

The Significance of CP Violation — 25 Years Later

On July 27, 1964, a paper published in *Physical Review Letters* described an experiment performed by four researchers at BNL's Alternating Gradient Synchrotron (AGS) using detectors salvaged from the old Cosmotron and borrowing a beam of particles from another experiment.

AGS experiment E181 had started just over a year earlier, in June 1963, as a result of a page-and-a-half proposal.

"It was done very quickly," says T. Laurence Trueman, Associate Director of High Energy & Nuclear Physics. "From the time it was proposed until it was completed was just a matter of months."

Now, 25 years after publication, that *Physical Review Letters* paper has led to a better theory for the basic building blocks of matter, a new theory for the dominance of matter over antimatter in the universe and the 1980 Nobel Prize in physics for the principal researchers, James Cronin, now of the University of Chicago, and Val Fitch, of Princeton University.

This remarkable outcome was unexpected. The researchers meant to prove with high precision that a reaction that shouldn't occur didn't occur. But instead, they proved that it did — a result known to physicists as "CP violation."

To CP or Not To CP?

Physicists used to have a simple rule that it doesn't matter whether you look at a mirror image of an experiment or at the experiment itself — the physics should be the same. They called this "parity conservation."

In the late 1950s, however, physicists realized that in some cases the rule was broken — parity was violated.

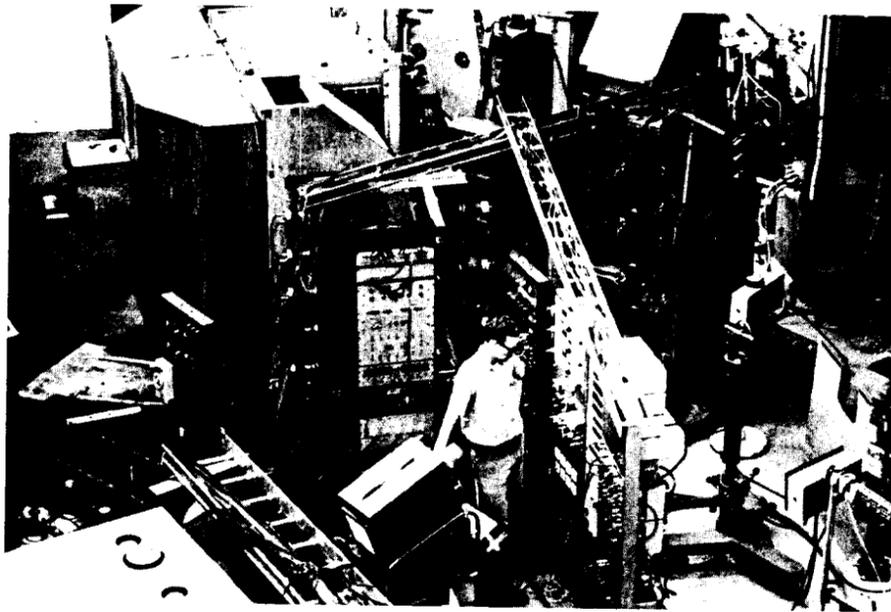
But another, more difficult rule *seemed* to work: If you looked in a mirror — changing parity — and replaced the matter with antimatter — changing charge — *then* the physics should be the same.

This supposed "symmetry" was called charge conjugation/parity, or CP, conservation.

At the AGS, Cronin and Fitch planned to test CP conservation by studying strange particles called neutral kaons, which come in two varieties: one that lasts a *short* time, called a K_S ; and one that lasts a relatively *long* time, called a K_L , which was discovered at the AGS in 1956.

According to CP conservation, the K_S can decay into two particles called pions, but the K_L can't.

AGS E181 showed otherwise: Out of 23,000 K_L decays, 45 of them produced two pions. This "CP viola-



A 1963 photograph of AGS experiment E181, which detected CP violation. A scientist is checking the electronics in the event detection system.

tion" shook up physicists quite a bit.

"When CP violation was discovered it was a revolutionary finding," says William Marciano, a high-energy theoretical physicist in BNL's Physics Department. "People thought CP was a very sacred symmetry."

But the finding was quickly accepted.

"People tried to find alternative explanations, but they were quickly ruled out," says Trueman.

Finding New Building Blocks

An important area where CP violation has proven its worth is in understanding the smallest building blocks of matter: quarks.

"In 1964, people knew about only three quarks — called up, down and strange," says Marciano. "The J particle, which revealed the existence of the fourth quark, 'charm,' was discovered at the AGS in 1974."

"What was noticed by two Japanese scientists, Kobayashi and Mas-

kawa, was that if you went from four quarks to six quarks — what's called the standard model — you could accommodate CP violation," adds Marciano.

Since then, the fifth quark, 'bottom,' has been discovered, but the sixth quark, 'top,' is still at large.

The discovery of the fifth quark vindicated the standard model and its explanation of CP violation. Though now widely accepted, the standard model is still vague: It predicts CP violation, but that prediction is based on other experimental results rather than theoretical insight.

"We don't understand why CP violation is the size that it is, but we can accommodate it," says Marciano.

Does It Matter if It's Antimatter?

The significance of CP violation ranges from the smallest pieces of nature, quarks, to the largest chunk of nature — the universe itself.

Most astronomers and physicists now believe that the universe was created roughly 15 billion years ago in a huge explosion called the "Big Bang." The energy from the blast was turned into pairs of matter and antimatter particles, which eventually went on to form the universe as we know it.

According to the scenario, an equal amount of matter and antimatter should have been created. But matter and antimatter have a nasty habit of running into each other, annihilating themselves and turning into energy in the form of light.

So, if matter and antimatter were created equally, why is the world around us made mostly of matter?

Part of the answer is that more matter than antimatter was formed during the early evolution of the universe — what physicists call a "baryon asymmetry." But how can that happen?

The answer may lie in CP violation. The BNL experiment provides an example.

One of the consequences of AGS E181 has to do with the decay of the K_L into three particles: a pion, an electron and a neutrino. If CP were conserved, the K_L would make a negative pion and a positron — the antimatter version of the electron — exactly 50 percent of the time. It would make a positive pion and an electron the other half of the time.

But because of CP violation, the K_L actually has a slightly greater chance of making negative pions and positrons: In 1,000 decays, the K_L will form about 499 electrons and 501 positrons.

If all these positrons and electrons were to crash into each other, turning themselves into light, there would be two positrons left over.

So physicists found a way to make more antimatter than matter. And, if it happens for the K_L , then maybe it

(Continued on page 2)

Lab to Slash Electric Bill by Cutting Demand

By signing an agreement to cut the Lab's electrical demand to 23 megawatts (MW) or below for up to 15 critical days from July through September, BNL may now earn rebates of \$15,600 per MW reduced from the Long Island Lighting Company (LILCO).

Effective July 1, Brookhaven joined the LILCO Energy Cooperative, a group of 380 commercial and industrial LILCO customers who have agreed to cut their electrical demand to predetermined levels on days when usage is expected to meet or exceed LILCO's generating capacity. For achieving the reductions, member institutions receive electric bill rebates up to \$15.60 per kilowatt per month.

The Lab's electric demand is lowest during the summer, when BNL's Alternating Gradient Synchrotron is annually shut down for maintenance and upgrades. Last summer, however, demand was as high as 26.5 MW, "which is lower than the rest of the year, but we still can come down 3.5 megawatts," says Mark Toscano, a staff engineer in the Energy Management Group (EMG) of BNL's Plant Engineering Division.

In a given month, if the Lab uses less than 27 MW, then all of that electricity is supplied by the New York Power Authority (NYPA). Because NYPA and LILCO share transmission lines, when the Lab

cuts its NYPA power demand, it then frees up transmission capacity for LILCO.

So, on up to 15 critical days, noon to 8 p.m. on Monday through Friday from July to September, LILCO can now call on BNL to reduce its power demand — with a minimum of two hour's notice.

On a critical day, LILCO will page Brookhaven's EMG. They, in turn, will notify the Lab's major electricity consumers: the AGS, National Syn-

chrotron Light Source, Water Treatment Plant, Steam Plant and others.

Via the plextron system, the rest of the site will be requested to reduce cooling, lower or turn off lighting and shut down non-essential equipment over the following eight hours.

As the EMG monitors energy consumption, it will be able to determine how the load was reduced proportionally. Thus, the different facilities at the Lab can be reimbursed for their share of reduction rebate.

A handshake between Parke Rohrer (third from left), BNL Associate Director for Management & Physical Plant, and Edward Youngling, Long Island Lighting Company (LILCO) Vice President for Energy Management, seals the energy cooperative agreement signed on July 20. The onlookers are: (from left) Edward Murphy, head of BNL's Energy Management Group, Plant Engineering (PE); PE staff engineer Mark Toscano; LILCO energy cooperative program supervisor, Jerry James; and Mark Culp, chairman of PE's demand-limiting committee.



Roger Stoutenburg

Coming Up

Nobel laureate Michael S. Brown will present the 19th George B. Pegram Lecture Series on Wednesday and Thursday, August 9 and 10. Brown, who is Director of the Center for Genetic Disease at the University of Texas Health Science Center, Dallas, will first talk about "Genes That Control Cholesterol." During his second presentation, Brown will discuss "When Genes and Environment Collide." Both lectures are at 8 p.m. in Berkner Hall.

Summer Students Saves With Heimlich Maneuver

When Erik Still decided not to go out to dinner with his friends on July 11, but instead to grab a quick sandwich at the Cafeteria around 6 p.m., little did he know that he would meet Lena Cutrone — and help to save her life.

"I was the only one on line at the sandwich counter, waiting to order a roast beef with cheddar," recalls Still, a health physics summer student in the Safety & Environmental Protection (S&EP) Division, "when Lena — I didn't know her name at the time — was coming over from the grill to help me. She popped a french fry in her mouth as she passed the grill, but started to choke."

"I was on my ten-minute break, making myself a hamburger with some fries and onions for supper, when I saw one more customer — Erik — and went over to help him," explained Cutrone, who has worked at the Cafeteria for the past seven months. "But on the way, a piece of french fry got stuck in my throat and I couldn't breathe, so I ran over to Larry [Sidman], who was working behind the steam table."

With Cutrone choking, unable to talk and pointing at her throat, Sidman, another Cafeteria employee, attempted the Heimlich maneuver, the emergency procedure to aid a person choking on food or another object. Named after the U.S. physi-



Roger Stoutenburgh

Behind the grill at the Cafeteria, Lena Cutrone is surrounded by her rescuers: (from left) Darin Briggs, Erik Still and Larry Sidman.

cian who devised it, the maneuver requires the rescuer to perform an upper abdominal thrust that forces air from the victim's lungs upward to dislodge the obstruction.

"I had never done this for real before, so I asked if anyone on line could do the maneuver so I could call for help," says Sidman.

As an unnamed customer tried the

maneuver on Cutrone, Sidman found that the office containing the Cafeteria's phone was locked — so he asked his co-worker Darin Briggs to run for help while Sidman looked for another phone. A volunteer with the Ridge Fire Department, Briggs ran immediately across the street — to BNL's Firehouse.

"I still couldn't breathe and I had

this terrible, terrible feeling — I did not want to die here," remembers Cutrone. "At the very moment I began to see black and I was just going down, Erik took over and did the maneuver — I was able to cough up and I could breathe again."

"I haven't had any formal training — some friends of mine had shown me how to do the maneuver," explains Still, who will enter his second year in a health-physics master's program at University of Washington. "My knowledge was sufficient this time — but I will take a CPR course. I was just glad that I took the initiative and could help."

Members of the Blue Shift of BNL's Fire & Rescue Group came on the scene just as Still succeeded in helping Cutrone, but they checked her out nonetheless.

"My throat and ribs were sore for a few days — but I'm so glad to be alive," says Cutrone. "I owe these guys for all they've done — thank God they were here at the right time. Now I'm going to take CPR, so I can help anyone else who needs it."

— Marsha Belford

To learn the Heimlich maneuver and to be trained in cardiopulmonary resuscitation (CPR) on site, ask your supervisor or your safety coordinator to arrange the training with S&EP, or call S&EP Safety Training Specialist Robert Malachowsky, Ext. 7717.

AIG Meeting

An "Introduction to PROLOG and Its Utilization in Artificial Intelligence" will be presented at the next Artificial Intelligence Group (AIG) meeting by Claude Sauders, National Synchrotron Light Source, and Inn S. Kim, Department of Nuclear Energy. They will give their talks on Thursday, August 3, in the Computing & Communication Division seminar room, Bldg. 515, at 1 p.m.

The speakers will discuss comparison of PROLOG with other computer languages, PROLOG syntax and examples of its use. For more information, call Ralph Fullwood, Ext. 2180.

Programming Seminar

The concept of object-oriented programming and how it promises to transform the world of programming and computers will be discussed by Dave Stampf, Computing & Communications Division (CCD) in a programming seminar on Tuesday, August 1, from 10:30 a.m. to noon, in the CCD Seminar Room, Bldg. 515.

Stampf will describe this important movement for the layman, as well as for the experienced programmer. A few examples from Object Pascal, Smalltalk and C will be examined and demonstrated. Those interested in this exciting topic are invited to attend.

Physical Review Has Ph.D. Opening

The American Physical Society (APS) seeks a Ph.D. physicist to join the editorial staff of *Physical Review Letters* at the APS Editorial Office, Ridge. Duties will include all aspects of journal publication, from review through production.

The requirements of the job are: a sound knowledge and broad interest in physics, strong communications skills and familiarity with the scientific community's expectations of a scientific publication. Editorial experience is desirable, but not necessary.

To be considered, send a resume and cover letter that includes a statement of current salary and other requirements to Joseph Ignacio, Personnel Manager, The American Physical Society, 1 Research Road, Box 1000, Ridge, N.Y. 11961.

CP Violation

(cont'd)

happens for other particles in a way that would make more matter than antimatter. Maybe it could even explain the baryon asymmetry in the universe.

"If you want to explain the baryon asymmetry of the universe, CP violation is necessary," says Marciano.

Unfortunately, CP violation has only been seen in one particle — the kaon.

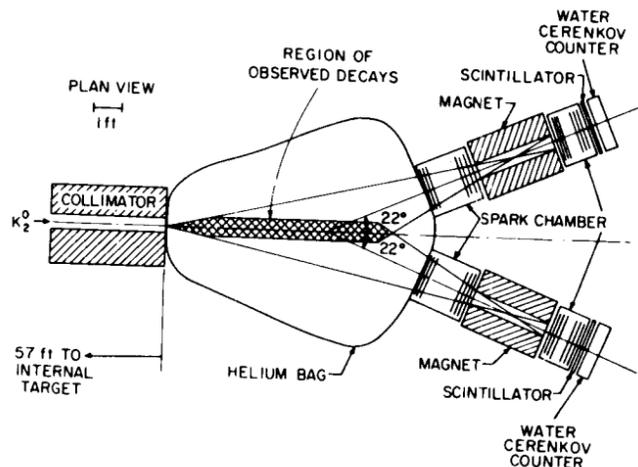
"It's not clear what the connection is between the CP violation in the kaon and the CP violation responsible for the baryon asymmetry," says Marciano.

The Future of CP

Because CP violation has so many consequences for physics and astrophysics, it's still an area of active research today, but the focus is on a new type of CP violation, called "direct" CP violation.

Fitch and Cronin saw their CP violation in the decay of the K_L particle, which turns out to be a very odd particle — it's actually a slightly uneven mixture of matter and anti-

A diagram of the experimental setup for AGS experiment E181.



matter. That unevenness causes the "indirect" CP violation.

"Indirect CP violation is the only CP violation — up until recently — that's been seen in the past 25 years," says Marciano.

But in 1987, researchers at CERN, the European particle physics laboratory, found the first evidence for direct CP violation by comparing the decays of the K_L and K_S into two pions. Other scientists are still trying to confirm that result.

"This is of great interest, because the standard model predicts there should be something there," says Marciano.

That relationship to the standard model emphasizes the role of CP violation in modern physics.

"There are still a lot of open questions out there, but CP violation is generally viewed as a fundamental problem," Trueman says. "I think its full significance is not fully understood yet."

— Kevin Eber

Inside Info

Jerome Barancik, who heads the Injury Prevention & Analysis Group in the Department of Applied Science, has received the Medical Pioneer Achievement Award from the New York Coalition for Safety Belt Use.

Presented annually, the award is given to individuals or corporations that have been instrumental in saving lives and preventing injuries on our nation's highways. In receiving the award, Barancik is in excellent company — the preceding awards were given to New York Governor Mario Cuomo and the Medical Society of the State of New York.

Barancik became involved in the issue of safety belt use even before it became mandated by New York State law in 1985. He has done several studies on injuries and is currently involved in a study using hospital records to determine whether there has been a change in the occurrence and severity of motor-vehicle crash injuries before and after the law.

The techniques of this study are

similar to those he is using for a concurrent study on occupational injuries at U.S. Department of Energy facilities.

The National Radio Astronomy Observatory (NRAO) will be getting a new telescope to replace the 300-foot radiotelescope that collapsed last November due to a stress fracture in one of its supports. The NRAO is BNL's sister laboratory because it, too, is managed by Associated Universities, Inc.

The federal government has agreed to provide \$75 million to design and build the radio telescope at NRAO's Green Bank, West Virginia site. The telescope's dish will be about 100 meters in diameter, which is about the same as its predecessor, and it will be fully steerable.

Pending final approval, work on the telescope is expected to begin late in 1989 and be completed by 1993.

Note to Employees:

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

Arrivals & Departures

Arrivals

Russel J. Reaver . . . Sfrgrds & Sec.

Departures

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

Razvan M. Mariotti AGS

Grace G. Shiue Biology

Hospitality News

A tour of the Vanderbilt Museum on Tuesday, August 8, will be sponsored by the Hospitality Committee for BNL employees and guests who live on site. The tour bus will leave from the Recreation Building in the apartment area on site at 9 a.m. and will return there around 3 p.m.

While transportation will be provided free of charge, there is an entrance fee to the museum. It is suggested that you bring your lunch.

To sign up for this trip or for additional information, call Roberta Zucker, 878-2372, or Milica Stevanovic, 821-6916.

Scoop of the Week

The scoop for summer week number six goes to Chuck LaSalla, Fire & Rescue Group of the Safety & Environmental Protection Division, for informing the Bulletin how a "Summer Student Saves With Heimlich Maneuver."



Throughout the summer, the Bulletin will be trading hop tips for scoops of cold, frozen yogurt. To enter the Scoop of the Week contest, rush your news and feature scoops to the Bulletin, Bldg. 134, or call Ext. 5053. If you scoop the Bulletin's informed sources and a story based on your idea is published, you'll win an official certificate for soft-serve, frozen yogurt, redeemable anytime at the Cafeteria.

Bowlers Needed

Female bowlers are needed this September for the Pink League on Tuesday nights in Port Jefferson. Beginners are welcome. If you are interested in joining this handicap league, contact Donna Cunningham, Ext. 4599.

Applications are now available for all bowling leagues for next season, at the BERA Sales Office located in the Cafeteria.

Service Awards

The following employees received service awards during the month of July, 1989:

Thirty-Five Years

Eleanor Grist.....Biology
Carol S. Redvanly.....Chemistry

Thirty Years

Charles Geonie Jr.....Plant Eng.
Archer J. Post.....AGS
Albert G. Prodell.....Accel. Dev.
Charles W. Zavesky Jr....Cent. Shops

Twenty-Five Years

Robert M. DiLello.....Sup. & Materiel
Nicholas J. Parinello.....AGS
Veljko Radeka.....Instrum.
Henry P. Stemm.....Cent. Shops

Twenty Years

John D. Axe Jr.....Director's Off.
Thomas Crews.....Plant Eng.
Frank G. Heimburger.....AGS
Dorothy Marelli.....Personnel
Irving Montanez.....AGS
Masaki Suenaga.....App. Science

Ten Years

John C. Biggs.....ADD
Cyrus Biscardi.....NLSL
William J. Carapezza.....ADD
Richard A. DiFranco.....AGS
Stephen M. Gill.....AGS
William J. Luckas Jr.....Nuc. Energy
Anthony Mercer.....Sup. & Materiel
Robert E. Mills.....App. Science
Ronald A. Mulderig.....Plant Eng.
Edward T. Murphy.....Plant Eng.
Lev Neymotin.....Nuc. Energy
Joseph G. O'Connor.....Reactor
Dysart A. Ravenhall Jr.....AGS
John P. Russell.....Con. & Proc.
Paul W. Sawina.....Safgrds. & Sec.
Carl A. Skrezec Sr.....AGS
Henry W. Strelecki.....ADD
John W. Tradeski Jr.....ADD
Narinder K. Tutu.....Nuc. Energy
Alcide L. Viotto.....ADD
Clarence R. Wilkins.....Sup. & Materiel

Leaving the Lab — After 35 Years or More

At the end of the month, the Bulletin salutes those employees who are retiring with 35 or more years of service.

As one of BNL's employees who celebrated 40 years of service during the Lab's 40th anniversary year, Gerald (Jerry) Strickland was featured in a June 1987 Bulletin article. At the time, he was quoted as saying, "I will be retiring at the end of December."



Jerry Strickland

December stretched on into almost two more years, as Strickland was persuaded to continue his safety and quality assurance duties in the Department of Applied Science until he reached the age of 70. Having just celebrated that birthday, he's retiring at the end of July. But for Strickland, it's not really good-bye, as he is being retained by DAS as a consultant.

A chemical engineer, Strickland came to the fledgling laboratory on August 15, 1947, at the request of Warren Winsche, with whom he had worked at Oak Ridge National Laboratory. Strickland and Winsche worked on the design and construction of the Hot Lab in Bldg. 801, which opened in 1951 and is still used today for handling radioactive chemicals.

During his years at BNL, Strick-

land and his colleagues worked on a series of efforts related to reactor fuels, on applications of metal hydrides as alternative energy-storage media and on developing coating techniques for fuel-cell electrodes.

In 1985, when he first considered retirement, Strickland took on his safety and quality assurance responsibilities. For the last two years, he's been doing that part time, so his change to retirement and consultancy is another step in his gradual process of separation.

Now, he says, "I'm looking forward to retirement. My wife and I will be staying at our home in Blue Point, but we'll be doing some traveling, and I'll probably become more involved with volunteer work. And there are repairs around the house that I've fallen behind in. Woodworking and photography are also my hobbies, so I know I'll be busy."

Still, leaving a place where you've worked for 42 years — minus two weeks — is a big step, and Strickland acknowledges, "I feel a lot better coming back as a consultant because the ties won't suddenly be broken. I will still see a lot of the people here."

When Michael Tesla started working at BNL as a rigger on April 11, 1947, he was already familiar with the Lab site, having spent four days here when it was the Army's Camp Upton, in 1942, after he enlisted in the Air Force.

Forty-one years later, in April 1988, Tesla, now a heating and maintenance engineer in the Plant Engineering Division, was strolling through the BNL woods with his partner Kenneth Anderson when Tesla stumbled across a Camp Upton leftover — what turned out to be a live land mine from World War II. A few days after the Suffolk County bomb squad had safely detonated the mine, Tesla's friend Bob Geib found the mine's metal top, which survived the blast.

Geib gave Tesla the remains, but Tesla decided, "It would just sit on my shelf in the basement. It really belongs in the Exhibit Center where people can see this World War II

souvenir and know what to watch out for in the woods." So after polishing it up, he donated the mine top to BNL's Camp Upton Historical Collection.

In between his brushes with Camp Upton, Tesla found "my second home" at BNL. That was somewhat unexpected for him. When his rigging job ended after six months, and he was offered a position in the heating department, he was not particularly interested. But he decided to stay through the next winter . . . and the next . . . and the next . . .

When Tesla started at BNL 42 years ago, he lived in Sound Beach, "but since I expected to quit," he said, "I moved to West Babylon." So for 41 years he's had a long ride to work. "At least I won't have to worry about traveling on the Expressway anymore," he said. "That's a dangerous road."

Though he "hopes to do a little traveling, visiting my children in Maryland and Florida," Tesla plans to stay on Long Island, "unless the taxes go up too high. I'm setting up a little workshop, where I'll do a little woodworking and make some toys."

But before he begins his retirement, Tesla said, "I want to thank the Lab for everything, and to wish success and happiness to BNL and to all my friends."



Michael Tesla

Outdoor Volleyball

The third mixed-league, outdoor volleyball tournament will be held on Wednesday, August 9, from about 5:15 to 8 p.m. Participation will be limited to 36 players on a first-come, first-served basis. Entry fee is \$2.

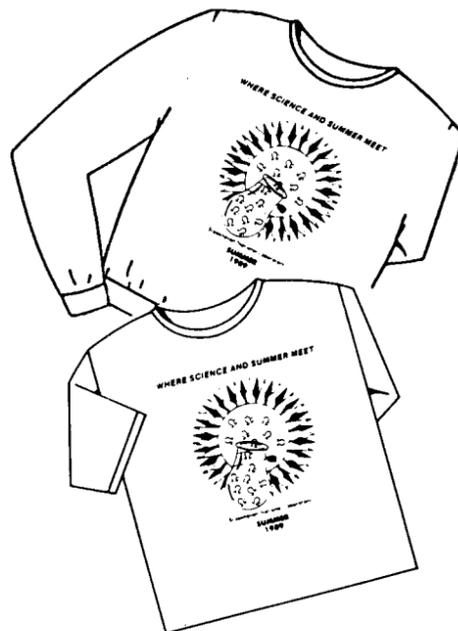
To register for the tournament, contact Kathi Barkigia, Ext. 7661, or Terry Sullivan, Ext. 2840, by Monday, August 7. In the event of bad weather, the tournament will be moved to the gym.

Summer T-Shirts and Sweatshirts

Good news for anyone who still wants to order a "Where Science and Summer Meet" BNL T-shirt or sweatshirt: The deadline has been extended through August.

The shirts are 50% cotton and 50% polyester. They are available in unisex adult sizes (small, medium, large, extra large) and unisex children's sizes (small, medium, large). T-shirts cost \$6 each, and sweatshirts are \$12 each; prices include tax.

Orders and payments can be mailed or brought to Renee Flack, Affirmative Action Office, Bldg. 185A, Ext. 3316. Each order should be accompanied by cash or a money order made payable to "Renee Flack — T-Shirts '89". No personal checks, please. Allow two weeks after placing order for delivery.



Astronomical Society

See the rings of Saturn tonight at the Astronomical Society's public open house. Society members also hope to observe Uranus and Neptune with their telescope, which was recently fine-tuned.

The program starts at 8 p.m. at the on-site Observatory. Admission for non-members is \$1. Please call Keith Power, Ext. 7772, beforehand to check that weather conditions are suitable.

Soccer Club

Pickup soccer games are now being held at the BERA field on Mondays after 5 p.m., and on Wednesdays and Fridays at noon. For more information, call Enrique Abola, Ext. 4383.

Cafeteria Menu

Monday, July 31

Soup: Tomato rice (cup) .75
(bowl) .95

Chicken fingers-sweet 'n sour or BBQ w/pot. or veg. 3.10

Pepper steak and onions 3.10

Lite line: Tuna salad platter 3.10

Hot deli: Pastrami 2.85

Tuesday, August 1

Soup: Peasant chicken chowder (cup) .75
(bowl) .95

Veal Parmesan w/garlic bread 3.10

Tuna, egg and noodles au gratin 3.10

Lite line: Fruit platter 3.10

Hot deli: Ham salad melt 2.85

Wednesday, August 2

Soup: Ham & vegetable (cup) .75
(bowl) .95

Beef chow mein 3.10

Turkey broccoli Mornay 3.10

Lite line: Chef's salad 3.10

Hot deli: Vegetarian submarine 2.85

Thursday, August 3

Soup: Cream of turkey (cup) .75
(bowl) .95

Chicken teriyaki w/pot. or veg. 3.10

Eggplant Parmesan w/garlic bread 3.10

Lite line: Broiled chicken breast 3.10

Hot deli: Corned beef 2.85

Friday, August 4

Soup: New England clam chowder (cup) .75
(bowl) .95

Beef macaroni & cheese 3.10

Lemon dill broiled fillet of whitefish 3.10

Lite line: Broiled whitefish 3.10

Hot deli: Turkey & cheese croissant 2.85

BROOKHAVEN BULLETIN

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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.

SCIENTIFIC RECRUITMENT - Candidates may apply directly to the department representative named, or through the Office of Scientific Personnel, Ext. 7813.

ASSISTANT SCIENTIST - Experimental physicist to develop monochromators, other x-ray optic instrumentation and data acquisition system for a monochromatic computed tomography system, which will be developed on the X-17 superconducting-wiggler beam line at the National Synchrotron Light Source. Contact: A. Dilmanian, Medical Department.

Motor Vehicles & Supplies

78 HONDA CX 500 - V-twin, water cooled, shaft drive, 5,700 mi., excel. cond., 2 helmets incl., \$600. 424-6931.

78 SCIROCCO TURBO - high mi., excel. tires, fuel inject., needs work, \$200. Gar, Ext. 4387.

77 LINCOLN TOWN CAR - good transportation, high mi., \$750. Bob, 288-7816.

76 KAWASAKI MOTORCYCLE - 400cc, low mi., runs well, \$400 firm. Roy, 929-3207.

73 POSTAL JEEP - L.H.D., 6-cyl., a/t, runs well, best offer. 744-4386.

72 DODGE CORONET - custom, 8-cyl., a/c, p/s, p/b, good cond., \$600. 689-2471.

72 TRIUMPH MOTORCYCLE - 650cc, runs well, looks good, \$1,250; '79 Honda CX 500 cc, \$550. Frank D., Ext. 2022 or 399-4480.

71 AMC REBEL - new trans., brakes, good battery, passed inspection, extra snow tires in trunk, asking \$75. Ron, Ext. 5502.

71 HORNET - runs well, best offer; roof luggage rack for VW Beetle, best offer. 929-6744 eves.

70 MERCEDES BENZ 250 - partially restored, new paint, leather int., 4-dr., asking \$1,200. Janene, Ext. 4660 or 369-1065 after 5:30 p.m.

HONDA ACCORD - low mi., excel. cond., \$4,500. 758-2023.

TIRES - 4. Dunlop Sport D-3, 195R60/14, A-temp., A-traction, 44 psi, \$120/all. Dave, 447-2963.

CENTER HUBCAPS - 2, for late 60's - early 70's Corvette, \$25; trailer hitch for a Wagoneer, \$20. Jim, Ext. 4452.

TIRE - new Firestone 721, 235/75R15, Eldo rim, \$50. Ernie, 588-4987.

CAR STEREO - Sears, am/fm cass., 5-band graphic eq., dig. tuning, seek/scan mem., never used, \$85. Mitch, 928-4013 eves.

HUBCAPS - 4, '80 Buick, \$7 ea.; Lee oil filters, LF-40, \$2 ea.; air filters AC, AT78CW; Lee maxi AFL-52, \$3 ea. Shiu, Ext. 3372.

88 TOYOTA SUPRA - loaded, under warranty, clean in & out, must sell, new car is in. 736-7603.

86 PONTIAC FIERO GT - red, 4-spd., 6-cyl., loaded, Eagle GT's, 35k mi., extras, mint cond., \$7,800. 924-4097.

86 CHEVROLET CAVALIER - 82k mi., a/t, p/s, 4-dr., w/nice seat cover, tuned up May, \$3,500. Ext. 3126 after 7 p.m.

86 MITSUBISHI PICKUP - 4wd, 68k mi., fiberglass cap, good cond., \$4,500. 286-4801.

86 FORD MUSTANG GT - am/fm cass., excel. in & out, \$8,500. John B., Ext. 4028 or 751-2713.

86 HYUNDAI GLS - 5-dr., 22k mi., \$3,900. Barbara, 744-0960.

86 LINCOLN TOWN CAR - brown w/tan velour interior, immaculate in & out, 33k mi., fully loaded, \$13,000. Margaret, 369-1521.

86 OLDSMOBILE CUTLASS - 6-cyl., p/w, p/s, p/b, excel. cond., \$7,900. JoAnn, Ext. 4120 or 689-7963.

85 NISSAN SENTRA XE - h/b, a/t, p/s, p/b, am/fm stereo, 66k highway mi., excel. cond., \$3,400. Kevin, Ext. 2238.

85 OLDS CUTLASS SUPREME - 2-dr., a/t, a/c, am/fm, black, mint cond., \$5,150. Pete, Ext. 2498.

85 TOYOTA COROLLA LE - 29k mi., am/fm, sunroof, a/c, cruise, 4-dr., 5-spd., burgundy, \$5,400 neg. Richard, 231-5749.

85 RAM CHARGER - 4wd, a/t, a/c, hitch, new tires, 75k mi., runs well, \$8,300. Ext. 2015.

84 DODGE CONQUEST - silver, black leather seats, new brakes, tires, excel. shape, must see, make offer. Mike, 878-0842 after 3 p.m.

84 TOYOTA CELICA GT - 80k mi., gray, sunroof, fully equipped, a/t, am/fm cass., good cond., \$5,000 neg. Richard, 231-5749.

83 NISSAN SENTRA - h/b, 4-dr., 5-spd., a/c, p/s, p/b, am/fm, excel. cond. in & out, new muffler, needs engine work, \$400. Chris, Ext. 3723 or 3200.

82 DATSUN 200 SX - 5-spd., 2-tone blue, a/c, p/w, cass., new tires, brakes, exhaust, tuned, excel. cond., \$1,695. 724-7758.

82 SUZUKI GS650L MOTORCYCLE - windshield, trunk, low mi., excel. cond., \$1,100. Joe, 728-7298.

82 PONTIAC FIREBIRD - 6-cyl., a/t, p/s, p/w, p/b, a/c, stereo cass., mint cond. in & out, must see, \$4,000. Larry, Ext. 3942 or 727-1412.

80 HONDA ACCORD - 5-spd., a/c, 4-speaker stereo, new tires, super clean, \$1,700. Joe, Ext. 5131.

80 BUICK SKYLARK - 4-dr., 107k mi., no rust, clean, runs well, many new parts, \$1,000 neg. Ext. 3076.

80 PONTIAC FIREBIRD - gray, red interior, V-6, a/t, \$2,500. Patty, 732-6311.

80 OLDSMOBILE CUTLASS - a/t, a/c, rebuilt trans., very clean, good cond., \$1,500. Ext. 4985 or 331-8459.

79 OLDS DELTA 88 - royal, 4-dr., a/t, am/fm, fully powered, sunroof, excel. running, good cond., \$1,350. Sebek, Ext. 3919 or 3203.

79 BUICK LA SABRE - 2-dr. sedan, a/t, a/c, am/fm, leather interior, new muffler, runs well, good body, \$2,000. Paul, 286-0922 after 6 p.m.

78 HONDA HAWK MC MOTORCYCLE - 400cc, helmet, windshield, extras, orig. owner, \$450 firm. Bill, 286-9097.

Boats & Marine Supplies

29' ULRICHSON - fly bridge, FWC, 327 runs well, sleeps 5, galley w/range & oven, elec. head, refrig., excel. cond., asking \$4,500. Jack, 732-2754.

19' BAYLINER CUDDY - 1986, w/trailer, 125 h.p., o.b., electric winch. Ext. 2434 or 395-1387.

19' BOWRIDER CRUISER - 1972, w/1976 115 h.p. Johnson, Coast Guard pkg., trailer w/electric winch, \$3,500. Frank, Ext. 2314 or 567-5131.

18' MACH 1 SPOILER BOWRIDER - 1987, I/O, 130 h.p., Merc Cruiser, like new, custom cover, \$8,000. 467-6034 after 6 p.m.

17' ARISTOCRAFT, 60 h.p. Merc Cruiser, I/O, recently rebuilt, w/trailer, ready to go. \$1,600. Mark, Ext. 2599.

16' TRIHULL - looks like Boston Whaler, w/40 h.p. Johnson Seahorse, elec. start, steering & full controls, \$1,200. Rob, 878-2702.

14' O'DAY JAVELIN - \$425. Terry, 473-8426.

SUN FISH - in good cond., \$625; 25 h.p. Johnson outboard, 1972, runs well, \$325. 878-2577.

Furnishings & Appliances

STOVE/REFRIGERATOR - apt. size, sink, 2-burner stove, used 6 months, 25"x30"x36"h, \$500. 286-2093.

SEWING MACHINE - Singer, in cabinet, \$25; lawn spreader, \$9; bottle capper, 60 years old, \$10. 878-6637.

DINING ROOM SET - 6 chairs, w/hutch, must see, excel. cond., \$1,700. 689-7963 or Ext. 4120.

STEREO CABINET - 4 shelves, holds speakers, asking \$35. 724-7758.

EASY LIFT CHAIR - helps you stand easily from a sitting position, also reclines, excel. cond., orig. \$1,000, sell for \$400. Ext. 3499.

WATER BED - king size; kitchen table w/4 chairs; 13" color TV & stand; convertible couch. Ext. 2957.

REFRIGERATOR - white, 18 cu. ft., 2 years old, auto ice maker, \$450 or best offer. John, Ext. 4394.

SWIVEL ROCKER - Lazy-Boy, tangerine velour, excel. cond., \$30; Tappan wall oven, range top, hood, owners manual, good cond. 286-0336.

FREEZER - Gibson, upright; ladder back chairs; sofa, antique sideboard, all in good cond. 363-7032.

STEREO CABINET - dry sink, Colonial, pine, walnut stained, excel. cond., sells for \$400, asking \$90. Bob, Ext. 3509 or 289-9533.

CAPTAIN'S BED - twin, Scandinavian-style, teak wood, 2 drawers for storage, \$160. Terry, 473-8426.

LIVING ROOM SET - rattan 7' couch, 2 chairs, navy, loose cushions, \$900; GE 25" color tv w/remote, 1 year old, \$350. 727-6998, leave message.

MICROWAVE CART - 60" table, solid maple, work top w/storage, excel. cond., new, orig. \$200, sell for \$95. Dan, Ext. 7518 or 929-3195.

MAPLE HUTCH - table & chair; microwave & cart; sofa/sleeper; oak etagere; recliner; color tv & stand. Pat, Ext. 4628.

REFRIGERATOR - General Electric, white, 11.5 cu. ft., immaculate 55 1/2" h x 24" w x 28" d, \$100. Debbie, Ext. 4269.

FREEZER - GE, upright, \$140; child's 6-drawer dresser, w/bookcase; oak 6-drawer dresser; more. Sue, 744-7060 or Johnny, Ext. 5723.

ENTERTAINMENT CENTER - Thomasville, mint cond. 361-8583 after 6 p.m.

ELECTRIC RANGE - Sunray, 20", excel. cond., \$75. Claire, Ext. 7121 or 281-8306.

COPCO PANS - 6, red, from Denmark, new, still in carton, \$20 each, \$100 for all 6. 475-4963.

COUNTER-TOP RANGE - and wall oven, Caloric, s/s, excel. cond., \$150 all. 878-8967.

WICKER HANGING LAMP - full-size headboard; loveseat & chair w/cushions, \$150. Nancy White, Ext. 3857 or 751-3298 eves.

SLIDING GLASS DOOR - thermal pane & curtain rod, \$50. Tony, Ext. 4605.

ORIENTAL BEDROOM LAMP - \$30; oak bar chair w/arms, \$50; horse shoe set, \$10; mimosa seedling, \$3; more. Kathy, 744-2203.

Tools, House & Garden

LAWN MOWER - Lawnboy, 21" cut, self-drive, w/bag & mulcher plate, \$125. Dan, Ext. 4987 or 698-7322 eves.

LAWN TRACTOR - Wheel Horse, 11 h.p., 8-spd., 36", good cond., \$595. 286-0682.

ELECTRIC MOTORS - two, 5 h. p., 3-phase, \$300. 289-0967.

WATER PUMP - three-stage jet, Flint & Walling make, new GE 1 1/2-h.p. mctor, w/pressure tank, used 3 years. 821-3925.

Sports, Hobbies & Pets

BIKE - BMX, boy's, 20", chrome frame, coaster & hand brakes, excel. cond., \$65. Justin, 286-2093.

GOLF CLUBS - Wilson, 1,200 lt., 3-pw, 3 woods, putter, \$150. Ext. 2015.

BIKE - 10-spd., pump, 2 locks, needs work, \$40. Ext. 2420.

BICYCLE - girl's, 10-spd., 24", yellow, good cond., \$40. Ext. 3126 after 7 p.m.

GOLF CLUBS - left-handed, for beginner, good cond. Rick, Ext. 2973.

STRINGING MACHINE - Omega, portable, hardly used, sells in Tennis Magazine for \$210, asking \$150. Ext. 2913.

MOUNTAIN BIKE - Ross, 10-spd., women's, new, \$150. 727-6998, leave message.

BICYCLE - girl's, 3-spd., English bike, 24", approx. 23 years old, very good cond., \$45. Dan, Ext. 7518.

BICYCLE - American, men's, large frame, 27", racing wheels, 10-spd., light blue, excel. cond., \$40. L. Davis, 325-0389.

CLASSICAL GUITAR - good for beginner, w/like new vinyl case, \$50; classical guitar w/vinyl case, no strings, \$20. Jennifer, Ext. 4938.

BASSETS - AKC registered Basset pups, champ sired, 4 males, 2 females, all shots, health guaranteed, ready Aug. 10. Robin, 286-3238.

FISH TANK - 55 gallon, complete saltwater system, w/exotic but simple filtration, many extras, \$400. Vito, Ext. 4547.

PIANO - upright, \$200 neg. Pat, Ext. 3336.

BICYCLE - Huff, 20", girl's, pink & white, excel. cond., \$30. Ext. 4302 or 744-2411.

BICYCLE - Arolite, Saint Tropez, BMX, 20", excel. cond. Bob, Ext. 5286 or Art, 298-9594.

BIKE - Columbia, 28", 10-spd., excel. cond., \$35. 286-0336.

FISH TANK - 29 gallon, salt water set-up, pumps, stones, special assorted rocks & extras, \$55. Ext. 2050 or 928-4013 eves.

FISH TANK - 55 gallon, salt water, w/cabinet, extra pump & coral, \$500. 727-6998, leave message.

AQUARIUMS - 10-gallon, 20-gallon, pump, heaters, filters, fish feeder, thermometers, etc., \$40. Joe, pager 0925 or 728-1859 eves.

POOL LADDER - over-wall, \$35; 5-gallon console humidifier, \$50; self-cleaning gas range, \$100; room gas furnace. George, 924-9656.

Audio, Video & Computers

TV - Panasonic, color, 19", excel. cond., \$75. Ext. 4985 or 331-8459.

COMPUTER - IBM PC clone, 512K ram, two 360K floppies, color graphics adapter & monitor, asking \$350. Mark, Ext. 3515.

VCR - GE, VHS, only 6 months old, warranty, \$200. Ext. 3126 after 7 p.m.

COMPUTER BOOKS - MS DOS handbook, \$10; Running MS DOS, \$10. Susan, Ext. 7716.

ARCADE MACHINE - Midway, Miss Pac Man, upright, good cond., you pick up, \$500. Warren, Ext. 4939 or 924-7552.

SOFTWARE - DOS 4.01, original, still in the box, 6 diskettes, manual, \$60. Ext. 4743.

RADIO - Sanyo, model FT528, am/fm stereo, tape player, new, best offer. Gerry, Ext. 2055.

CD STEREO SPEAKERS - 12"x31", new, still in carton, \$25/each. 286-8338.

Miscellaneous

BABY ITEMS - changing table, carriage, crib, backpack, etc.; vanity sink w/faucets; ping-pong table. Les, Ext. 5180 or 751-7746.

VINYL REPAIR KIT - professional, for anything made of vinyl, orig. \$250, asking \$100. Pete, 399-2813.

WARM-UP SUITS - 2, Adidas, women's, size large, new. Ext. 3805.

BABY SWING - like new, \$35; crib w/mattress, \$40. Ext. 3748 or 345-3271.

NIGHT GOWNS - Undercover Wear, different sizes, \$10/each. 399-2813.

Lost & Found

GLASSES - in black case, lot July 24, around Bldgs. 129 & 197B. Andy, Ext. 4210.

WALLET - found outside pool 7/17. Ext. 2420.

KEY - found at baseball field #1. Ralph, Ext. 3900.

Free

FIREWOOD - you cut, large maple. 281-7844.

FIREWOOD - trees already down, you cut up and carry. 928-2780.

DOG - 3-yr.-old black & white pointer mix. Ext. 2214.

KITTEN - 8 weeks old, orange tiger-striped, good disposition, house-broken, needs good home. Clare, Ext. 3438.

Car Pool

BOHEMIA-OAKDALE-SAVILLE - need 2 more drivers for car pool, also can meet at Exit 59 LI Expressway. Frank, Ext. 2314.

PATCHOGUE - van pool seat open, leave name & number. Ext. 4669.

Yard & Garage Sales

MANORVILLE - multifamily, household, automotive, fixtures, toys, etc., July 28-30, Woodland Ave. off Moriches-Yaphank Road. 878-1060.

BROOKHAVEN HAMLET - antiques, collectibles, jewelry, dishes, etc., 27 Chapel Ave., July 29, 9-4.

PORT JEFFERSON - 3 family, July 29, rain date August 5, 375 Old Town Road across from Ward Melville H.S. Lew Jacobson, Ext. 5198.

MANORVILLE - household items, toys, Sat. & Sun., July 30 & 31, 12:00 noon-5 p.m., 16 Florence Drive. Bob, 878-4556.

Real Estate

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

For Rent

CENTER MORICHES - 2-rm. apt. w/full bath, second floor, private ent., no pets, single or couple, avail. Aug 1, \$400/mo. +, one mo. security. Lois, Ext. 4904.

NORTH SHIRLEY - 6-bdrm. house avail., \$1,000/mo. + util. (215) 867-8064 or (215) 758-3930.

PORT JEFFERSON - Harbor Hills, furn. 3 bdrm. house, 3 baths, priv. beach, nonsmoker, \$1,200/mo. + security, 9/1/89-9/1/90. 473-3604.

PORT JEFFERSON STATION - 3-bdrm. ranch, 6 rooms + Florida room, all appliances, fenced & treed yard, \$950/mo. includes utilities. Rich, 698-5298.

SHIRLEY - 3-bdrm. apt., l/r, d/r, eik, full bath, w/w, private ent. & yard, \$950/mo. includes utilities & cable, 1 mo. security. 281-3332.

TERRYVILLE - 1-bdrm. apt., nice area, near Stony Brook University, separate ent., \$500/mo. includes utilities. George, Ext. 4406 or Linda, 928-3216 eves.

For Sale

CENTER MORICHES - 3-bdrm. ranch, quiet cul-de-sac, convenient location, near water, \$145,000. 878-0175.

HOLBROOK - 3-bdrm. townhouse/condo, 5 appl., w/w, 1 1/2 baths, tennis courts, swimming pool, clubhouse, balcony & fenced-in patio, 15-20 min. to BNL, \$129,000. Ext. 2873 or 472-3236.

MASTIC - 3-bdrm. ranch, 1/4 acre, 1 1/2 baths, den, fin. bsmt., deck, appl., house fan, 3 ceiling fans, shed, fence, near school, shopping, 15 min. to Lab, asking \$115,000. 265-2366 after 6 p.m.

MIDDLE ISLAND - Coventry Manor, 3-bdrm. townhouse, 2 full baths, kitch., l/r, d/r, laundry rm., 5 appl., ca/c, pool, tennis, asking \$106,000. Rosalie, Ext. 3160 or 289-5704 after 5:30 p.m.

N. PATCHOGUE - 3-bdrm. ranch, f/p, large kitchen, bsmt., low maint. & taxes, appliances, ig sprinklers, louvered porch, \$132,900. Arnie, Ext. 2040 or 289-1870 eves.

N. SHIRLEY - 3-bdrm., 2-bath Cape, full bsmt., remodeled, immac. cond., \$104,900. Mark, Ext. 4289 or 281-5060.

PORT JEFFERSON - 4-bdrm. Colonial, full bsmt., 2-car gar., 2 baths, ca/c, all oak floors, walk to harbor, village, mint cond., priced to sell. 474-1482 eves.

PORT JEFFERSON STATION -