

## Lattice Supports QCD Theory

What a difference a letter makes! The addition of a "T" not only makes simulating stimulating, but it also changes the meanings of other words with which those are used. For example, the Monte Carlo that stimulates is a gambling resort. But the Monte Carlo that simulates is a powerful tool used by physicists for statistical sampling.

Monte Carlo simulation of statistical systems has long been used by solid state physicists. But it wasn't until 1979 that Michael Creutz, Laurence Jacobs and Claudio Rebbi of BNL's physics department began a program of applying this technique to relativistic quantum field theory, the primary tool of the elementary particle physicist.

The BNL physicists have had spectacular results, ranging from the demonstration of quark confinement to calculations providing evidence for a rich spectrum of bound gluon states (glueballs). "Ten years ago, no one imagined the potential of Monte Carlo methods for high energy physics," said Creutz, "and only a few years ago, calculating these results, even

mechanical field. But the fluctuations on a finer lattice are considerably more subtle, and physicists have turned to techniques of statistical sampling — i.e., Monte Carlo.

In their initial work, Creutz, Jacobs and Rebbi used lattice gauge theory to demonstrate aspects of quantum electrodynamics (QED), the physical theory that explains the motion of charged particles in an electromagnetic field. This theory has been well-tested experimentally, so the physicists knew what the outcome should be. The lattice calculations agreed in most ways with expected results, although a few tantalizing discrepancies appeared.

With the practicality of the new analytical approach proved, Creutz extended it to quantum chromodynamics, or QCD, the mathematical analogue of QED and the theory proposed to explain the interactions of quarks — the particles presumed to be the fundamental building blocks of matter. "Both QED and QCD have a nice geometry to them that goes well on a lattice," said Rebbi. "Today all the interactions we know about are based on gauge theories, and all these can be described on the lattice."

The initial aim was to show quark confinement — a QCD prediction that physicists have been quite eager to prove. Quark confinement is the phenomenon whereby two or three quarks remain perpetually captive within the nuclear particles they form, in a way that can be compared to the balls on the end of a bola (a hunting device from South America). The quarks can move freely, but are held in check, or confined, by the (string) tension connecting them.

The numerical study of this phenomenon begins with the storage of the initial values of all variables in the memory of Applied Math's CDC-7600 computer. In the subsequent Monte Carlo simulation, several hundred thousand random changes are made on these variables. Then the computer calculates the average quantum-mechanical effects produced by the sample configurations. "In the case of QED, to sweep a lattice with 10,000 sites takes about 500 milliseconds," said Rebbi. "We can sweep the whole thing about two times per second, changing variables each time."

Besides indicating quark confinement, Rebbi said that Creutz's results "showed that these computations, done by computers available today, could be useful. This started a whole trend of investigations making use of numerical simulations."

Since that demonstration, the physicists have used the technique to explore other predictions of QCD. Creutz has come up with an estimate of string tension, the force which holds the quarks together. Further results predict that quarks will deconfine — but only at extremely high temperatures. In sum, Rebbi reported last year, these techniques have made it possible to estimate such QCD predictions as the glueball mass, the deconfining temperature of quarks, the expectation value of the topological charge, and many more quantities of great experimental and theoretical interest. And recently, he said, "Within the past two years, we've extended this process to numerically determine the masses of many particles with strong interactions."

All the investigations so far have assumed stationary quarks. Though



Mort Rosen

How important Monte Carlo techniques have become to high energy physics was demonstrated last week when over 60 physicists met at BNL from May 2-6 for a conference on "Monte Carlo Methods and Future Computer Architectures." The conference organizers, shown here, were (from left) Garry Rodrigue, George Michael and Theodore Einwohner of Lawrence Livermore National Laboratory; Carl Moser, of the Centre European de Calcul Atomique et Moleculaire; and Claudio Rebbi of BNL. During a session on Quantum Field Theory, chaired by Michael Creutz, Rebbi spoke about "Monte Carlo Simulation of Lattice Gauge Theories." Other sessions centered on Statistical Mechanics, Quantum Statistical Mechanics, Transport, Computers and Applications, General Purpose Machines and New Designs.



Mort Rosen

Claudio Rebbi and Michael Creutz

qualitatively, would have been regarded as hopelessly difficult."

For their groundbreaking work, the theoretical physicists had two mentors. One was Robert Swendsen, then of BNL's solid state physics group, who was using Monte Carlo methods to analyze properties of spin systems. Of this transfer of techniques, Creutz said, "There's a deep mathematical connection between the subfields of physics." And Rebbi added, "Something I find very nice in our Physics Department is the exchange of ideas. The three theory groups here are quite integrated."

The ideas of their second mentor — Ken Wilson of Cornell — gave the physicists a framework in which to use Swendsen's Monte Carlo techniques. In 1974, Wilson proposed using a lattice formulation for high energy physics. A lattice is a regular geometrical arrangement of objects or points over an area or in space. Wilson's proposal called for positioning particles and their fields over a cubic lattice, with discrete points of both space and time. Then, while preserving particle size, the lattice would be shrunk, or renormalized, finally converging to ordinary time and space. This scaffolding forms the basis of what is called lattice gauge theory.

On a coarse lattice, only simple calculations are required to demonstrate various phenomena, because there are large fluctuations in the quantum-

lattice gauge theory can be used to simulate moving quarks, until now, this required so much computation that even the most powerful computers could not handle it. But working with Giorgio Parisi and Enzo Marinari of the University of Rome, and with Herbert Hamber, who was then with the solid state theory group at BNL, Rebbi recently proposed an approximation scheme which makes the computation feasible. (Independently, the scheme was also suggested by Donald Weingarten of Indiana University.) In test calculations, theoretical results have been in good agreement with experimental values.

Numerical computations cannot permanently substitute for the rigor of analytic work. Nevertheless, lattice gauge theory has given theoretical high energy physicists an impressive tool with which to test the predictions of QCD.

— Anita Cohen

### 200th Brookhaven Lecture Maurice Goldhaber

Maurice Goldhaber, AUI Distinguished Scientist, will talk about a subject that is receiving considerable publicity, "The Question of Proton Decay," in the 200th Brookhaven Lecture on May 18 at 4:30 p.m., Berkner Hall. Because this is a special occasion, wine and cheese will be served at the Brookhaven Center following the lecture at about 6 p.m. A buffet supper is scheduled for 6:30 at a cost of \$7.50 per person. Reservations should be made by calling Ext. 3541 before 5 p.m. on the day of the lecture.



Mort Rosen

Twenty-five biomedical program directors at other laboratories met here late last month to listen to BNL staff give a cross section of the Lab's many activities in this field, and to hear from DOE as to current policy, budget projections and common problems. This group usually meets two or three times a year, with the agendas of the first and second days being the responsibility of the host laboratory and of DOE headquarters, respectively. Brookhaven has biomedical research in four departments - Biology, Chemistry, Applied Science and Medical; and in two divisions - Instrumentation and Safety & Environmental Protection. Above, from left, Dr. Charles W. Edington, Associate Director of DOE's Office of Health and Environmental Research looks over the agenda with Victor Bond, BNL Associate Director for Life Sciences & Safety; Len Emma, Assistant to the Director who helped organize the meeting; and Jean Hummer, who is Management Assistant to Dr. Edington.



Peter Horton

On April 27, Yoshikatsu Nagase, chief architect and vice president of the North America Taisei Corporation, toured the Brookhaven House. The visit was an opportunity to compare Japanese and American research and development efforts in residential housing. Taisei Corporation has built the Solarhouse as part of Japan's national project to make that country as self-sufficient as possible. Both the Brookhaven House and the Solarhouse are extremely energy conservative, but the Brookhaven House features passive solar components while the Solarhouse utilizes a highly technological level of active solar systems, with roof collectors driving Rankine cycle engines for heating, cooling and hot water. Construction of the Japanese house is also technologically advanced, using precast foamed concrete panels for the exterior envelope. The Brookhaven House uses a modified wood stud construction which dates back to colonial times. Both houses integrate their solar components with traditional regional architectural styles, resulting in designs acceptable to a broad market. The Japanese house has a compact two story plan, with both Japanese and Western style bedrooms. All room sizes are based on the module of the straw tatami mat. Using a modification of the traditional shoji screen sliding door idea, rooms in the Solarhouse can be closed with a glass panel, an insulating panel, or a thermal storage radiator, all set into a multiple slider so they can be used individually or in combination. Above BNL architect Ralph Jones (kneeling, left) also explained to Mr. Nagase a design for turning a high-rise industrial structure into a passive solar, energy conserving apartment building. Looking on at the model were (from left) Alex Grinell, an architect from New York City; John Andrews, head of DEE's architectural and building systems division; and Tom O'Hare, DEE associate chairman.

## Equipment Demos

The Scientific Instrument Service Group of the Instrumentation Division will demonstrate **multichannel analyzer equipment and application**, from 10 a.m. - 4 p.m. on May 18 and 19, rooms B and C at Berkner Hall. For information call George Sintchak, Ext. 5039, or Thomas Stuart, Ext. 4227.

A demonstration of the newest addition to the line of **MICOM word processors** will be given on Friday, May 20, from 10 a.m. to 4 p.m., in the Seminar Lounge, Physics Bldg. (510A). This word processor is ergonomically designed, self-contained and fits right on the desk. During the months of May and June it is priced at \$5,600 with printer.

## Arrivals & Departures

### Arrivals

Anthony Calligeros Jr. .... Plant Eng.  
 Anthony J. DiMauro .... Central Shops  
 Linda A. Fallat .... Tech. Info.  
 Ulises Feliciano .... Plant Eng.  
 Margaret D. O'Sickey .... Fiscal  
 Dimas Rodriguez .... Plant Eng.  
 Willis R. Sceviour .... Reactor

### Departures

None

## Att: Inventors

The inaugural meeting of the N.Y. Society of Professional Inventors will be held on Wednesday, May 25, at 7:30 p.m. in Lupton Hall, the State University of New York at Farmingdale on Route 110. The association has been formed so that inventors might have an opportunity to share some of the common problems of inventing. For further information, call 420-2397.

## To Cash A Check

Effective immediately, BNL identification must be presented for all transactions with the site Cashier in Bldg. 134.

## Inside Info

The Department of Energy and Environment has reverted to its former name, the Department of Applied Science. In making the announcement, Lab Director Nicholas Samios said that "The programs of the Department, particularly in the areas that have been termed energy sciences and energy technologies, address broader issues than energy alone and, indeed, already include national resource areas (strategic materials, resource assessment, geosciences, etc.). The environmental science programs also are broadening to include studies of non-energy related environmental and health contaminants."

## Patent Awarded

Richard M. Lambrecht, Chemistry Department, and Geerd-J. Meyer, a former BNL employee, were awarded U.S. Patent #4,364,898 for inventing a method of preparing high purity radon-211. The radioisotope can be prepared by the bombardment of bismuth-209 with lithium-7. The radon-211 can be isolated from the target quite easily by degassing at elevated temperatures, and the radiochemical purity of the product is better than 98%. It can thus be used as a generator system for astatine-211, which is of potential interest in biomedical applications.

## Speaking Out

Reporter: Anita Cohen  
 Photographer: Mort Rosen

Do you play the lottery? We found that the people we asked were split on this question, with the strong feelings of those who don't play offset by the equally strong hopes of those who do.

### Lamar Gardner

(Central Shops) — Oh, yes I do — I play Lotto every week. Usually, I change the numbers around, but once in a while I play the same numbers. If I won, I would like to travel around the country and see all of my relatives and friends that I haven't seen since I was a little kid. But so far I haven't won anything and I've got to stay right here. Actually, I'm a songwriter and I would like to use the winnings to help that along.



Jill C. Bonner (Physics) — I'm a mathematical physicist and I know what the odds are and I would not, myself, play a state lottery. There's an urge to gamble in many people; in mathematicians that is probably suppressed because they know the odds.



Stephen Plate (CBA) — Well, I never play it. I don't feel it's a reasonable risk. Obviously someone is making a profit off of it, so it's a less than even chance of winning. I can use my money more wisely than that.



Iaan Fabien (NSLS) — No I don't play. I think it's really a drain on my money. The odds are too great. I like the odds when they are more in my favor.



### Jackie Mirzadeh

(Director's Office) — No I don't play. I'm not usually lucky that way. I've picked horses for someone and he's won with amazing frequency, but the minute I put my own money on them, they come in last. If I put money on something, I generally don't win.



Karen Vogel (Fiscal) — We play Lotto every week. No luck. But if I got lucky, I'd give some to my family and I'd take some. I'd party a couple of weeks, go to Hawaii and just walk around with a sign saying, "I won the Lottery!"



### Tony Salvo

(Contracts & Procurement) — I do play Lotto, with two other people from the office. We've each put in two bucks a week for about six months now and we haven't collected a dime. We stay with the same numbers. We've talked about changing them but we figure if we do, and if they ever came in, we'd kill ourselves. If we ever win, the first thing I'd do is travel. And one of my hobbies is photography. I'd probably want to go into that in more depth.



Jack Feldman (CBA) — Yes, six to eight of us play the lottery (Lotto) as a group, every week. We've won \$40 in two years — divided by six. If we did win big, I'd probably invest it.



Roger Stoutenburg

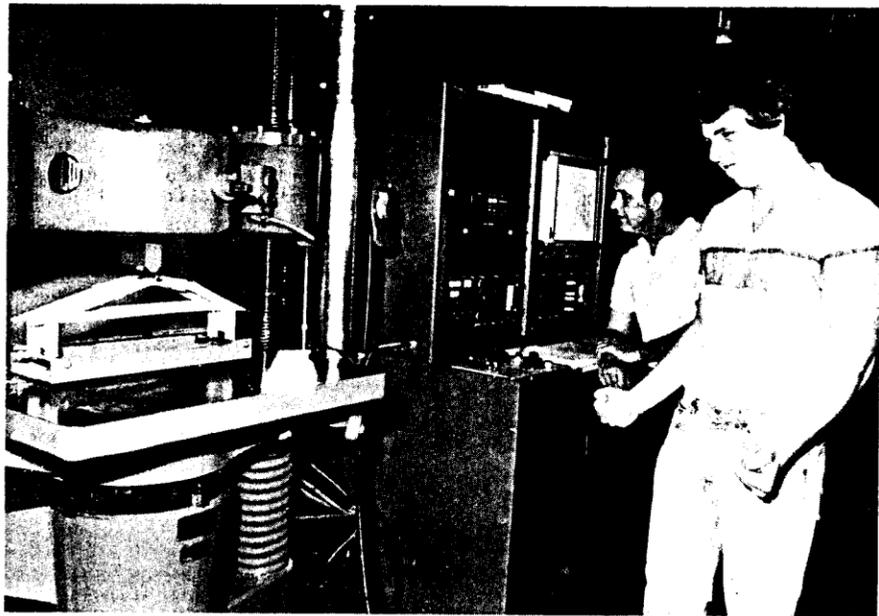
Fascinated by Nora Davies' deftness with a word processor are a group of Hauppauge High School students who visited BNL during Professional Secretaries Week as guests of the Upton Chapter of Professional Secretaries International (PSI). While half the students visited the Word Processing Center at Photography & Graphic Arts (above), the rest watched Mary Cooper of Applied Math use word processing equipment in an office situation. The demonstrations capped a day of activities that included a Lab tour and a rap session with PSI representatives. Accompanying the students around the site were PSI members Susan Carlsen (S&EP), Sandra Green (S&EP), Fran Ligon (DO) and Upton Chapter President Betty Ivero (DEE - upper right).

# BROOKHAVEN BULLETIN

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## Building Better Balsa Bridges

As the hydraulic press descends upon the model bridge built by East Islip H.S. senior Daniel Tohill (top), the stress is felt by both Tohill and his creation. Like the other 300 models tested last Saturday in BNL's third annual Model Bridge Contest for high school students, Tohill's bridge was constructed solely of balsa wood and Elmer's glue, to strict specifications.

Don Horne (rear, top photo) was one of those monitoring the hydraulic stress testing machine in Bldg. 480, on which each bridge was tested to determine the one with the highest strength-to-mass ratio. And each bridge met a fate similar to that of Tohill's, which finally flew apart under pressure. Still, Tohill's bridge

was better than the rest. The small structure carried a load of 1084 pounds on its 117.3 gram frame, for a strength-to-mass ratio of 9.24. For achieving the best ratio of the day, Tohill earned a Hewlett-Packard programmable calculator. Other honors in the contest went to Ron Hochbrueckner (2nd), Steve Olafson (3rd), and William Schwenzler (4th), all of East Islip H.S.

For the bridge testing, Marty Woodle (CBA) was assisted by Bill McGahren (CBA) and Jim Cullen (CBA), while Don Horne (DAS) and Carl Klamut (DAS) operated the machine. Janet Tempel and Jackie Mirzadeh of Public Relations coordinated the contest.



## R/C Model Club

Everyone is welcome to attend a club sponsored film which will be shown at noon in Room B, Berkner Hall, on May 17.

At noon on May 19, a flying demonstration will take place at the BERA Recreation Park.

## Microcomputer Club

If you are an owner/user (or thinking of buying a microcomputer, come to an organizational meeting, sponsored by the BERA Microcomputer Club on Tuesday, May 17, at noon in the Biology Conference Room, Bldg. 463.

The objective is to form a user group at various levels of experience. Possible common interests that will be discussed include information exchange, swap/trade equipment, choosing accessories/peripherals, equipment/product evaluation, software library, game cartridge sharing library, and club discount purchases.

For more information, call George Sintchak, Ext. 4227.

## Bowling

### White League

D. Adams rolled a 240, T. Erickson 210, M. Stoeckel 187, R. Scheidet 207, J. Vogel 202, P. Lebitski, J. Roesler 210, J. Petro 205. Clearwater is in first place followed by the Old Timers and Looney Tunes.

### Purple League

High games were bowled by A. Benson 203, J. Connelly 205, K. Riker 209, E. Meier 236, J. Sheehan 200-200, G. Spira 203, E. Sperry 222. Good Guys are in first place followed by the Drafts and Good Times.

### Pink League

R. Rosati had games of 176-198-177, E. Kristiansen 162-178, M.G. Meier 196, S. Moore 164, S. Long 170, J. Thiede 165, C. Tyler 171.

### Red/Green League

N. Combatti bowled 220-201 for 603 scratch. R. Larsen 216, E. Sperry IV 216, L. Jacobson 215, H. Marshall 211, J. Ferrante 210-205, J. Muller 208, K. Riker 205, T. Prach 205, C. Bohnenblusch 201, T. Holmquist 201, E. Maier 200, C. Neuls 200.

## Motorcycle Club

The Motorcycle Club is planning an after work supper ride on Tuesday, May 17. Those interested meet at the Cafeteria parking lot.

## Volleyball

Reminder: the volleyball end-of-season party will be held on Friday, June 3, at the Brookhaven Center. There will be a hot and cold buffet, as well as an open bar. Tickets are available from Lois Marascia in Bldg. 197C (Ext. 4904) at a cost of \$3 per person. Reserve your tickets as soon as possible.

## Cafeteria Menu

Week Ending May 20, 1983

### Monday, May 16

Cream of chicken soup	(cup) .65 (bowl) .75
Turkey chow mein on white rice	1.85
Beef livers w/onions & 1 veg.	1.80
Hot Deli: Veal pattie & peppers	(bread) 1.85 (roll) 1.95

### Tuesday, May 17

Pork and cabbage	(cup) .65 (bowl) .75
Spaghetti special "all you can eat" w/meat sauce & garlic bread	1.90
Beef burgundy on white rice	1.95
Hot Deli: Grilled Reuben	1.90

### Wednesday, May 18

Turkey rice soup	(cup) .65 (bowl) .75
Meatcakes & onions w/1 veg.	1.80
Southern-fried chicken w/stuffing & cranberry sauce	1.85
Hot Deli: Barbeque top round of beef	(bread) 1.95 (roll) 2.05

### Thursday, May 19

Beef noodle soup	(cup) .65 (bowl) .75
Braised swiss steak w/onions & mushrooms & 1/veg.	2.10
Knockwurst & sauerkraut	1.85
Hot Deli: Roasted turkey breast	(bread) 1.85 (roll) 1.95

### Friday, May 20

Manhattan clam chowder	(cup) .65 (bowl) .75
Macaroni & cheese w/1 veg.	1.85
Shrimp vegetable oriental on white rice	2.00
Hot Deli: Breaded fish fillet hero	1.95

## Runners' Corner

On Sunday, May 1, close to 3000 runners participated in the Long Island Marathon, starting at 8:30 a.m. in Eisenhower Park, and ending about 6½ hours later for the 2247 finishers on the boardwalk in Long Beach.

Among those hardy souls were four BNL'ers, two of whom were running in their first marathon. Fighting a strong headwind, the first BNL'er to cross the finish line was Bill (Skip) Medeiros, DAS, in 495th place. He knocked off more than 10 minutes from his N.Y. Marathon time with a 3:22:41. He was followed by Frank Marotta, S&EP, with a time of 3:56:25 for 1295th place. Jack (Steady) Weisenbloom, Accel., posted a 4:25:16, good enough for 1772nd place. Bernie Silverstein, S&EP, finished in 1811th place with a time of 4:28:15.

Starting in February, Frank and Bernie had gradually built up to 60-70 miles per week in training for their first marathon. Their plan was to "just finish." All went well until Bernie suffered leg cramps after 21 miles, and only his firm commitment to the idea of finishing prompted him to wave away the "meat wagon" (a bus that picks up runners in trouble).

With Skip Medeiros it was a "piece of cake" and it will whet his appetite to better his time in the next New York Marathon.

As for Jack Weisenbloom, the old veteran has decided to stop horsing around and work on his speed. He runs eight to ten miles per day in all kinds of weather and one can be sure that with his speed training, he will break four hours in his next marathon.

One other BERA member, Dave Penoyar, spouse of Jeanne Penoyar (DNE) jogged to a 4:32 as a warmup for the upcoming Ottawa Marathon on May 15.

— Gus Prince

## Tennis

### Court Reservations

Two tennis court reservation systems will go into effect Monday, June 6. The rules for court use are posted at courtside and in the BERA Sales Office, Berkner Hall.

Under the advance reservation system (A), three of the courts may be reserved for weekday play the day before play (thus Friday for Monday play). On-court scheduling (system B) offers the three remaining courts on a first come-first served basis to players who sign the blackboard at courtside at the time of play.

Reservation sheets for system A are held at the BERA Sales Office from noon to 1 p.m. on the day preceding play. Reservation sheets for the day's play will be posted at courtside in the morning, where players may reserve any courts that remain open. Only group 1 from the priority players list below may use system A. Only groups 1 and 2 may use system B.

1. Laboratory employees, including Visiting & Guest appointees.

2. Laboratory employees playing with family members or personal guests.

3. Immediate family members of Laboratory employees.

4. Personal guests of Laboratory employees.

**Note:** It is against Laboratory policy for anyone to use Lab facilities for profit. This includes use of the tennis courts for conducting paid, private tennis lessons.

### Tennis Ladder

Men and women are invited to compete in the Tennis Ladder which will begin on Monday, May 23. Sign-up sheets and ladder rules are now posted at the BERA Sales Office. Player rankings will be posted by Friday, May 20 and will be according to the order of sign-up. Players will be allowed one free challenge until June 10, thereafter, the posted rules will apply. The ladder will be run this summer by Tennis Committee member George Oldham. Other members of the Committee are Eena-mai Franz (chairman), Naresh Bhagat, John Elmore, Andy Kevey, Marilyn McKeown, Larry Passell, Steve Shapiro, Niels Schumburg, Paul Valli and Gail Williams.

### Annual Tournament

The tournament will get under way on Saturday, July 23, and players can sign up at the BERA Sales Office beginning June 27. Further details will be given in a later issue of the Bulletin.

## Afro-American Club

The Afro-American Culture Club cordially invites one and all to attend an Installation Dinner Dance on May 28 from 8 p.m. to 2 a.m. at the Brookhaven Center. A donation of \$10 includes dinner, open bar and continuous music. The evening's entertainment will be provided by the MJB Jazz Band and DJ "Master Mike." For tickets and information contact Mary Durham, Ext. 3427, or Berthel Becton, Ext. 4961.

The regular monthly meeting of the club will be held on Tuesday, May 17 at noon in Room A, Berkner Hall. All employees are invited to attend.

## 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 present Laboratory employees.

1867. **FABRICATION ASSISTANT** - Requires a working knowledge of machining, welding, sheet metal fabrication and a thorough knowledge of materials. Individuals will prepare job orders for fabrication, materials and shop supply orders and numerical controlled machine tool programs. Central Shops Division.

1868. **ELECTRICIAN A** - Under minimum supervision, lays out, constructs, installs, maintains, repairs and operates electrical systems, equipment, controls and related devices. Requires minimum of five years' industrial electrical experience. Plant Engineering Division.

1869. **SECRETARIAL POSITION** - Requires extensive knowledge of Laboratory procedures and the ability to perform administrative and technical secretarial duties for a large group of people. Should have several years' experience as a lead Secretary at the Division level. Excellent technical typing required, word processing skills desirable. Accelerator Department/Colliding Beam Accelerator.

**OPEN RECRUITMENT:** Opportunities for present Laboratory employees and outside applicants.

1870. **TECHNICAL POSITIONS (3)** - Requires AAS degree in mechanical technology or equivalent and experience with cryogenic devices and/or vacuum leak detectors. Will be involved with the assembly, operation and maintenance of cryogenic refrigerators and associated systems. Occasional shift work. Accelerator Department/Colliding Beam Accelerator.

1871. **CLERICAL POSITION** - Requires excellent typing skills and the ability to use a computer terminal for processing records as well as general office skills. Will work in Production Material Control Group. Accelerator Department/Colliding Beam Accelerator.

### Autos & Auto Supplies

77 **CADILLAC** - Coupe DeVille, p/s, p/b, a/c, power sunroof, am/fm 8-track, low mi., fully equipped, excel. cond. Gary, Ext. 2350.

81 **CHEVETTE** - 2 dr., 4 spd., am/fm tape, like new exterior, deluxe interior, radials, \$3,700. 473-2473.

74 **VW** - Super Beetle, 58,00 mi., lt. blue, excel. cond. in/out, 4 new radial tires, \$2,500. 589-5490.

72 **HONDA** - CL-100, good cond., \$150. Dan, Ext. 7518 or 929-3195 eves.

73 **SUZUKI** - T-500, good cond., fairing, saddlebags, many new parts. Dan, Ext. 7518 or 929-3195 eves.

81 **DATSUN 210** - low mi., good cond. Ext. 4395.

71 **DODGE CHARGER** - radials, new carburetor, starter, water pump, fuel pump, needs minor work, \$375. 744-9802.

73 **PONTIAC CATALINA** - 2 door, runs good, reliable transportation, \$400. 744-9802 eves.

79 **HONDA MOTORCYCLE** - CM400T, 2,000 mi., garaged, must sell, \$1,000. Ext. 7125.

80 **KAWASAKI** - 660, LTD, red, crash bars, helmet, excel., \$1,850. Bob Johnson, Ext. 3354.

75 **HONDA STREET BIKE** - CB125S, factory over-hall, clean. Ext. 4489.

80 **HONDA HAWK** - CB400T, excel. cond., low mileage, extras, \$895. 286-8814 after 5:30 p.m.

79 **FORD FAIRMONT FUTURA** - 2 dr., 6 cyl., radials, 4 spd., 41,000 mi., asking, \$3,500. 271-5981.

**DUNE BUGGY** - new paint, new parts, mint, best offer. John, Ext. 5385 or 744-0290.

72 **DODGE POLARA** - 4 dr., a/t, p/s, p/b, good running, \$450. 924-8213 after 5:30 p.m.

74 **WILDERNESS TRAILER** - 18', self-contained shower, sleeps 6, elec. brakes, excel. cond., \$3,000. 878-1934.

79 **HONDA DIRT BIKE** - Z50R, 50cc, mint cond., hardly used, \$240. Ext. 3604 or 878-0516 after 6 p.m.

76 **BUICK REGAL** - good cond., a/c, p/s, tape, silver, a/t, \$2,000. Sandy, Ext. 4933 or 369-2065 after 5 p.m.

**B. SONIC CAR STEREO** - w/pair of speakers, new, not used, \$120 or best offer. Richard, Ext. 4584.

80 **HONDA** - CB125S, commuting or fun, light beginners cycle, w/helmet, \$550. Ext. 4761 or 924-3556 eves.

74 **FORD GALAXY** - runs good, 2 dr., a/c, p/s, hi mileage, good body, \$800. Joe, Ext. 4661.

70 **VW BUG** - semi-auto, rebuilt engine, new brakes, \$650. 543-4531.

75 **VEGA** - 4 cyl., excel. running, new shocks, exhaust, heavy duty clutch, \$1,400. Whitey, Ext. 2913 or Ramona, 928-3088.

81 **CITATION** - 4 dr., V6, a/t, a/c, p/s, p/b, low miles, \$4,595. 567-9025 after 6 p.m.

73 **FORD GRAN TORINO** - a/t, p/s, a/c, clean, \$1,100. 929-4840.

79 **HONDA MOTORCYCLE** - 750F Super Sport, 2,700 mi., professionally maintained, polyglycolated, garaged, \$2,100. 473-7809.

74 **CAMARO** - 8 cyl., a/c, p/s, p/b, new interior, 7 band equalizer, 100W speakers, custom rims, new tires, new trans., \$2,000. 929-4258 after 6.

72 **HONDA MOTORCYCLE FRAME** - 750cc, custom rigid frame w/fender & seat, oil tank, many extra parts, asking \$350. 654-2076 eves.

**VW PARTS** - muffler assemblies, \$28; bumpers, \$27; 009 distributor, \$36; full line of new parts at discount prices, call for needs. Augie, Ext. 2419 or 289-4211 eves.

78 **YAMAHA MOTORCYCLE** - 650 Special, new tires & battery, excel. cond., garaged, asking \$1,350. Bill, 563-1647.

81 **HONDA CIVIC** - am/fm cassette, radials, clean, 2 dr., lift back, \$3,800. Janet, Ext. 4049 or 744-8087.

71 **CHRYSLER** - 4 dr. sedan, a/t, p/s, p/b, a/c, \$400. Ext. 2610 or 744-5709.

75 **T-BIRD** - grey on grey, full power, has all options, excel. cond. in & out; (2) radial tires, 185R7014, like new, \$65/pr. See Greg at Service Station or 399-4213.

78 **PORSCHE** - 33,000 mi., fm, a/c, \$9,000. 212-358-5705.

**RIMS** - slotted chrome, 14", Plymouth, 2/\$25; (1) white lettered F-70 tire, mounted included. 744-3141.

73 **BUICK REGAL PARTS** - & glass, negotiable. Mike, 727-4922 after 5 p.m.

75 **TRIUMPH TR6** - needs work, \$1,700. Ext. 5053 or 472-1735 after 5 p.m.

79 **OLDS CUTLESS CALAIS** - T-roof, a/c, am/fm cassette, electric windows, rear defroster, black/grey, \$5,500. Ext. 7009.

78 **FIAT SPYDER** - 1800, convertible, 5 spd., 49,000 mi., very good cond. 589-0643.

74 **FIAT ENGINE** - & transmission, new valves & rebuilt transmission, \$175. Peter, Ext. 2734 or 928-2469.

73 **PLYMOUTH DUSTER** - 6 cyl., 3 spd. on floor, high miles, \$700 or best offer. Randy, Ext. 5410 or 399-0039.

73 **TOYOTA PICK UP** - 4 spd., recent valve job, good cond., \$1,600. Al, Ext. 5128.

77 **FIAT SPYDER** - convertible, 4 cyl., heater, new brakes, Michelin radials, canvas cover, excel. cond., \$2,800. 757-9352.

73 **CAPRI** - 4 cyl., a/t, 25 mpg, \$550. Frank, Ext. 2314 or 567-5131.

**TRAILER HITCH** - class III, 10K lbs., carrier & head, \$75; Ford carburetor, 2 bl. pass. or truck, 1965-1974 with instr. sheet, \$25. 732-5004

74 **TR6** - excel. in & out, new top. John, 585-4741.

77 **HONDA MOTORCYCLE** - 750F Super Sport, low mileage, many extras, runs excel. Jim, Ext. 4095 or 665-7535.

**TIRES** - (4) Goodyear polyglass G70-15', raised white letter, excel., \$125. Fred, 234-8229.

80 **PONTIAC TURBO TRANS AM** - p/s, p/b, p/w, a/c, t-top, excel. cond., am/fm, asking \$8,500; 1969 Olds Ninety-Eight, good running cond., all power, needs minor work, asking \$600; used cars, \$1,000 & up. Steve, 929-6877 after 5:30 p.m.

73 **PLYMOUTH STATION WAGON** - 123,000 mi., orig. owner, immaculate, good running cond., good tires, \$750. Bob, 473-7377.

### Boats & Marine Supplies

**CHRYSLER ENGINE** - '73, 105 HP, new power pack, tune-up, winterized, runs perfect; 20' Owens wood boat w/cabin, '59, \$850 for both or \$650 for eng. & \$250 for boat. Linda, Ext. 2733.

16' **CONET** - wood and fiberglass, new trailer, aluminum mast, best reasonable offer. Bernie, Ext. 4842 or 331-2298.

**SUNFISH** - new sail, excel. cond., \$600. Joe, Ext. 7961 or 878-2655 eves.

32' **CAMPER NICHOLSON** - ocean going, little ship, diesel, self steering, lifecraft dinghy, \$43,000. 922-9220 eve.

**SAILFISH** - wood hull, \$300. Bill, Ext. 4633.

15' **M.F.G.** - fiberglass, boat motor, trailer, asking, \$600. Ext. 3457 or 698-5701.

1954 **CHRIS CRAFT EXPRESS CRUISER** - repowered 135 HP Palmer, classic A-1 shape, \$2,300. HR2-1206.

**SUNFISH SAILBOAT** - & trailer, excel. cond. Ext. 7148 or 363-2522 after 6 p.m.

1981 **TRI-HULL** - all fiberglass w/65 HP Mercury, showroom cond., dock space in E. Moriches avail., \$2,600. 399-4122.

**MARINE ENGINE PARTS** - new, used, reconditioned, large inventory, Johnson, Evinrude, OMC, Sterndrive. 265-5218 eves.

1967 **EVINRUDE** - 100 HP, excel. cond., \$225. 298-9581.

14' **BLUEJAY SAILBOAT** - fiberglass over wood, old, asking \$500 or make offer. Ken, Ext. 7959 or 581-1169 eves.

18' **SPEEDBOAT** - 1969 Chris Craft, mahogany, PROP - Merc 65-150, excel., \$35. Les, Ext. 4107.

33' **PEARSON SAILBOAT** - weekly chartering, bareboat, Aug. 8-31, will deliver, \$500 weekly. M. King, 567-0821.

**LOBSTER POTS** - (5) sea pots, 42" long, 700 ft. rope & bouys, \$60. Carl, Ext. 3499 or 928-6944.

**ZINCS** - shaft collars, rudder buttons, outdrives, OMC, Merc., Volvo, etc. Bob, Ext. 4664 or 298-4089.

35' **PEMBROKE F/B** - sedan T/Chry. V-8's, sleeps 7, fully equipped, luxury live aboard. GR5-8710.

### Yard Sale

**MIDDLE ISLAND** - Boy Scout yard sale, Sat., May 14, 10 a.m. to 4 p.m., Anchor Bank, Rt. 25. 924-3528.

**BROOKHAVEN** - fabric samples, misc. items, May 13-14, 9 a.m. to 5 p.m., 10 Epsom Course.

**PATCHOGUE** - May 13-14, 10 a.m. to 4 p.m., 101 Jennings Ave., depression glass, clothing misc.

**FT. SALONGA** - craft & yard sale, May 27, 10 a.m. - 4 p.m., Greenknoll Ct., off 25A, rain date May 28. Ellen, Ext. 4513.

### Free

**CONVERTIBLE SOFA** - black vinyl, for church or other non-profit institution. Bernie, Ext. 4842.

**FIREWOOD** - cut the trees, take the wood, 30 to 40 ft. high trees. Walt, Ext. 2907 or 698-0576.

**BIRD DOG** - male, altered, loves children, 10 mo. old, must have large yard. Ronnie, Ext. 7958.

**GERMAN SHEPHERD** - AKC, 1-1/2 yrs. old, female, good disposition & behavior w/children or adults, to good home only. Ext. 2492 or 475-8658 after 6 p.m.

**BLACK LABRADOR** - female, spayed, 2 yrs. old, good watch dog, nice family dog. 286-1205.

### Miscellaneous

**CHANDELIER** - 4 light, lovely, old, \$75, flexible; child's bike, 2-wheel, convertible, \$15. 286-3847.

**BOY'S THREE PIECE SUIT** - Botany, navy, size 14, \$25. Sue, Ext. 7235 or 399-1736 after 5 p.m.

**GRAY FOX** - mounted in natural pose on log, \$125 firm. Bob, Ext. 3354.

**ROLL-TOP DESK** - solid oak, \$500; GE 19" color TV, remote control, \$425. 981-9584 eves.

**FOLDING BICYCLES** - (2), 3 spd., \$60/ea. Bill, Ext. 4633.

**BEDROOM SET** - oriental style, dresser, chest, black lacquer w/mother of pearl inlaid, \$600/ea. 981-4419.

**BABY ITEMS** - 5 drawer changing table, \$20; crib bumper, dust ruffle, 6 sheets, pr. curtains, diaper stacker, \$30/set. Peter, Ext. 2304.

**BABY WALKER** - \$4; training chair w/wood frame, \$5, (will persons answering last ad for walker please call again). Ext. 7530.

**TENNIS AND RAQUETBALL EQUIP.** - name brands wholesale. Rich, Ext. 4482 or 277-1129.

**DINING ROOM SET** - table, 6 chairs, buffet, solid pecan, \$650; couch, \$100. 744-1845.

**KEROSENE HEATER** - Sears 9,300 BTU, used only 1 season \$90; 9' pool table, AMF Grand Prix, slate top, automatic ball return, excel. cond., all accessories \$1,095. Linda, Ext. 2733.

**POWER SNOW PLOW** - 8 ft., new cutting blade & hoses, complete undercarriage & controls. 758-6892 after 6 p.m.

**MATTRESS** - boxspring, frame, \$30; loveseat, brown, beige, blue, country style, \$100. Joe, Ext. 7961 or 878-2655 eves.

**DINETTE SET** - with 2 chairs, colonial, \$50; clothes dryer, gas, \$35. Ext. 3153 or 744-1418.

**LEATHER SPORTS COAT** - sz. 42, very good cond., \$40; pool stick w/case, prof. model, sacrifice for \$25; guitar amplifier w/case, old but good, \$25; RCA 19" color TV, has picture but needs work, \$30; compact washing machine, great for apt., \$50. 399-4122.

**UNISEX TIE-DYED T-SHIRTS** - in adult sizes. Hovi, Ext. 2923 or 3102 eves.

**CANOPY FRAME** - white, good cond., \$50. Ext. 2964.

**ENGLISH COCKER SPANIEL PUPPIES** - all shots, 3 black males, 1 black & tan female, reasonable. Liz, 286-1662.

**ORGAN** - Gilbransen electronic, 2 keyboards, \$75. Dick, Ext. 2911.

**SYNTHESIZER** - Multivox MX2000, excel. cond., \$400. 363-2614 after 6 p.m.

**DRESSER OR BUFFET** - Danish Modern, 18"wx30"hx5'long, \$95; chandeliers, many to choose from; bathroom vanity, headboards. Jake, Ext. 4532.

**MEN'S BICYCLE** - 10 spd., excel. cond., \$65; Oster juice extractor, \$30. Ext. 4575.

**GATE** - 5 ft. chain link, walkway gate, self-closing, all hardware included, \$35. Victor, Ext. 2395.

**GOLF CLUBS** - bag & cart, McGregor, used 1 yr., like new, excel., \$175. 732-5004.

**COMPUTER** - VIC-20 with cassette drive, joystick, 5 game cartridges, home finance and WP software, \$200. Alan, Ext. 2928 or 821-1389.

**SOFA** - loveseat & chair, beige velvet, excel. cond., \$700; oriental style rug, earthtones, 6'x9', good cond., \$100. 589-3315.

**CARPETS** - beige, 12x15; brown, 9x12; blue 10x11; grey, 8x10; brown, 12x14; coffee table. Ext. 3565 or 924-8594.

**DINING SET** - Broyhill, wood credenza, hutch, six chairs, gold upholstery, walnut, new, \$990. 732-3951 after 6 p.m.

**WET SUIT** - Parkway, men's large, mittens, boots, excel. cond., \$120. 289-0413.

**ADULT TRICYCLE** - excel. cond., \$100. Betty, 727-9016.

**TV DESCRAMBLER** - for "Spotlite," east ender's only, \$75. Paul, 727-4859.

**SOFA BED** - beige/gold stripe, good cond., \$50. 286-1097.

**BEE HIVES** - w/bees & queen, produce your own hone, \$125/ea. Hugh, Ext. 4424 or 924-3293.

**CEILING FAN** - Emerson, 36", brown, var. speed, \$50; brass chandelier, 5 light crystal, \$50. Bill, Ext. 7625 or 732-9102 eves.

**COLECOVISION CARTRIDGES** - Cosmic Avenger & Space Fury, used only once, \$20/ea. 744-8063 days.

**DOORS** - (2), 4' wide sliding for closet w/track, excel. cond., \$30. Ext. 3173.

### 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

**EAST MORICHES** - Newport Beach, 3 bdrms., 2-1/2 baths, 2-car garage, laundry rm., fireplace, fenced back yard, 2-zone heating, 1/2 acre, deeded private beach rights, docking space/launching ramp avail., near the Hamptons, \$70,000. Ext. 2733 or 878-8491.

**BROOKHAVEN** - 4 bdrms., 2 baths, formal dr., lg. lr. w/stone f/p and beamed cath. ceil., lg. eik, finished basement, brick screened patio, garage, beautifully landscaped, \$125,000. 286-1082.

**MIDDLE ISLAND** - Coventry Manor, 3 bdrm. townhouse, 5 min. to Lab, central a/c, 5 appliances, new w/w carpet, wood stove, loft den, skylights, cathedral ceiling, prime location, wonderful for family w/children, \$47,900. Ext. 5284 or 924-4237.

**MEDFORD** - older home, income property, mother/daughter, 3 apts., 2 furnished & rented, property 115'x300'+, nice residential area, reasonable taxes, 86 Oregon Avenue, \$65,000. Contact James Houlik, 581-4882 or write Wilma Eriksen, 102 W. Caribbean, Port St. Lucie, FL 33452.

**SHOREHAM** - contemp. ranch, 3 bdrms., lr., dr., eik, den, 2 1/2 p, skylight, 2-1/2 bath, 1/2 acre, private beach, covered patio, \$83,000. 744-7196.

**HOLBROOK** - 2 bdrm. house, large property, garage, new roof, siding, asking \$39,900. 585-4741.

**RIDGE** - (3) one acre wooded building plots, each 100'x400', quiet residential area, \$13,900/ea. 924-3236.

### For Rent

**MIDDLE ISLAND** - Artist Lake condo, 1 bdrm., unfurn., 5 appliances, 5 min. to Lab, avail. end of May, \$415/mo. includes heat & hot water. 331-2025 between 10 a.m.-3 p.m. or 924-5942 after 6 p.m.

**SHIRLEY** - furnished 3 rm. basement apt., business people preferred, security, \$400/mo. 399-5548.

**MT. SINAI** - 3 bdrm., 2 bath, ranch, full finished basement, fully furnished, located off Canal Rd., July 1-August 31, \$700/mo., util. not included. Ext. 4260 or 2618.

**NORTH SHIRLEY** - lovely modern 1 bdrm. apt., kitchen, dinette, lr., storage & bath, furnished, 5 min. from Lab, 1 person, \$375/mo. or business couple, \$425/mo. includes all, security & refs. required. Kathy, 281-5605, 6-8 p.m.

**EASTHAM/CAPE COD** - June-Sept., 4 bdrm. house, sleeps 8, 2 baths, washer/dryer, dishwasher, deck, near beaches, \$575 per week. 7