8:30-5:00. Gee, Ext. 7654.

MASSAPEQUA/FARMINGDALE - points west on Southern State Pkway, leave vicinity Exit 32, Rte. 110. Plotkin, Ext. 4717.

HEMPSTEAD - near Southern State Pkway, summer student seeks pool, regular hours. Mike, Ext. 3403.

Real Estate

Real Estate advertised for sale or rent is available without regard for the race, color, creed or national origin of the applicant.

For Sale

BERKSHIRES (PITTSFIELD, MA) - 3 bdrm., den, f/p, sundeck, gargage, fenced yard, oil furnace, block to nice lake, $55,000 or trade for L.I. Ext. 3312.

LEISURE VILLAGE (GREENBRIAR) - 2 bdrm., all appliances, good location. 744-7140.

SHOREHAM WATERFRONT - woodsy, garden setting, 5 room house & big porch overlooking water. 744-9749 or Box 609, Shoreham.

For Rent

N. SHIRLEY - lrg. furn. studio apt. w/kitchen utilities included, private entrance, 5 min. from Lab & stores, 1 person only, $375 all. 281-8044.

CALVERTON - spacious 1 bdrm., unfurnished apt. to sublet through March 1985, hardwood floors, heat included, avail. immediately, $435. Diane, Ext. 4142 or 324-8150.

PORT JEFFERSON STATION - 3 bdrm. apt., full kitchen, basement, a/c, garage, avail. July 1, $650/mo. plus util. Ext. 4094 or 751-6575 eves.

CATSKILL MOUNTAIN CHALET - near Hunter Mountain, 1 week, $150. 878-2244.

LA BONNE VIE, CORAM - sublet, 2 bdrm., free heat & cooking, tennis, pool, prime location, all appliances. Ext. 4272 or 698-3822.

S. JAMESPORT - cozy home in country setting, 3 bdrm., l/r, kitchen, d/r, porch, utility rm., walk to beach, 30 min. from Lab., avail. Sept. 1, $375/mo. & util. Walt, Ext. 2907 or 698-0576.

SHOREHAM NORTH - 4 bdrm. Colonial, 3 baths, washer/dryer, f/p, den, carpeting, garage, yard, avail. immed., $1,250/mo. includes all. 744-8659.

PORT JEFFERSON - 1 room. 473-6432.

RIDGE - 2 bdrm. townhouse, 1-1/2 baths, washer/dryer, dishwasher, no pets, preferrably no children, $550/mo. Betsy, Ext. 5182 or 924-5513.

Wanted

HOUSE TO RENT - 3-4 bdrm., unfurnished, north shore between Port Jeff. & Rocky Point. Rich, 928-9119 after 6 p.m.

OLD SWIMMING POOL LINER - Ext. 2007.

SUMMER CHILD CARE NEEDED - for 10 yr. old boy, Bayport area. Ext. 2484 or 363-5344 after 6 p.m.

AIR CONDITIONER - small window type. Edith, Ext. 4379 or 3002.

TRAVEL COMPANION - reliable person to share driving & fuel costs from NY to California, dates negotiable. 589-3272.

RECORDS - 45 rpm & some LP's of the 50's and 60's era. Frank, Ext. 3120.

CELLO - 3/4 size. Ext. 3388 or 286-3903.

GOLF CLUBS - for RH 10 yr. old. J. Medina, Ext. 7636.

RELIABLE PERSON - to watch 2 yr. old small dog for 3 weeks in July. 928-8465.

DORM SIZE REFRIGERATOR - Cindy, Ext. 2301 or 924-3243.

CAMPBELLS SOUP LABELS - send to F. Chandler, Bldg. T-89, for St. Mary School, E. Islip.

WORLD BOOK ENCYCLOPEDIA SET - 1 yr. old. Max, Ext. 3665.

GARAGE - for car storage, reasonable, Patchogue area preferred. Carol, Ext. 2896 or 475-8640.

RELIABLE TEEN - part-time light housekeeping & cat sitting, Brookhaven. Colin, Ext. 4154 or 286-1234.

MINERALS - mineral collection, old minerals or related books, magazines, any language. Plotkin, Ext. 4717.

REFRIGERATOR - 17 or 18 cu. ft. for college students. Norman, Ext. 3354 or 472-3985.

CAR-TOP CARRIER - for VW Rabbit, to rent or borrow for 2 weeks in August. Ext. 7190 or 369-1844.

TO RENT - 2-3 bdrm. house or apt., furnished if possible, for 7/1, 8/1 or 9/1 may be possible, 2 females. Debbie, Ext. 3420 or 736-5744.

Classified Ad Policy Deadline is 4:30 p.m. Friday for publication Friday of the next week.