BROOKHAVEN BULLETIN
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BROOKHAVEN NATIONAL LABORATORY

NRAO: Covering the Cosmos

This article is the first in a series of occasional stories about BNL's "sister" laboratory, the National Radio Astronomy Observatory, or NRAO.

They wait patiently in a quiet valley amid the Allegheny Mountains of Green Bank, West Virginia; stand proudly atop Kitt Peak southwest of Tucson, Arizona; and serve as sentinels of the sky above the Plains of San Agustín, 50 miles west of Socorro, New Mexico. They are the radio telescopes operated by the National Radio Astronomy Observatory (NRAO) from its headquarters in Charlottesville, Virginia.

NRAO Director Paul Vanden Bout and Associate Director Robert Brown came to BNL from Charlottesville earlier this month to attend a meeting of the Board of Trustees of Associated Universities, Inc. (AUI). Like Brookhaven, NRAO is operated by AUI. But while BNL's operation is specified under a contract with the U.S. Department of Energy, AUI's NRAO contract is with the National Science Foundation.

The "sister" laboratories are both user-dedicated, maintaining large-scale facilities where visiting scientists can do research not possible at less well equipped individual institutions. For NRAO, these facilities are radio telescopes.

Info From Outer Space

Most NRAO users are astronomers. Some are astrophysicists; others are chemists. All told, about 650 users from 150 institutions (mostly universities) used NRAO equipment in 1985 to get information about objects in outer space. Brown explained that this information comes from naturally occurring radio waves. "Both radio telescopes and optical telescopes collect light from objects in the sky," he said. "Optical telescopes collect what you can see. Radio telescopes collect and amplify radio waves, which are just another form of light. The techniques are complementary. A researcher might use both kinds of instruments to enhance his knowledge."

Although everything emits radio waves, different objects tend to favor different wavelengths. At shorter wavelengths of just a few millimeters (mm), the brightest objects are galactic clouds of dust and gas. At longer wavelengths, 100 centimeters (cm) and beyond, the brightest objects are such things as pulsars, the dense remnants of supernovae explosions. Between these extremes, other celestial objects are detectable. To cover the cosmos, NRAO maintains a variety of radio telescopes, each capable of detecting different wavelength ranges. The instruments are located at three sites.

Green Bank. When NRAO was founded in 1957, this West Virginia valley was chosen as an ideal site for radio telescopes because the surrounding mountains provided natural protection from man-made radio interference. But because those mountains also made access to Green Bank difficult, Charlottesville, Virginia, the nearest urban center, was selected for NRAO headquarters. There, computer data collected on Green Bank telescopes are processed, and an electronics development laboratory is maintained.

Today, Green Bank is known primarily for two telescopes:

- 300-foot Transit Telescope — The 300-foot diameter reflector on this telescope can be moved in a north-south direction. When completed in 1962, it could observe only wavelengths longer than 21 cm, but a resurfacing of the reflector in 1971 made possible useful operation at wavelengths as short as 6 cm.

The original telescope proved to be more than enough in July 1968, when it detected the first pulsar to be found by American astronomers. In November of that year, the 300-foot telescope was used in the discovery of a pulsar in the Crab Nebula. Explained Vanden Bout, "This told people for the first time that pulsars were indeed the remnants of exploding stars."

- 140-foot Telescope — Unlike the 300-foot, this telescope can be steered for observing the skies in any direction. It is also specifically designed for use at shorter wavelengths, down to 1 cm.

Collecting radio waves from interstellar clouds, the 140-foot telescope led to a spectacular finding — that complex molecules could be found in outer space. Until 1968, it was assumed that only simple molecules existed there. This discovery raised questions about the role of organic molecules as precursors of the more complex molecules from which living matter evolved.

Mort Rosen

Robert Brown (left) and Paul Vanden Bout, while at Berkner Hall to attend the AUI Board of Trustees meeting.

Kitt Peak. Located 55 miles southwest of Tucson, Arizona, this mountain is controlled by the Kitt Peak National Observatory, the optical astronomy counterpart of NRAO. But as one among many guests on Kitt Peak, NRAO has maintained a radio telescope there since 1968 — the 12-meter Millimeter-Wave Telescope. Very short wavelengths, about 3 mm, are this telescope's forte.

About 60% of the 40 molecules discovered by their radio emissions have been found with the 12-meter telescope. This was helped by the telescope's 6,000-foot altitude, which, with a high, dry atmosphere, reduces the effect of water vapor, which can cause radio waves to be absorbed.

The Plains of San Agustín. In positioning the Very Large Array (VLA), planners were also looking for a site with a low water-vapor content in the atmosphere. But the array of 27 antennas, each with a diameter of 25-feet, also required a remote, high altitude site in a broad, flat valley offering protective mountains and low radio noise. The array is distributed over the Plains of San Agustín in a Y formation of railroad tracks, with two branches 21 kilometers (km) long and one branch 19 km.

Fully operational since 1981, the VLA is much greater than the sum of its parts. By electronically joining together a number of relatively small antennas, NRAO synthesizes a huge aperture. The larger the area of the telescope, the finer the angular resolution, and, thus, the finer the detail observable with it. The VLA gives the best angular resolution available today.

VLA in Disguise

This is one reason the VLA was a logical setting for Carl Sagan's current best seller, "Contact." Although the main telescope with which contact with extraterrestrials is made is called Aries in the novel, Vanden Bout and Brown are sure it's a "thinly disguised" VLA. But they don't expect that the VLA, or any NRAO telescope, will become dedicated to the search for other life in the universe. "If somebody is going to be transmitting to us, the best way to see if they are there is to conduct a good program of astronomical research," explained Brown. "Then, if they are there, chances are you will find them."

In real life, one of the most exciting discoveries at the VLA has been the streams, or jets, of relativistic particles coming out of active, energetic galaxies. Explained Vanden Bout, "It's as if each such galaxy had an AGS in the center spitting out relativistic particles. Instead of an AGS, it's a black hole."

But what is driving those jets away from the black hole? That's one of the questions NRAO hopes to answer with the Very Long Baseline Array, or VLBA.

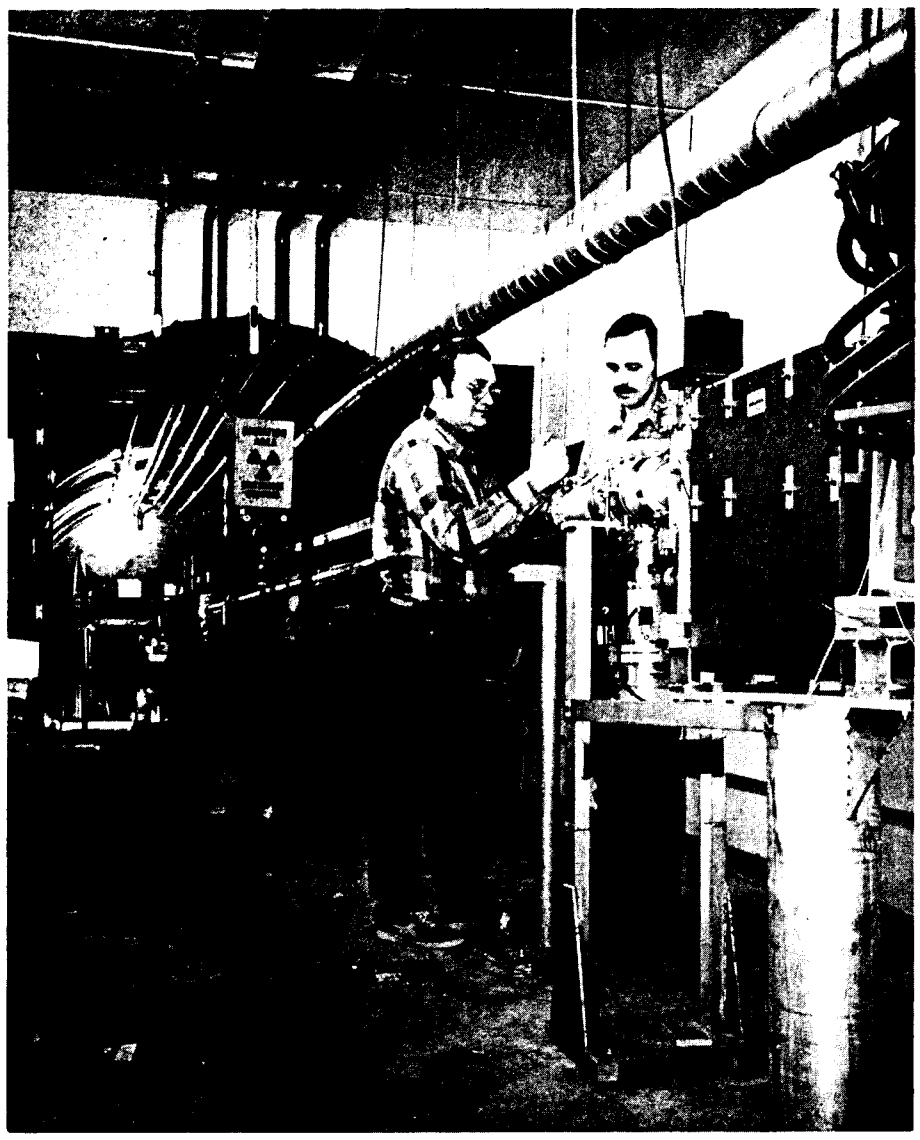
VLBA Greater Resolution

Though the VLBA will use the same size reflectors as the VLA to synthesize

(Continued on page 2)

Radio waves emitted from the galaxy Cygnus A (shown here) were detected by observers John Cowan, John Dreher and Richard Perley using the Very Large Array (VLA). The data were then processed by super computer to produce this image. Notice how two jets of relativistic particles stream outward from the small dot in the center, which represents a black hole. Before the jets were discovered at the VLA, there was no correlation between the black hole, where power originates, and the wispy clouds called radio lobes, which contain much of the energy emanating from Cygnus A.

— NRAO photo



Peter Horton

Brent Nelson (left) and Hans Abendroth install the last vacuum section in the heavy ion transfer line.

Tunnel Ready for Heavy Ions

Thousands of pieces were joined together to build the Heavy Ion Transfer Line linking the Tandem Van de Graaff accelerator with the Alternating Gradient Synchrotron (AGS). These pieces include parts for such things as magnets, beam diagnostic equipment, control and monitoring systems, as well as 2,200 feet of ultra-high vacuum hardware. On Friday, March 14, the last pieces fell into place as the last vacuum section was installed.

Under this ultra-high vacuum, beams of heavy ions from the Tandem will be sent to the AGS via the transfer line at an energy of seven million electron volts per nucleon. Once ions such as oxygen or sulfur arrive at the AGS, they will be accelerated to a maximum energy of 14 billion electron volts per nucleon.

The ultra-high vacuum system was designed and installed by Physics Department personnel. Members of the Accelerator Department took part in extensive preliminary studies and tests, were responsible for leak checking, and designed and fabricated ion pump supplies and a vacuum monitoring system. Personnel from the Tandem made hundreds of ultra-high vacuum joints and welds with such precision that none of them were found to leak, which was "almost unbelievable," according to Peter Thieberger, associate manager of the HITL project.

In other project developments, magnets, power supplies, and electrical interconnections have been put in place. The beam diagnostic equipment built at the AGS and the computer control systems developed at the AGS in collaboration with the Tandem group have been installed. And the commissioning of the beam line has begun.

NRAO (Cont'd)

a huge aperture, only ten will be employed. But together, these ten antennas will provide an angular resolution about 50 times that of the VLA. "With VBLA resolution," said Vanden Bout, "you could read the inscription on a penny in Los Angeles from BNL. In cosmic terms, that means we can look for objects the size of our solar system at the extreme edge of our galaxy and even beyond."

The key to attaining this resolution is to distribute the ten telescopes across a huge expanse — from Hawaii to St. Croix, from the Canadian border to southern Texas. Ground was broken earlier this year for the first station, in Pie Town, New Mexico, 50 miles west of the VLA. The VLBA will be completed in the early 1990s.

The computer data collected from all NRAO telescopes are processed into images at computer centers in Charlottesville and Socorro. Said Brown, "In terms of taking an image, and processing it, pixel by pixel, to remove the effects due to atmosphere, our work is pioneering image processing research."

Despite its many locations, NRAO is about one-tenth the size of BNL, in terms of personnel and funding. That's both because it is a single-purpose institution and because experiments with radio telescopes can usually be done very quickly — in days or hours.

Still, anyone familiar with both BNL and NRAO would surely notice many similarities in the institutions. As Vanden Bout said, "It all has to do with Lloyd Berkner, the former president of AUI (1951-1960) who set up the NRAO and in whose building we now sit [Berkner Hall]. He patterned it after BNL, fixing the character of the place." — Anita Cohen

It's a fact: Mount Sinai was originally called Old Man's. But when the community applied for a post office, says the Long Island Gazeteer, the authorities declined to accept the name. So "the new postmaster's wife opened her Bible at random and laid down her knitting needle on the page; the needle was pointing at the name Mt. Sinai."

It's a fact: Long Island has had many other names. The Long Island Gazeteer cites: Island of Nassau, Ilant de Gebrokne Lant, Isle Plowden, Manitie, Long-Isle, Syon, Matouwacks, Matowa, Matowcas, Mattanwake, Meitowax, Paumanack, Seawanhacky, Wamponomon, Fish-shaped Paumanok, Nassau Island and Crooked Row.

Dollars for Scholars

Associated Universities Incorporated (AUI) has made a corporate donation of $1,000 to the Renate W. Chasman Scholarship for Women. In making the contribution to the scholarship fund for Long Island women returning to scientific and technical studies, Robert Hughes, President of AUI, cited the appropriateness of honoring Renate Chasman, the late BNL physicist "who was a valued colleague and friend of so many BNL staff members." This donation brings the fund, which is administered by Brookhaven Women in Science (WIS), to about $5,500.

The first corporate donation, of $500, was made last month by Long Island Trust, a commercial bank with 46 branches in Nassau and Suffolk Counties. It was solicited by Betty Heldman, a member of the WIS scholarship committee.

Former BNL Assistant Director R.C. Anderson, along with the Provost of Southampton College, Timothy Bishop, and Evelyn Berezin, a Long Island businesswoman, have accepted the scholarship committee's invitation to select the first $1,000 Chasman Scholarship winner this August.

Patents Awarded

Donald W. Huszagh, DAS, was awarded U.S. Patent #4,529,127 for inventing a portable machine for spraying quick-setting resins onto a roadway.

During recent years, two component resin compositions have been developed for industrial and commercial uses. These resins are maintained as separate viscous liquids until they are mixed together, at which time a thermal reaction takes place, resulting in the liquid becoming a solid that has a combination of properties extremely useful in a wide variety of applications.

One application for these resins is as an overlay or coating for road surfaces that is tough, coarse, relatively impenetrable and weather resistant, thereby protecting and extending the life of the road surface.

Huszagh's machine has a pneumatic control system, including apparatus for purging the machine of mixed resin with air and then removing remaining resin with solvent. Interlocks prevent contamination of solvent and resin, and mixed resin can be purged in the event of a power failure.

The Subject Is Rock Eaters

Rock eaters. That's what Stephen Roll lightheartedly calls certain microorganisms that can oxidize metals found in low-grade ores.

These microorganisms are the focus of a project that Roll is working on, with Audrey Brisson, Daniel Dobryn and Chung Lee. The four are graduate students enrolled in the MIT School of Chemical Engineering Practice, which places students at various research laboratories and industrial institutions around the country. This is the fourth year of the MIT Practice School at BNL, and during the current session, which began in January and will run through May, a total of 11 projects will be tackled by 15 students working in teams.

The project on rock eaters requires the students to evaluate the economics of using these microorganisms to remove toxic metals from geothermal waste.

Says Dobryn, geothermal energy accounts for 3% of the electricity generated in the states of California, Hawaii, Nevada, New Mexico and Utah. All told, that saves 25 million gallons of oil a year. The problem with some geothermal plants is that they produce waste containing high levels of toxic metals. Environmental regulations require that this waste be disposed of in hazardous waste sites, at great cost.

A cheaper alternative may be to clean the waste by bio-leaching, which is the process by which the rock eating microorganisms promote the dissolution of soluble metals. According to Brisson, the four students are working specifically with two species of *Thiobacillus*, to see how well they remove metals such as zinc and chromium.

The students have four weeks on this project, working under the guidance of BNL scientists Lawrence Kukacka and Eugene Premuzic. Both are in the Department of Applied Science; Kukacka advises them on geothermal energy and Premuzic lends his expertise on the biochemistry of microorganisms. The students have been putting in long hours, says Lee, in an intense effort to do in one month an assignment that would ordinarily take well over a year.

The bio-leaching project, like all the assigned projects drawn from BNL's wide range of research and advanced development activities, gives the MIT students practical problems and work experience not available in the academic environment. But it isn't a one-sided arrangement. The students' work at BNL has resulted in a number of journal publications and patentable ideas.

Peter Horton

MIT graduate students (from left) Daniel Dobryn, Stephen Roll, Chung Lee and Audrey Brisson in a laboratory where they grow microorganisms that can bio-leach toxic metals from geothermal waste. The students are enrolled in the MIT Practice School, currently in session at BNL.

Midday Music

It is highly unusual for visitors who come to see the Lab to then turn around and put on a concert for our enjoyment. But that is what is happening on Wednesday, March 26, in Berkner Hall. The Bromley Youth Concert Band, from London's Borough of Bromley, is on a two-week tour of the Northeast, and they asked to visit a "prestigious institution" on Long Island. Brookhaven was chosen. The Band then offered to play a concert here at lunchtime and so will enliven the premises from noon to 1 p.m. on Wednesday.

The 70 members of the Band range in age from 15-18 and come from the Bromley Youth Symphony Orchestra. Included in the Band's repertoire are overtures, marches, suites and show music.

Missing Persons

If an average person weighs 150 pounds, then the 70 BNL Weight Watchers have lost the equivalent of 4.61 people. After being weighed four times during the after-work Weight Watchers sessions, the Tuesday and Thursday groups have lost 691.5 pounds, or 304 and 387.5 pounds respectively. With three more weeks of dieting left, the dieters could figuratively lose 3.46 more people and gain healthier bodies if they stay hungry. Encourage any weight watcher you know with a carrot, not a cookie.

Two new Weight Watchers groups will be forming soon. People on the waiting list for the first two sessions will have priority in signing up. Others who would like to be added to the list, please drop a note to Health Promotion Specialist Elaine Friedman, Medical Department, Bldg. 490, as soon as possible.

Equipment Demo

The Instrument Mart Inc., an electronic test equipment distributor headquartered in Great Neck, will present a display of general purpose electronic test instruments at Berkner Hall, Tuesday, March 25, from 11 a.m. to 3 p.m. Among the products on display will be oscilloscopes, multimeters, panel meters, signal and function generators and power supplies.

PSI News

Mary White, Training and Development Administrator, Personnel, will talk about "Styles of Managing Conflict" at the next meeting of Professional Secretaries International. The meeting will begin at 6 p.m. on Thursday, March 20 in Room C, Berkner Hall.

I.B.E.W. Meeting

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

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AMD Course

The Applied Math Department is offering a course in C Programming Language for Programmers:

Six 1-1/2 hour sessions
10:30 a.m. to noon, Tuesdays and Thursdays
March 25, 27, April 1 through 10
AMD Seminar Room, Building 515
Lecturer: G. Rabinowitz

The C Programming Language is a general purpose language that features economy of expression, modern flow control, data structures and a rich set of operators. Its lack of restrictions and its generality make it more convenient and effective for many tasks than more powerful languages.

Programming knowledge is a prerequisite for this course. To register or for more information, call Ronald Wittlock at Ext. 4112.

CREF Values

February	72.38	March	72.35
April	71.97	May	75.52
June	76.40	July	76.69
August	75.94	September	73.77
October	77.12	November	82.20
December	85.78	January	86.50

February $92.83

Cafeteria Menu

Week of March 24

Monday, March 24		
Chicken noodle soup	(cup)	.65
	(bowl)	.85
Beef stroganoff over noodles		2.45
Homestead pork chop & rice		2.45
Hot Deli: Smoked turkey	(bread)	2.25
	(roll)	2.40
Tuesday, March 25		
Chicken rice soup	(cup)	.65
	(bowl)	.85
Veal parmesan with spaghetti and garlic bread		2.65
Stir fry beef & broccoli over rice		2.50
Hot Deli: Roast beef	(bread)	2.30
	(roll)	2.45
Top your own hamburger from the grill area		2.25
Wednesday, March 26		
Split pea soup	(cup)	.65
	(bowl)	.85
Filet of fish w/ choice of 1 veg.		2.65
Beef stew w/ baking powder biscuits		2.45
Hot Deli: Fresh ham	(bread)	2.30
	(roll)	2.45
Thursday, March 27		
Tomato lentil soup	(cup)	.65
	(bowl)	.85
BBQ brisket of beef w/ choice of 1 veg.		2.50
Sweet & sour pork over rice		2.45
Hot Deli: Kielbasi	(bread)	2.30
	(roll)	2.45
Top your own baked potato from the hot deli area		1.50
Friday, March 28		
Manhattan clam chowder	(cup)	.65
	(bowl)	.85
Roast turkey w/ dressing and choice of 1 veg.		2.50
Filet of fish w/ choice of 1 veg.		2.50
Hot Deli: Corned beef	(bread)	2.30
	(roll)	2.45

Note to Diners

The Cafeteria will be closed on Saturday, March 22. On that day, snack bar service will be available from 9 a.m. to 2 p.m. at the Brookhaven Center.

BERA News

Golf

An organizational meeting of the BERA Golf Association will be held on Friday, April 4 at 5:15 p.m. in the lounge of the Recreation Hall. Membership applications for 1986 are being sent out to last year's members. Prospective members are welcome at the meeting and may obtain an application by contacting Ron Webster, Ext. 2845.

Afro-American Culture Club

Elections for president and treasurer will be held on Wednesday and Thursday, March 26 and 27, in the lobby of Berkner Hall, from 11:30 a.m. — 1 p.m. both days. Candidates for president are Robert Mosely and Bruce Penn; for treasurer, they are Rose Lawrence and Abass Wessen.

Cooking Exchange

The Cooking Exchange meeting on Wednesday, March 26, will feature special dishes of Spain.

Meetings are held in the Recreation Hall between 12:30 and 2:30 p.m. and are open to employees and their immediate family members. A small donation of $1.25 per person entitles those present to a copy of the day's recipes, samples of the dishes prepared and coffee or tea. Babysitting is provided at 50¢ for each child.

For more particulars, call Sara Morse, 282-1712; Susan Sears, 744-7831; or Lucia Cardoso, 282-3071.

Basketball

Game #1

Runaways — 52		Hollywood — 48	
J. Shephard	3	G. Mack	16
T. James	14	E. Meier Jr.	12
P. Johnson	6	R. Kowalski	6
G. Smith	2	A. Powell	2
R. Moran	11	D. Nordstrom	12
J. Desmond	12		
A. Stillman	2		
J. Ripka	2		

Game #2

Longshots — 80		Coasters — 54	
L. James	14	M. Williams	4
J. Garrison	6	B. Allen	22
R. Seymore	28	P. Ratzke	6
L. Walcott	6	R. Rowley	5
M. Colon	16	G. Grigg	8
E. Taylor	4	L. Lawrence	6
B. Johnson	1	L. Snead	3
C. Coughanowr	3		
P. Brown	2		

Note: Corinne Coughanowr broke new ground last night by being the first woman to play in the BNL basketball league.

Volleyball

League I	W-L
Dinkers	43-4
Up Fagrabs	35-12
X-Rayted	22-25
Bumpers	22-25
Net Results	11-36
TNT	8-39
League II	
Phoubars	47-0
Nuts & Bolts	26-21
Fossils	24-23
Chungas Revenge	23-24
Cannonballs	17-30
Upton-Ups	4-43
League III	
Print-outs	33-18
Foul-Up II	32-19
Screwballs	29-22
The Buddys	26-25
Light n Lively	17-34
Couples	16-35
Open League	
Odds & Sods	37-5
Dakota	38-7
Phoenix	27-15
Court Jesters	19-26
Rowdy Radicals	17-28
Generic	13-32
Out of Control	2-40

Swim Club

At the New York City Masters Swim Meet at CCNY on Sunday, March 9, the eight members representing the BNL Swim Team captured 18 age-group medals. As well, Toshi Sugama finished second overall in the 100-yard breaststroke and third overall in the 200-yard breaststroke, and Ron Wittlock finished second overall in the 200-yard backstroke.

Commissioner's Trophy Mixed Freestyle Relay
2:11.24 - 7th

Ron Wittlock, Laurie Hastings, Marsha Belford, Paul Michael

50-yard Freestyle		
Paul Michael	30.99	6th men 55-59
100-yard Freestyle		
Don Makowiecki	1:33.68	5th men 40-44
50-yard Butterfly		
Wlodek Guryn	31.12	5th men 35-39
Marsha Belford	38.15	3rd women 25-29
50-yard Backstroke		
Ron Wittlock	33.22	2nd men 50-54
Wlodek Guryn	34.02	2nd men 35-39
Marsha Belford	44.04	2nd women 25-29
100-yard Backstroke		
Ron Wittlock	1:14.34	1st men 50-54
200-yard Backstroke		
Ron Wittlock	2:43.57	1st men 50-54
50-yard Breaststroke		
Toshi Sugama	33.46	1st men 35-39
Marsha Belford	42.87	3rd women 25-29
Laurie Hastings	43.36	2nd women 30-34
Peggy Micca	51.17	1st women 40-45
100-yard Breaststroke		
Toshi Sugama	1:15.18	1st men 35-39
Marsha Belford	1:34.07	1st women 25-29
Laurie Hastings	1:35.14	3rd women 30-34
Peggy Micca	1:51.33	1st women 40-45
200-yard Breaststroke		
Toshi Sugama	2:50.25	1st men 35-39
Laurie Hastings	3:32.33	2nd women 30-34
100-yard Individual Medley		
Wlodek Guryn	1:09.92	3rd men 35-39
Marsha Belford	1:26.58	1st women 25-29
Laurie Hastings	1:30.48	5th women 30-34

Softball

An organizational meeting of the BERA Slo-Pitch Softball Association will be held on Friday, March 28 at noon in Room B of Berkner Hall. One representative from each team in the Employee's and Mixed Leagues should attend, preferably the team captain, as well as league representatives and the softball board. Among the topics on the agenda will be the 1986 league structure, rules changes, schedule, rosters and dues. Each team should submit a preliminary roster at this time.

Anyone who would like to play softball but who doesn't have a team should call Sharon Smith, Ext. 3995.

Bowling

Red/Green League

High games were bowled by F. Powers 222/209/611 scratch, N. Combatti 214, T. Prach 214, J. Ferrante 208, K. Riker 206, R. Larsen 204, H. Marshall 203, E. Sperry 203, J. Morris 202, S. Dimaiuta 201, C. Bohnenblusch 200.

Purple League

Mary Grace Meier rolled a 234/181, Ken Asselta 219/203, Gene Fales 217, Bob Barberich 214/210/621 scratch, Bob Jones 203, Maria Apelskog 175, Sharon Smith 175.

White League

Dick Adams had games of 225/207, Jim Roesler 211, Ken Riker 205/204, Ed Sperry IV 204, Mary Austin 203, Ben Belligan 202, Ted Erickson 201, Joyce Mortimer 200, Kay Conkling 198/195, Annamarie Spira 197, Pat Manzella 192.

Arrivals & Departures

Arrivals

Robert L. Foxworth ..... NSLS

Departures

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

Evelyn Blanck ..... Fiscal

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 and/or appropriate bargaining unit, 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 Employment Manager, Ext. 2882.

THE VACANCIES LISTED BELOW HAVE BEEN EXEMPTED BY THE DIRECTOR'S OFFICE FROM THE CURRENT FREEZE ON OPEN REQUISITIONS.

LABORATORY RECRUITMENT - Opportunities for Laboratory employees only.

2410. MASTER WELDER, GROUP LEADER - Central Shops Division.

2411. MATERIAL HANDLER - Supply and Materiel Division.

OPEN RECRUITMENT - Opportunities for Laboratory employees and outside applicants.

2412. BIOLOGY ASSOCIATE - Requires BS or equivalent in biology, biochemistry, biophysics or related discipline. Must also be well-organized, self-disciplined and be able to work with a minimum of supervision. Responsibilities include the operation of BNL's Scanning Transmission Electron Microscope for outside users and core R&D projects; preparation of antibodies and assistance with specimen preparation or photography as required. Knowledge of molecular structures and protein purification highly desirable. Biology Department. Reposting of Job No. 2393.

2413. CLERICAL POSITION - Requires excellent and extremely accurate typing skills to perform diverse clerical duties within the Personnel Records area. Previous experience in this area is highly desirable. Involves detail work in record keeping and some computer interfacing. Excellent communication skills are necessary. Personnel Division.

2414. TECHNICAL POSITION - Requires AAS in mechanical technology or equivalent experience. Working from general instructions, will do some associated drafting and record keeping. Will construct and lay out precision fine wire electrodes for multiwire proportional chambers. Knowledge of the following areas is desirable: electronic testing of detectors, handling of compressed gases, vacuum practice, clean room practice, high voltage and cryogenic liquid handling. Instrumentation Division.

Autos & Auto Supplies

55 CHEVY BELAIR - 2 dr., sedan, no eng., $500; 67 Chevy Camaro RS, V8, a/t, p/s, new tires, brakes, 95% complete, $3,500. 395-1588 eves.

71 HONDA MOTORCYCLE - 450 cc, custom paint, completely rebuilt, $1,000. John Wharton, 821-0089.

79 FORD PINTO - a/t, p/s, a/c, $1,400. 363-6940 eves.

75 GRANADA - 4 dr., manual shift, well maintained, am/fm, 4 spd., new battery, $600. Ext. 4785 or 475-1844.

PIONEER CAR STEREO - am/fm cassette, new, excel. cond., $100. Ext. 2752 or 751-6571 eves.

83 HONDA SHADOW MOTORCYCLE - 750 cc, low mi., garaged, $1,750. Frank, Ext. 4113 or 395-3165.

80 CHEVY MONZA - p/s, p/b, a/c, good cond., $2,300. 878-0786.

76 CAMARO - V8, a/t, 83k mi., new cam, lifters, brakes, tires, am/fm stereo, $1,095. 744-1367.

75 FORD LTD WAGON - good cond., $600 neg. Ext. 3125.

74 BUICK APOLLO - a/t, p/s, p/b, a/c, am/fm, 4 dr., 90k mi., very good cond., $900 or best offer. Ext. 3701 or 751-8128 eves.

70 FORD LTD WAGON - 9 pass., mech. sound, body good, rel. transp., $695. 475-2598 after 5 p.m.

BATTERY - 12 volt, Die-Hard, side mount, used 2 wks.; bucket seat covers, tan. 286-8554.

73 CHEVY PICKUP - 4x4, V8, a/t, p/s, p/b, a/c, 31-10x15 tires, rally wheels, running boards, anti-slip diff., more, $3,800. 269-9510.

73 VW FASTBACK - a/t, reb. eng., $1,100; 73 Squareback, std., $700; 73 bus, new eng., $2,500. Ext. 4463 or 751-2422.

74 DATSUN PICKUP - w/cap, excel. cond., new radials, exhaust, clutch, no rust, $1,595. Ted, Ext. 7992.

82 HONDA ACCORD - 4 dr., 5 spd., 63k mi., silver, excel. cond., $6,200. Russ, Ext. 3059 or 698-9364.

MOTORCYCLE LOCK & CHAIN - w/plastic cover over links, $20; owner's manual for 1977 Sportser, $5; leather bags (not Harley), $30. Tony, Ext. 4605.

72 OLDS CUTLASS SUPREME - $900 or best offer. 924-0582 eves.

SHORT BLOCKS - (2) 350 Chevy, 1-4 bolt, both apart and need work, $40 ea; early Buick or Jeep parts, V6, blocks, heads, cranks, etc. Bill S., Ext. 4434 or 399-6168.

PICKUP CAP - 8 ft., Winnebago, sliding windows, good cond., $200. Ext. 2462 after 7 p.m.

77 PLYMOUTH ARROW 200 - 41k mi., 5 spd., a/c, radio, excel. cond., $1,500 or best offer. Ext. 2611 or 751-4098 after 5 p.m.

75 CHEVY MONZA - a/t, h/b, good cond., $580 firm. Ext. 3187 or 2823.

82 DATSUN SENTRA - a/c, 5 spd., new exhaust & tires, good cond., 68k mi., $3,200. 874-2731 eves.

MOPED - good running cond., new ignition, tire, carb., needs work, $50. Ralph, Ext. 2368 or 928-6654.

74 MONTE CARLO - full power, mint int., $600. 924-6971 after 6 p.m.

SUZUKI GS 250T - 10k mi., excel., $800; fiberglass cap for Toyota short bed, $350. Jack, Ext 4411 or 929-8287.

79 TRAVEL TRAILER - 21' Shasta w/bunkhouse, sleeps 7, a/c, awning, spare, more, excel., $7,000. 924-4832 after 5 p.m.

AUTO RADIO - am only, essentially new, $15. Les, Ext. 2920.

74 DODGE DART - 318 V8, 2 dr., lt. blue, a/t, p/s, p/b, a/c, 84k mi., $650. Ext. 3896 or 475-0396.

73 DODGE CHARGER SE - heat, music, air, very good cond., $1,000; 75 Honda motorcycle, XL-175, street and dirt, very good cond., $400; util. trailer, $100. Len Kalmar, Ext. 4070 or 878-9582.

85 TOYOTA CELICA GT - liftback, blk./grey, sunroof, digital pkg., cruise, excel. cond. Scott, 281-1862.

67 MERCEDES BENZ - 200D, parts, make offer; 70 Mavrick, runs well, new clutch, brakes, extras, snow slicks radial tires, $500. Jerry, Ext. 2934.

76 VOLARE - a/t, slant 6, excel. cond., p/s, p/b, a/c, new brakes, exhaust, $950. Ext. 2171 or 957-7159.

84 HONDA SPREE - excel. cond., low mi., $300. Jerry, Ext. 7427 or 475-5591 after 5 p.m.

CARGO CARRIER - covered roof top, for car, $45. Henry, Ext. 3084.

75 BUICK LE SABRE - fully loaded, mint cond., 65k mi., $2,750. 924-3236.

79 OLDS DELTA 88 - a/t, a/c, p/s, p/b, excel., $2,600. Ray, 289-0883.

78 FORD PICKUP - F-100, red, 83k mi., 6 cyl., cap, standard, extras. Phillips, Ext. 4235.

67 CHRYSLER - convertible, new top, p/s, p/b, p/w, a/t, new seats, 383 V8. Tony, 698-9274.

69 BUICK LA SABER - p/b, a/t, a/c, p/s, good cond., $495; Toyota parts, 12" & 13" rims, trans., radiators, reasonable. Hank, Ext. 3848 or 472-0553.

79 MERCURY ZEPHYR - 6 cyl., a/t, a/c, excel. in/out, needs some eng. work, $1,300. Mike, 669-9482 eves.

85 KAWASAKI - 110 ATV, excel. cond., low hrs., $700. 751-7140.

83 HONDA - sta. wagon, a/c, roof rack, rustproof, extras, 5 spd., mint, garaged. Ext. 7585.

70 MUSTANG - 351 Cleveland, reb. trans., needs body work, $600. Jamie, 727-8100 or 878-1640.

82 PONTIAC T1000 - h/b, 4 spd., excel. cond., 39k mi., $2,700. 363-9527.

82 PLYMOUTH CHAMP - Mitsubishi, 4 dr., hatch, custom, stand., 60k mi., excel., $3,900. 929-4168 or 288-9178.

78 KZ 400 - very good cond., low mi., roll bar, luggage rack, dealer maint.; 74 Torino, 77k mi., a/t, p/s, p/b, am/fm cass., very good cond., $850. Ext. 2621 or 281-0360 after 6 p.m.

74 HONDA CIVIC - standard, good mech., 74k mi., $750. 744-5096.

77 KAWASAKI 400D - new tires, sprockets, 14k mi., runs great, $350. 878-4556.

75 FORD GRANADA - 2 dr., stick, reliable, low mi., $650. Ext. 2455 or 331-1432.

77 DODGE VAN - 6 cyl., a/t, p/s, p/b, seats 8, excel. in/out, $2,500. 369-0432.

TRAVEL TRAILER - 18', sleeps 6, self contained, new tires, brakes, $2,500. Artie, Ext. 2697 or 325-0743.

74 VW BUS - 7 pass., 110 HP eng., 20k mi., am/fm, $1,200. Ext. 2965 or 744-0960.

83 HONDA NIGHTHAWK - 650 cc, mint, maroon, 4k mi., very fast, garaged, $1,800 firm. Bob, Ext. 3145 or 286-0064.

Boats & Marine Supplies

MOORING CHAIN - galvanized, 1/2", new, $2.25/foot. Bob, Ext. 7197 or 399-1679.

16' MFG - 1972, Tri Hull, full canvas, 1979 Mercury 50 HP motor, elec. start, 1983 Cox galvanized trailer, extras, $2,800. 281-8458 eves./weekends.

MOORING - 300 lb., complete w/float, shackles, 40 ft. chain, used for 1 season, $325. 732-6838.

17' ISLAND DAYSAILOR - 1978, roller furling, galv. trailer, 4 HP Evenrude, excel. cond., $2,750. Rich, 472-9034.

23' O'DAY - 1980, 7.5 HP Honda, 6 sails, full race equip., keel ctr. bd., electronics, extras, excel., $15,400. Lloyd, Ext. 3381 or 286-1024.

27' CATALINA - sloop, 1976/7, 3 sails, inboard, cruise equip., very good cond. Ext. 2144.

MOORING - 200 lb., 12' 1/2" chain, 30' 3/8" chain, float, $175. Bill, Ext. 7229 or 473-1813.

30' MAST - Hobie Cat type, alum., good cond., $100. Slim, Ext. 3084.

KAYAK - custom Fox, Kevlar, complete w/spray skirt, sidewinder paddle, mint, $700 firm. 878-1640.

SURF WAVE-SKI - w/paddle, $150. Tim, Ext. 3496 or 281-7873.

28' OWENS - sleeps 4, new canvas/hardtop, sink, stove, stand up head, good cond., $2,000. 281-0360 after 6 p.m.

26' PEASON - 1972, 15 HP eng., 5 sail, DF. Ext. 3921 or 689-9214.

16' V-HULL BOWRIDER - 1983, 4 Winns, 120 HP Merc. cruiser, 15 hrs., full canvases, galv. trailer, power winch, garaged, $7,800 firm. 286-8797.

Miscellaneous

TRACTOR - Gravely, w/mower, snow blower, blade, wagon, more, $750. 732-3506.

SOFA - 85", contemporary, Haitian cotton, excel. cond. Carol, Ext. 4398.

FUR CAPE - like new, $50. Ext. 3701 or 751-8128 eves.

TRICYCLE - powder puff; 4-wheel cycle. 924-0582.

SIAMESE KITTENS - male, blue, chocolate point, adult males. Ramona, 928-3088.

BIKES - men's Schwinn, 3 spd., $15; boy's 20 inch, 5 spd., $15; generator, needs work, $150. 286-8554.

MAXELL DISKS - ds/dd, 5-1/4", new, 10/$10; port. typewriter, $25; ski pants, lt. blue, 5 jr., $8; lg. fireplace screen, $10. Jim, Ext. 3372.

G.E. REFRIGERATOR/FREEZER - 2-dr., harvest gold, like new, $200. 473-1456.

KEROSENE DRUMS - 55 gal., 2 for $5; Sears auto. Rotis. broiler grill, good cond., $15. 924-3236.

MEN'S SKIS - 205 cm, 200 cm boots, 10 med; woman's, 185 cm boots. 475-0509 after 6 p.m.

LEATHER JACKET - size 40R, excel., $25; changing table, white wicker, excel. cond., $15. Mike, Ext. 7941.

DINING ROOM TABLE - glass and chrome, (4) brown velour chairs, excel. cond., $300; (2) wood end tables. 234-1480.

CONVERTIBLE SOFA - Castro, queen size, gold herculon w/black trim, $150. 286-0259.

WOODEN VALANCES - painted white, (4) each 42" wide, (1) 84" wide, $10/5. 286-1331 after 5 p.m.

TUB - cast iron lion paw, antique red, matching sink, never used, $225; Foos' Ball table, tournament soccer, like new, extra balls and men, $200. Ron, 732-6712.

MINI DRYER - 115 Vac, excel. cond., good for apt. use, $100. Victor, Ext. 2395.

FUR CAPE - like new, $50. Ext. 3701 or 751-8128 eves.

CB ANTENNA - Big Stick, fiberglass, 2-piece whip, for auto, boat or home, $20. Ronnie, 732-6712.

14K GOLD CHAIN - 24", heavy beveled herringbone, $200. Ext. 4692 or 878-2040 after 6 p.m.

FRANKLIN STOVE - Atlanta stove works, (2) solid brass knobs, cast iron, mint, $150. Ext. 2529 or 588-7989.

SNOW THROWER - Sunbeam, snow champ, 12 in., elec., new. Kevin, 878-4285 after 5:30 p.m.

STEREO - phono, 8-track, w/speakers, dust cover, G.E., good cond., $35. 751-1884.

FURNITURE - Colonial sofa, chair, rocker, ottoman, pine frames, coffee table, (3) end tables, excel. cond., $950. Ext. 2529.

TWIN STROLLER - good cond., $25. 567-9025.

DEN SET - 3-piece, $110; 5-piece dinette set, $125; 64" bathroom vanity, $75. Rod. 751-7023.

CEDAR GUN CABINET - holds 12 guns, 2-drawers, 5'x6', glass doors. Ext. 4489.

BODY-BUILDING MACHINE - Soloflex deluxe, $500. Maria, Ext. 7692.

DINETTE SET - all formica, (2) pc. China, 48" oval table, (4) chairs, like new, $300. Ext. 2549.

BATHROOM SET - harvest gold, bathtub, toilet, sink w/3 door, 2 draw vanity, 2 mirror cabinet, towel bar, shower bar, soap dish, light fixture, $400. 732-6838.

COAL STOVE - Haas & Sohn, "Pluto" model, 121 V, autofeed, thermostat, brand new, in crate, $275. Ext. 2922 eves.

ELEC. HOT WATER TANK - 82 gal., Rheem, good cond., best offer. Bob, 475-4382.

GARDEN ROTOTILLER - excel. cond., $60; (2) 110 V elec. motors, 1/3 HP & 1/8 HP, 1725 RPM, $10 for both. Ext. 2705 or 286-1062.

COLONIAL FURNITURE - sofa, chair, rocker, ottoman, pine frames, coffee table, (3) side tables, excel., $950. Ext. 2529.

COUCH - gold, trad., very good to excel. cond. Ext. 4192 or 751-7787.

FRANKLIN STOVE - cast iron, Atlanta Stove Works, (2) lg. decorative brass knobs, excel., $150. Ext. 2529.

DUAL RECORD CHANGER - $15; Garrard SL55, $20. Walt, Ext. 7154.

BAY WINDOWS - Anderson, 4' picture, 2' casement, side units at 45°, Thermopane, incl. screens, excel., $450. Lloyd, Ext. 3381 or 286-1024.

SNOW PLOW - 7-1/2' Meyers, w/hydraulic power angle, very good cond., $700; metal frame bunk beds, w/mattresses, $50; upright freezer, Admiral, 15 cu. ft., excel. cond., $150. Len Kalmar, Ext. 4070 or 878-9582.

HOME COMPUTER - TI99/4A, orig. box, 6 games, joystick, cass. interface, speech module, manuals, software supplier cat., $50. Ext. 2807 or 281-0557.

DWYER UNIT - 2-burner stove, refrig. and sink, apt. size, good cond., $300. Slim, Ext. 3084.

TENNIS RACQUET - Head, like new, w/cover, $20; Sears rotisserie, A-1 cond., $20. 924-3236.

LOVESEAT - country French, wood trim, blue/beige print, orig. $600, sell for $175; coffee table, orig. $300, sell for $95; both for $260. 286-4652 after 6:30 p.m.

LG. AMARYLLIS BULBS - potted and in bud, $2.75 ea. 727-8631.

REFRIGERATOR - frostfree, 18 cu. ft., advocado, excel. cond., running but will need repair, $200; upright freezer, 14.8 cu. ft., needs repair, $50; 55 gal. kerosene drum, $5. Linda, Ext. 5141.

TRANSFER SWITCH - (1) left, for elect. generator. Joe, Ext. 7636 or 654-3472.

PRINTER - Commodore 801, almost new, $75. Ext. 2364 or 929-8944.

LOVE SEAT - advocado green, excel. cond., $135. 727-2471 after 5 p.m.

BUNNY RABBITS - $5. John, Ext. 3675 or 924-3528.

Yard Sale

MASTIC BEACH - 114 Pine Rd., Sat., April 5th, many items, furniture, etc.

Car Pools

MASTIC - would like to be a rider starting 3/24/86, will pay what driver deems fair towards gas, 8:30 to 5:00 shift. Jody, Ext. 2907 or 654-9094 after 6 p.m.

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 Rent

PORT JEFF. - Harbor Hills, 3 bdrms., 2-1/2 baths, l/r, d/r, f/r, patio, gas heat, central a/c, near beach/country club, partially furn. or unfurn., $900 mo. 928-0466.

SHIRLEY - 1 bdrm. apt., priv. ent., walk to beach, cable, single mature woman only, no pets, util. incl., 1 mo. sec., $475 mo. Ext. 2905, Wed., Thurs. or Fri.

FARMINGVILLE - 1 bdrm. apt., single, $500 mo. incl. all util. & cable. 732-2141 before 1 p.m.

CATSKILLS - 3 bdrm. chalet w/sleeping loft, near Hunter & Windham Mts., will rent wkeds. or wkly. Judy or Kay, Ext. 3595 or Bea, Ext. 3642.

RONKONKOMA - near LIE and beach, immac. 3 bdrms., l/r, d/r, eik, w/w, storage room, $725 mo. plus util., avail. 5/1. Ext. 2676 or 543-0487.

RONKONKOMA - near LIE and beach, lg. 2 bdrms., l/r, eik, full bath, storage, $585 mo. plus util., avail. 4/1. Ext. 2676 or 543-0487.

S. CAROLINA - Hilton Head, 2 bdrm. condo, tennis, golf tournaments beginning with the famous, plenty of sun, $300 wk. before 4/15, $400 wk. after 4/15. Ext. 3147.

MEDFORD - 2 bdrm., l/r, kit., f/p, w/w, appliances, garage, fenced yard, landscaped, extras, $850 mo. plus util., no pets, 698-0576 after 9 a.m. or 286-2005 after 12 a.m.

RIDGE - 2 bdrm. apt., quiet, upper, priv. res., prefer mature single, $500 mo. incl. util. Ext. 3430.

WADING RIVER - 2-1/2 rm. apt., full bath, pvt. ent., patio, non-smoking single person preferred, $450 mo. incl. util. 929-3071.

WESTHAMPTON BEACH - 2 bdrms. house, completely furn., $600 mo. plus util. Toni, Ext. 7140 or 878-4448 eves.

ROCKY POINT - upstairs apt. in 2-family house, 2 bdrms., kit., bath, garage, bsmt., fenced backyard, other tenent BNL employee, $500 mo. Armin, Ext. 4570 or Jueng, Ext. 3422 or 821-3240.

For Sale

OAKDALE - Idle Hour section, near water, 2-story Tudor, 4 bdrms., 2 baths, attached garage, full apt. w/pvt. ent., 1/2 acre on dead end st., $210,000. 363-6940 eves.

VERO BEACH, FL - 2 bdrm. condo., 2 baths, Florida room, many extras, active clubhouse, pools, tennis courts, hobbie & crafts center, $62,000. 698-5046 after 7 p.m.

STONY BROOK - 4 bdrm. cape, 2 baths, eik, "S" section, 2-car garage, w/w, pool, patio, portico, beautifully wooded. 751-7140.

BROOKHAVEN HAMLET - 12 acres, trees & shrubs, lg. barn, 14" top soil, (2) 4" wells, estate surroundings, terms. Jim, Ext. 4040 or 289-0876.

MIDDLE ISLAND - 1 bdrm. coop., new appl., w/w, cedar bath, track lighting, tennis and pool facil., $55,000. 924-9041 after 7 p.m. wkds.

BELLPORT - 3 bdrms., fenced 1/2 acre, l/r, d/r, eik, 1-1/2 car garage, bsmt., pool, deck, all appl., oak floor, $130,000. 286-2205.

PT. JEFF. STA. - condo townhouse, 2 bdrms., 1-1/2 baths, cent. air, appl., pool, tennis, clubhouse, $104,000. 928-8522.

BELLPORT - m/d, 2 sep. ent., 3 baths, 5 bdrms., Florida sunroom, many extras. 286-9051.

OTSEGO COUNTY - 3 bdrm. house, modern kit. and bath, furn., 1-1/2 car garage, 17-1/2 wooded acres, incl. stream, $60,000. 929-8287.

Wanted

TRAINS - Lionel, American Flyer, access., any cond. brings good price. Carole, Ext. 3362 or 924-4097 eves.

ALTO SAX - w/case, good cond., reas. Ext. 4669 or 744-9429.

MATURE WOMAN - non-smoking, own transp., to care for new-born and 3 yr. old. 751-1462.

TIRES - GR78-15, HR78-15, snow or reg., reas. Whitey, Ext. 2913.

CAMPER VAN - to rent for 1 wk. for a week this summer. Jim, Ext. 2432.

CAR TO RENT - 3/21/86-4/14/86, max. $60/wk. Harry, Ext. 7509.

OUTBOARD ENGINE - 4-5 HP. 473-2473.

HOUSE TO SIT - going away on vacation or business, I will stay w/your house. Ext. 3671 or 736-2131 eves.

TIRES - 15" F78 or G78. M. Strongson, Ext. 4192.

MAC USERS UNITE - overthrow the tryanny of Big Blue, seriously, let's communicate & educate by forming an onsite Macintosh users group. Chris, Ext. 4505.

ALTO SAX - w/case, good cond., reas. Ext. 4669 or 744-9429.

HELMET - BMX bicycle type; training wheels for kids bicycle. Pete, Ext. 4819 or 289-7218.

EASEL - for beginner painter. Ext. 3007.

LAWN ROLLER - Ext. 2364 or 929-8944.

HOMEOWNERS - interested in joining NYPIRG, fuel buyers group, Rocky Point, SWR area, save hundreds. Ext. 3637 or 473-9100.

HS STUDENT - to mow 3/4-1 acre lawn on reg. basis, also other jobs, Bellport Village. Ext. 2914 or 286-3742 wkeds./eves.

APT. - furnished, 4/10 to 4/20. Aaron, Ext. 3015 or 2854.

CAMPER REFRIG. - propane/electric, power inverter, 12 VDC to 110 VAC, 500 watts, any cond., reas.; elec. generator, propane/gasoline powered, 1.5-2.5 KW, 12 VDC deep cell batt., marine type, reas. Bob, Ext. 3145 or 286-0064.

Free

OAK FIREWOOD - in manageable pieces. Ralph, Ext. 2368 or 928-6654.

DALMATIAN DOG - 8 yrs. old, no papers, spayed, friendly, good w/children. 281-7844.

In Appreciation

The Weirshousky family wishes to thank everyone for their kindness during our time of sorrow.

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

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