BROOKHAVEN BULLETIN
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BROOKHAVEN NATIONAL LABORATORY

Axion Sought as Light Particle Answer To Dark Matter Question

From telescopic observation, it has been inferred that maybe more than 90% of the mass of the universe is missing. But don't worry — Physicist Al Prodell of the Accelerator Development Department (ADD), Senior Electrical Engineer Henry Halama of the National Synchrotron Light Source and their colleagues from the University of Rochester and Fermilab are among those trying to find it at the Lab.

In an experiment led by Research Collaborator Adrian Melissinos of Rochester, they have been searching since August 1, 1986, for hypothetical particles called axions. Axions are the leading candidates for the universal missing mass, or what is called dark matter. Axions are required to explain CP conservation in Quantum Chromodynamics (QCD), the theory describing strong interactions between quarks.

In addition to Melissinos, Prodell and Halama's visiting collaborators are: Susanna De Panfilis, Bruce Moskowitz, Joseph Rogers, Yannis Semertzidis and Walter Wuensch from the University of Rochester; and William Fowler and Frank Nezrick from Fermilab.

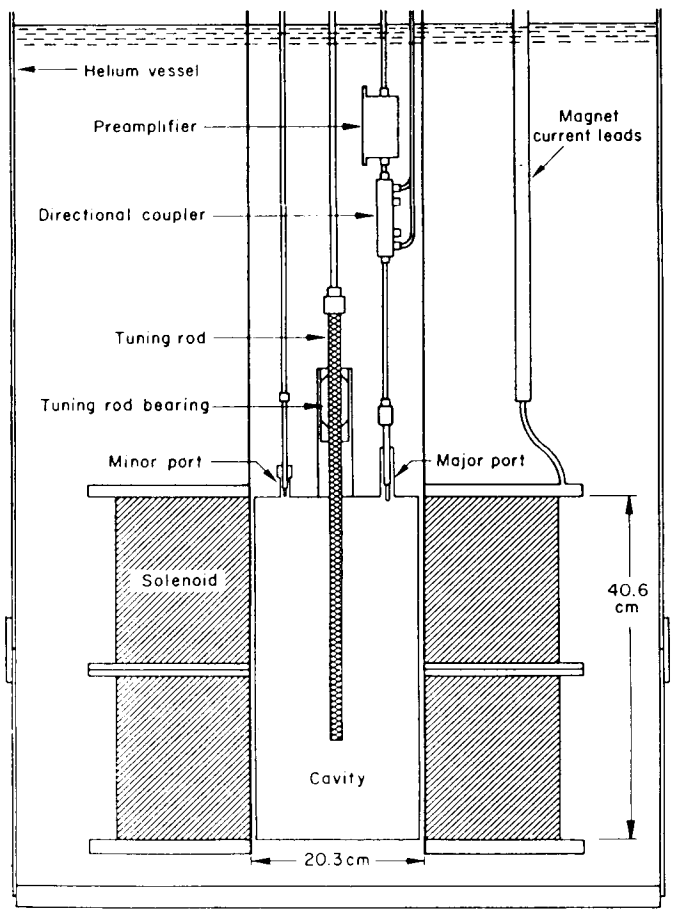
Mass was first noticed to be missing from galaxies in 1933, when an astronomer discovered that 90% of the matter in galaxy clusters was invisible. Later astronomical observations have led to the conclusion that at least 90% of all the matter in the universe is "missing," or not visible in any wavelength of electromagnetic "light." Therefore, what was invisible is called "dark" matter.

It is theorized that dark matter was made along with visible matter when the universe was created with a Big Bang, the hypothetical explosion of hot, compressed matter — all the matter now in the universe — some 20 billion years ago. As the universe expanded and cooled, physical forces split apart, particles dominated over antiparticles and particles of light matter clustered together.

Eventually, galaxies were formed, and, today, they rush apart as the universe is still expanding. Whether the universe continues to expand or whether it will collapse into itself may be determined by dark matter, as it is so massive. However, the nature of the missing mass — of what particles dark matter is made — is yet unknown.

Mort Rosen

The axion detector for Alternating Gradient Synchrotron experiment E805 resides in Bldg. 904. Pictured in front of the detector (left) are those responsible for its operation, maintenance and construction: (seated from left) Ron Picinich, Jim Briggs, Herb Hildebrand, Susanna De Panfilis, (standing from left) Yannis Semertzidis, Joe Rogers, Bruce Moskowitz, Walter Wuensch, Dan Wilson, Gary Nintzel, Roger Davis, Al Prodell, Henry Halama, and (on ladder) Bill DeJong.



Schematic of the axion detector.

Whatever it may be, each dark matter particle is thought to have some mass; as dark matter is more than 90% of the mass of the universe, it can exert a large gravitational effect. Hence, because it affects the motion of galaxies, dark matter has been indirectly detected.

To directly detect it, researchers have to first decide whether they are looking for a weakly interacting, low mass particle —like the axion, which is estimated to have a mass between 0.003 and 0.000001 electron volts — or a weakly interacting, heavy particle, like a magnetic monopole or a heavy neutrino.

The BNL, Rochester and Fermilab collaborators have chosen to search for axions, using a stimulated axion-decay scenario proposed by their colleague Pierre Sikivie of the University of Florida. In 1983, Sikivie pointed out that, according to theory, an axion in a magnetic field should decay into one microwave photon of a specific frequency.

So, the axion detector uses a microwave cavity, a cylinder of copper that traps microwaves within. If the microwaves produced by the decay of axions are of the same frequency as those of the cavity, they should resonate within the cavity, and the enhanced signal would be detected by a microwave receiver connected to the cavity.

Though estimated to be about 2.0 gigahertz, the frequency of the axion decay is unknown. Therefore, the collaborators are scanning from one to six gigahertz by using eight cavities of different sizes and, hence, eight differing frequency ranges. Each cavity is scanned twice over ten days. By slowly raising a sapphire rod in the resonator over the ten-day scan, each cavity is tuned over its frequency range.

The expected signal should be narrow, about one kilohertz. "It is like looking for a very narrow radio signal on a wideband radio," explains Guest Research Associate Bruce Moskowitz, "except we don't know what frequency our axion radio station is at, and there are five million stations to chose from."

There are supposed to be about 10^{13}

(Continued on page 2)

Learning Digital Electronics — Theory and Applications

Computers and control circuitry — how do they work? To get inside knowledge of the subject, 45 BNL'ers from six departments are attending an on-site course in digital electronics sponsored by De Vry Institute of Technology.

"Training runs for 16 half-day sessions from October to February, with 48 hours of classroom and 16 hours of lab," said Dennis Klein, a Senior Technical Supervisor in the National Synchrotron Light Source Department. Klein is providing liaison between BNL and De Vry.

"The course teaches the theory and practical application of digital devices and circuits, and the lab sessions provide application and trouble-shooting techniques, such as what kind of outputs to expect from certain inputs, what tools to choose or how to repair different types of failure," said Klein. "Electronics have evolved so much that these skills are needed in many Lab departments."

The Digital Electronics Training Program was arranged by Training and Development in the Personnel Division, at the recommendation of the Technical Training Advisory Committee. The committee, whose members include engineering and technical representatives from the Lab's various departments, was formed to identify Lab-wide technical training needs. Digital electronics emerged as a topic of principal interest.

According to Mary White, Training and Development Administrator, BNL will consider offering this or similar programs in the future, provided that there is sufficient interest on the part of employees and their departments.

Peter Horton

Six BNL departments are represented among the 45 employees attending the Digital Electronics Training Program. Pictured are (from left) William Cahill, National Synchrotron Light Source (NSLS) Department; Joseph Klemish, Safety & Environmental Protection Division; Thomas Huetter, who is teaching the course for De Vry Institute of Technology; Pooran Singh, Robert Best and Thomas Romano, all of NSLS.

Tributes to I.I. Rabi

I.I. Rabi's death on January 11 at the age of 89 ended a life that was rich in accomplishments. These included winning the Nobel Prize for Physics in 1944, playing a major role in U.S. science efforts in World War II, being a distinguished professor at a great university — Columbia — and helping to found both Associated Universities, Inc., and Brookhaven National Laboratory.

A private celebration of thanksgiving for the life of I.I. Rabi will be offered by his family and friends on Thursday, February 11, at 4 p.m., in St. Paul's Chapel at Columbia University.

Here, some of I.I. Rabi's many friends share their tributes to this giant of science:

Rarely has a man so completely captured and stayed attuned to the spirit of his times as did Rabi. Self-made, self-contained and fiercely independent, he moved easily among world leaders in any arena he felt was important. With commoner or king, Rab asked questions. Questions with enough bite to provoke thought, but drawn from a vast reservoir of good will. Smoke and mirrors were not for him. As scientist, statesman and sage, he pushed and prodded colleagues to simplify, to clarify.

Rab was one of the key founders of AUI. He was a major intellectual force in the creation of BNL. For decades, he personified the spirit, the purpose and the conscience of the Board of Trustees. All who knew him are profoundly grateful — for the honor and for the pleasure of his company.

— Robert E. Hughes
AUI President.

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To all of us, he was the beau ideal of the scientist-statesman and always a guiding presence. I think that no one better expressed the joy of science. The delight he took in learning shone in every question he asked and in everything he said.

— Marvin Kuschner
Chairman of the AUI Board of Trustees and Dean emeritus and Professor of Pathology, State University of New York at Stony Brook.

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Rabi was a national treasure. Throughout his life, he was deeply dedicated to science and humanity; that included his many outstanding contributions to physics and his pioneering efforts in establishing Brookhaven and CERN [the European Laboratory for Particle Physics.]

Whenever I met him, he always asked, "What's new?" On occasion, I could answer him, and he would question, "What does it do?" Rabi was always looking for the essential and basic. Probably more than any other person, he represented the best of American physics. The mixture of profound intellectual depth towards science and no-nonsense attitude towards life was what made Rabi truly unique.

— T.D. Lee
Enrico Fermi Professor of Physics, Columbia University. In 1957, Lee shared the Nobel Prize in Physics with C.N. Yang, for their proposal of non-conservation of parity, which the two theorists had worked on at BNL, as visiting scientists in the summer of 1956.

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I first met I.I. Rabi when I joined the AUI Board in 1947 and began coming to Brookhaven. But well before that, I had learned that Rabi was one of the most significant scientists in the U.S.

What I soon learned at our AUI meetings was that his most special and attractive characteristics were his broad wisdom and his deep moral sensitivity. His concerns went far beyond science and included education generally, international relations, and war and peace. His advice was sought by presidents and treasured by his friends. It became a commonplace to be told by a fellow scientist or activist, "I wasn't sure, so I called Rab and asked him what he thought."

Few people of his generation were so steadily and so deservedly influential, but I do believe that of all his postwar concerns, the welfare of BNL was closest to his heart, and, for this, the Laboratory can be rightfully proud.

— Franklin A. Long
Professor emeritus of Science and Society, Cornell University, and member of the AUI Board of Trustees almost continuously from 1947-74; named Honorary Trustee in 1975.

At BNL in October 1986, AUI President Robert Hughes (right) presented I.I. Rabi with a plaque, in recognition of his 40 years of continuous services as an AUI Trustee.

I.I.Rabi was an innovative scientist, an inspiring teacher, a statesman of science and a wonderful friend. I had the good fortune to be his graduate student at Columbia when he invented the molecular beam magnetic resonance method and to collaborate with him in the discovery of the deuteron quadrupole moment. Later, we collaborated on many occasions at MIT, Los Alamos, Columbia, Paris and elsewhere.

Rabi's research, lectures and personal discussions were all marked by his originality and fresh point of view. The first proposals for Brookhaven National Laboratory originated in such discussions with Rabi, and he worked hard and effectively to bring the dream to reality. Later, with Brookhaven as a model, he made the first proposal for CERN. Rabi was a wonderful person who will be greatly missed.

— Norman F. Ramsey
Higgins Professor of Physics at Harvard University. The idea for a Northeastern laboratory arose in discussions Ramsey and Rabi had in 1945, while they were colleagues at Columbia University.

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We all loved Rabi. He will be missed because of both the wisdom he gave and the fun derived from his interactions with people. All of science will be poorer because of his passing on, for statesmen and intellects of his stature occur all too rarely.

— Nicholas P. Samios
Director of BNL and Adjunct Professor of Physics at Columbia, where he received his B.A. and Ph.D.

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I.I. Rabi was devoted to science, especially physics, and to the institutions that provided the environment for productive research. He pursued science for its intellectual content, stimulated beneficial international competition and cooperation in science, and promoted the rational application of science in matters of national security, including arms control. His wisdom and advice were sought, respected and utilized at all levels, both nationally and internationally.

My interactions with Rab extended over almost 40 years in a variety of roles and environments: BNL, NRAO, AUI, the President's Science Advisory Committee and the International Atomic Energy Agency. A man of vision, a stimulator of thought and action, a challenger of tradition, he has left his imprint on those of us privileged to have been his associates and on the institutions he fostered.

— Gerald F. Tape
AUI Consultant, past AUI President and former BNL Deputy Director.

Axion (Cont'd)

axions per cubic centimeter, and, at the right frequency, there should be one microwave photon per second produced by axion decay. "If axions are everywhere in the galaxy, they should be inside our microwave cavity," continues Moskowitz, "except we can't hear their signal unless we get them to interact with a magnetic field and decay into microwaves."

To produce the necessary magnetic field, a six-tesla superconducting solenoid magnet surrounds the microwave cavity. "The magnet was built at BNL about 20 years ago, originally to evaluate the quality of the superconductor being manufactured for the seven-foot bubble chamber," says Al Prodell.

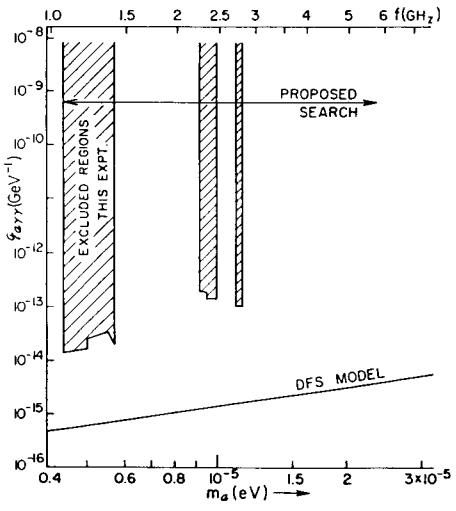
After over a year of trying to receive the axion signal, the researchers are still in the dark about where to tune in for axions. "In our first publication, we reported that we did not uncover any axions at a sensitivity that is 16 times less than what is postulated to be needed to test the most popular version of the axion theory," says Moskowitz.

This result, however, is the first experimental boundary on axions in the microwave range. Until this publication, researchers did not know — they could only theorize — that axions do not exist in the region the BNL, Rochester and Fermilab collaborators scanned.

Guest Junior Research Associate Joe Rogers explains, "With a stronger magnet, more axions would turn into microwave photons, and, with improved cavities and receivers, we could detect the axion signal more easily."

According to Prodell, the magnetic field was increased to eight teslas by the addition of an insert constructed by William Sampson and the Research & Development Group of the Magnet Division, ADD; the magnetic field may further be improved by another modification to the magnet before the experiment is completed at the end of the year.

As the axion-search team continues to look for the elusive particle, they are also undertaking a more active approach: In collaboration with Emilio Zavattini of CERN, the researchers will attempt to generate axions by using a laser beam. Again, the equipment will include reconditioned BNL apparatus, such as two CBA magnets and a refrigerator utilized for preliminary tests of the seven-foot bubble chamber magnet.



Graph showing the one-to-six-gigahertz microwave region on the upper axis to be scanned by the end of this year by the BNL, Rochester and Fermilab team searching for axions. "Excluded regions" are the microwave frequencies the team has already searched in which axions have not been found. The line labeled "DFS model" predicts the relationship between axion coupling, shown on the vertical axis, and axion mass, shown on the horizontal axis.

In the meantime, the axion-search team is undaunted. As Rogers concludes, "We are using the predictions of a simple version of a very speculative theory, but, if you make the theory a little more complicated, axions can couple more strongly to our detector. So, if nature is very kind, we will detect the axion. Whether or not we do, this is a first step."

— Marsha Belford

The BNL, Rochester and Fermilab team at the Lab is trying to detect axions that are theorized already to exist in the universe. At BNL, experimenters generally seek particles by first trying to create them using an accelerator. Axions are being sought in this manner also through an experiment at the Alternating Gradient Synchrotron, one looking for the rare decays of kaons. That rare K decay experiment, along with three others, will be discussed in an upcoming Brookhaven Bulletin article.

Arrivals & Departures

Arrivals

Leonard DeSanto Jr. ..... NSLS
Ronni D. Greene ..... Biology
Patricia M. Patterson ..... DAS
Rodney R. Porter ..... DNE
Frank Scheifele ..... AGS
Russell G. Tonkyn ..... Chemistry

Departures

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

Eugene Marichal ..... Medical
Robert Munoz ..... Sfgrds. & Sec.
John S. Ochab ..... Physics
Max J. Rose ..... Plant Eng.
Albert P. Schlafke Jr. ..... Accel. Dev.
David Zinger ..... Biology

In Memoriam

Thomas P. Browne, a Senior P&GA Specialist in the Photography & Graphic Arts Division, died on February 2, at the age of 50. Browne had been with BNL for 28 years. Within Graphic Arts, he operated the process camera used to convert photographic prints to half-tones and to create negatives for offset printing. Browne's behind-the-scenes work was an integral part of producing the Brookhaven Bulletin each week.

He was a resident of Lake Ronkonkoma and is survived by his mother Anne, of Lake Ronkonkoma, and his brother James, of Bohemia.

Stony Brook Events

The following events are scheduled at the Fine Arts Center of the State University of New York (SUNY) at Stony Brook. Call 632-7230 for ticket information:

- **Australian Chamber Orchestra** — under the direction of renowned British violinist Carl Pini, Saturday, February 6, 8 p.m.
- **Chester String Quartet** — Wednesday, February 10, 8 p.m.
- **Stony Brook Symphony Orchestra** — Saturday, February 13, 8 p.m.

Coming Up

Jerry Cooperstein, Assistant Physicist in the Physics Department, will deliver the next Brookhaven Lecture. He will speak about "When Stars Explode: Supernova 1987A," on Wednesday, February 17, at 4:30 p.m., in Berkner Hall.

Black History Month Profile

Afro-American Culture Club

Less than eight years ago, the Afro-American Culture Club (AACC) was stablished at BNL. Though it is one of the youngest organizations on the BERA roster, there are few groups that can match the 90-member AACC for the number and variety of its activities.

Traditionally, most AACC activities take place during February, Black History Month. This year's celebration kicks off tomorrow night, with the 7th Annual Gospel Extravaganza. Later on the month's agenda are an Evening of Jazz and Blues, and a Talent Show (see box for details).

As AACC President Bruce Penn points out, however, "The club is active all through the year." Every August since 1982, for example, the group has held a picnic open to the entire Lab community, and each May has seen the annual installation dinner for new officers. In addition, the AACC has been responsive to the needs of others, helping to solicit a donations to the African Relief Fund and organizing a clothing drive for those made homeless in Philadelphia after a 1985 fire.

When Dwight Brown, Greg Mack, Rick Petty and Ed Taylor first petitioned the BERA Board to sponsor the AACC in 1981, they envisioned the club as a conduit through which the majority of the Lab community could exchange positive cultural experiences.

"That's still the case," emphasizes Penn, "but unfortunately, when most people see that an event is sponsored by the AACC, they assume it's only for black employees. But our membership is open to all on-site employees and their immediate families, and we welcome participation at our events by everyone, whether as members or non-members."

In running a meaningful year-round program, one of the AACC's goals is to do it self-sufficiently. Though BERA may advance funds through its sponsorship, Penn says that the club has been able to return all those monies. "We're being sponsored but not supported by BERA," he says.

Actually, the club has gotten far enough ahead that, in 1985, it awarded its first scholarship. In 1986, after the untimely death of Dwight C. Brown, the AACC's first president, the scholarship fund was dedicated to his memory. The Dwight C. Brown Memorial Scholarships are awarded annually to children of AACC members. The first year, the scholarship consisted of a single $500 award to a graduating high school senior. Supplemented by donations, the scholarship fund has grown and, last year, two students received awards totaling $1,000 each.

While he is justly proud of this achievement, Penn, who will complete his two-year term in May, says there is still more he'd like to accomplish. "As part of the club's off-site activities, I'd like us to be more involved in minority community events," says Penn, "and I would like to see greater participation by a broader cross section of Lab employees."

Penn, a Deputy Department Administrator Manager in the Department of Nuclear Energy, became an AACC member about one year after the club was formed. "I did not expect to get so involved," he says, "but it has been a learning experience. I think everyone should be president of a group — it teaches you to compromise."

Before one can become president, however, he or she first has to be a member. AACC members pay an annual dues of $5 and meet in Berkner Hall on the third Thursday of every month. To become a member, contact Membership Chairperson Frances Ligon, Ext. 3709.

— Anita Cohen

Mort Rosen

The officers of the Afro-American Culture Club: (standing, from left) Vice President William Sells, Treasurer Rosalie Lawrence, Corresponding Secretary Barbara Kponou; (seated, from left) Recording Secretary Pauline Dixon and President Bruce Penn.

A Celebration of Black History

Three events are on the BNL calendar for Black History Month:

- **7th Annual Gospel Extravaganza,** Saturday, February 6, Berkner Hall, 7 p.m. Featuring the Central Jersey Community Choir; the Young Adult Choir, Somerset, New Jersey; the Jenkins Brothers, Somerset, New Jersey; and the Channel of Blessings, Freeport, New York. Advance tickets — $8 adults, $5 children; at the door — $10 adults, $7 children.
- **An Evening of Jazz and Blues,** Saturday, February 20, Berkner Hall, 7:30 p.m. Featuring Gwen Cleveland, accompanied by the International Jazz Ensemble; Doug "Harmonica" McLean and his five-piece Blues Band; and the MJBs, a five-piece jazz group. Advance tickets — $8 adults, $5 children; at the door —$10 adults, $7 children.
- **Talent Show,** Saturday, February 27, Berkner Hall, 7 p.m. Students from high schools throughout Long Island will compete for prizes by performing various acts. All tickets $3.

To purchase tickets for any event in advance, contact April Donegain, Ext. 2459; Mary Durham, Ext. 7143; Frances Ligon, Ext. 3709; Bruce Penn, Ext. 7213; or Public Affairs, Ext. 2345.

Learn to Garden

In March, the Cornell Cooperative Extension Association of Suffolk County will offer a series of spring gardening classes at all three campuses of Suffolk County Community College.

At the western campus in Brentwood, on Saturday, March 12, and the eastern campus in Riverhead, on Saturday, March 26, participants will be able to choose their three classes from a wide selection, which will be offered between 1 and 4:40 p.m. The fee per day is $6.

At the Ammerman campus in Selden, on Saturday, March 19, the expanded "Extension Expo" will go from 9 a.m. to 3:30 p.m. and include four classes, lunch and exhibits. The fee is $20.

All classes are first-come, first-served, and preregistration is required. For more information or to register, write to Caroline Kiang, Cornell Cooperative Extension Association of Suffolk County, 246 Griffing Avenue, Riverhead, NY 11901, or call 727-7850.

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Outside Info

On January 19, Department of Energy (DOE) Secretary John Herrington accepted as final the list of seven sites that the National Academies of Sciences and Engineering recommended as "best qualified" for the Superconducting Super Collider. The sites are located in Arizona, Colorado, Illinois, Michigan, North Carolina, Tennessee and Texas. On January 15, the state of New York had withdrawn its Rochester site from the final list. Secretary Herrington plans to designate a preferred site in July 1988 and to announce the final site selection in January 1989.

Att: Taxpayers

Does each of your dependents age five and over (including dependent adults) whom you list on your federal tax return have a Social Security number? If not, either you or they should apply for one, as you are required to include the number on all tax returns due after December 31, 1987, as per the Tax Reform Act of 1986.

In general, a person can apply for a number by mail or in person at any Social Security office. An individual who is 18 or older or was born outside the United States must apply in person. An appointment to apply can be made by phone. When you apply, you need evidence of your child's date of birth, identity and United States citizenship or lawful alien status. The application lists the proofs you can use. For more information, ask Social Security for the free leaflet, *Applying for a Social Security Number.*

Cooking Exchange

According to their lunar calendar, the Chinese will celebrate the New Year on February 17, and this year is the year of the dragon. The makings of a Chinese New Year's feast will be demonstrated on Wednesday, February 10, led by Jean Tsang. Among the recipes to be demonstrated is that for hoku, a combination of different meats, tofu, vegetables and mushrooms. Hoku is cooked at the table in a big pot, from which everyone eats directly. Other dishes to be demonstrated are silver New Year's cake, steamed rice cupcakes and assorted fried rice cakes.

All Brookhaven employees and family members are invited to attend. The meeting will take place from 12:30 to 2:30 p.m. in the Recreation Bldg. To help defray the cost of ingredients, there is a $2 charge per adult. Babysitting is available at 50¢ per child.

The Cooking Exchange has scheduled the following meetings through spring:

Date	Topic
Feb. 24	Hearty winter soups & breads
Mar. 9	English tea party & ploughman's lunch
Mar. 23	German cookery
Apr. 13	Italian cookery
Apr. 27	Mexican cookery
May 11	Fish recipes
May 25	Desserts

If you have any questions about the Cooking Exchange, please call any of the following members:

Member	Ext.
Ana Bagan	3110
Sharon Hall	3032
Kazuko Hamagaki	3089
Takako Inagaki	3112
Kazuko Kuno	3222
Meda Long	3027
Pat Pennington	3010
Milica Stevanovic	3009
Lisa Vaknin	3187

Reports Available

The following reports are now available to the Laboratory staff and to affiliates of the DOE, AUI and NRC. Others may purchase the reports from the National Technical Information Service, U.S. Dept. of Commerce, 5285 Port Royal Rd., Springfield, VA 22161. Staff members should call the designated contact at the extension listed.

BNL-52088
Contact: C. Sauter, Ext. 4207
1986 Environmental Monitoring Report. R.P. Miltenberger et al.

BNL-52090
Contact: T. Hoffman, Ext. 5257
Proceedings of the ICFA Workshop on Low Emittance e^--e^+ Beams. Held at BNL Mar. 20-25, 1987. Editors: J.B. Murphy et al.

All film badges will be changed tomorrow. Please place your badge in its assigned rack space before leaving work today.

Bowling

Red/Green League
R. Jansson bowled a 234, M. Guacci 230, T. Prach 213, D. Jesaitis 208, P. Pietraski 203, E. Sperry IV 202, E. Meier 201.

Purple League
Ed Meier rolled a 204.

In Stormy Weather:
Dial 282-INFO

Cafeteria Menu

Week of February 7

Monday, February 8

Beef barley soup	(cup)	.75
	(bowl)	.95
Fried fish w/1 veg.		2.95
Hungarian goulash over noodles		3.05
Julienne salad plate (lite-weight)		2.25
Hot deli: Turkey breast	(bread)	2.75
	(roll)	2.85
	(hero)	2.95

Tuesday, February 9

Chicken noodle soup	(cup)	.75
	(bowl)	.95
Braised Swiss steak w/1 veg.		3.05
Chicken pot pie w/1 veg.		2.95
Seasonal fresh fruit plate (lite-weight)		2.25
Hot deli: Chicken patty on a bun		2.85

Wednesday, February 10

Split pea soup	(cup)	.75
	(bowl)	.95
Broiled fresh fish w/1 veg. (lite-weight)		2.95
Roast turkey w/dressing, gravy & 1 veg.		2.95
Hot deli: Baked ham	(bread)	2.75
	(roll)	2.85
	(hero)	2.95

Thursday, February 11

U.S. Senate bean soup	(cup)	.75
	(bowl)	.95
Baby beef liver w/sautéed onions & 1 veg.		2.95
Italian lasagna w/meat sauce & garlic toast		2.95
Spinach, bacon & egg chef's platter (lite-weight)		2.25
Hot deli: Pastrami	(bread)	2.75
	(roll)	2.85
	(hero)	2.95

Friday, February 12

Fish chowder	(cup)	.75
	(bowl)	.95
Baked fish supreme w/ 1 veg. (lite-weight)		2.95
Baked macaroni & cheese w/1 veg.		2.75
Hot deli: Sloppy Joes on buns (two)		2.85

Swim Club

If you can swim a straight line, but can't dive off the starting block or flip a turn at the wall, come to the Swim Club meeting on Thursday, February 11, at 5:15 p.m., at the BNL pool. After practicing racing starts and turns, we'll hold a short workout. For more information, call Marsha Belford, Ext. 5053, or Peter Heotis, Ext. 2304.

Volleyball

Standings as of January 25

League I		League II	
Upfagrabs	29-4	Nuts & Bolts	21-9
Dinkers	25-8	Set-Ups	20-7
Xrayted	20-13	Chunga's Revenge	18-12
Cannonballs	10-23	Fossils	16-14
Phoubars	10-23	Slammers	13-14
Bumpers	5-28	Upton Ups	6-21
		Photons	5-22

League III		Open League	
Printouts	23-7	Dakota	22-2
Sourcerers	23-7	Phoenix	21-6
Spikes	18-12	Serendipity	19-8
Screwballs	16-14	Not Too Bad	11-16
Renegades	15-15	Rowdy Radicals	7-17
MISfits	14-16	Duituits	6-21
Airheads	7-23	Leftovers	4-20
Good Times	4-26		

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.

LABORATORY RECRUITMENT - Opportunities for Laboratory employees only.

2787. OFFICE SERVICES POSITION - Requires excellent computational skills, a solid background in a payroll environment and experience that demonstrates an aptitude for figures and accuracy. Proficient use of calculators and data-entry experience necessary. Fiscal Division.

2788. SECRETARIAL POSITION (temporary) - Requires AAS in secretarial science or equivalent experience and a knowledge of Laboratory policies and procedures. Duties will include preparing correspondence and technical reports on a word processor and making travel arrangements. Alternating Gradient Synchrotron Department.

2789. OFFICE SERVICES POSITION - Requires good knowledge of office practices. Responsibilities will include distribution of mail, answering telephones, typing, filing, photocopying, cataloging and shelving of books in the department library. IBM PC data-entry experience helpful. Applied Mathematics Department.

OPEN RECRUITMENT - Opportunities for Laboratory employees and outside applicants.

2790. AUTO-TRUCK MECHANIC - Under minimum supervision, performs required repairs, maintenance, servicing and incidental operation of gasoline and diesel engine vehicles, such as automobiles, trucks, trailers and material handling equipment. Responsibilities will include limited welding and brazing. Work will involve using computerized diagnostic equipment. Experience with this type of equipment highly desirable. Staff Services Division. (Reposting of Job #2755)

2791. P&GA SPECIALIST - Requies AAS in art and/or 3-5 years' equivalent experience. Skills should include LeRoy lettering, layout, paste-up, mechanical and isometric drawings. Experience with computer graphics for creating slides and viewgraphs is very desirable. Illustration Section. Photography and Graphic Arts Division.

Motor Vehicles & Supplies

81 DODGE OMNI 024 - p/s, p/b, a/t, a/c, am/fm cass., new tires & muffler, $1,500; 78 Chevy Monza, 4 speed, am/fm cass., $350 neg. 874-3796.

82 MUSTANG GT - new eng., trans., brakes, sunroof, asking $6,900; 81 Mustang, a/c, p/w, TRX wheels, asking $1,300. Ext. 4188 or 363-5170.

82 JEEP GRAND WAGONEER LTD - fully loaded, leather int., sunroof, excel. cond., $8,200. 728-0827.

80 YAMAHA 650 MAXIM - $750. 286-0422 after 6 p.m.

81 OLDS OMEGA - a/t, p/s, p/b, a/c, new brakes, rebuilt trans., $1,200. Ext. 7795 or 589-8331.

79 THUNDERBIRD - black, 88k mi., am/fm cass., a/t, full power, good cond., $1,300. Jerry, Ext. 7427 or 475-5591.

80 CITATION - 88k mi., p/s, p/b, am/fm, runs well, needs some work, best offer. Ext. 3767.

78 AMC CONCORD - a/t, p/s, radio, 83k mi., good cond. Ext. 4101 or 286-0918 eves.

86 CAMARO - red w/black int., V6, 44k mi., Kenwood stereo system, loaded, $7,500. John, 727-3673.

74 CHEVY NOVA - 3 speed, good cond., needs clutch, $100 firm. David, 369-9755.

78 CONCORD - 4 dr., a/t, p/s, am/fm cass., 6 cyl., 69k mi., good cond., $950. Beeper 251 or 281-0360.

83 TOYOTA COROLLA WAGON - 5 speed, 96k mi., am/fm cass., mint in/out, hitch. Ext. 5384.

70 MUSTANG - 250 V6, a/t, 16k mi. on rebuilt eng., runs well, best offer. 735-7940 after 6 p.m.

77 HONDA ACCORD - hatchback, a/t, a/c, am/fm radio, new brakes, exhaust, good tires, excel. in/out, runs well. 758-5592 eves.

72 CADILLAC SEDAN - excel. in/out. John, Ext. 4988 after 4 p.m.

84 HONDA CIVIC 1500 SPORT - hatchback, 5 speed, highway miles, $2,800. 821-0622.

80 RABBIT - a/t, am/fm, sunroof, new tires & brakes, good cond., $1,500. 579-2612.

80 CHEVETTE - white, 4 dr., good trans., new tires, $550. 361-8812.

85 VOLKS JETTA - a/t, a/c, am/fm cass., excel. cond., 58k mi., $5,500. Ext. 7264 or 283-7716 eves.

80 HONDA ACCORD - 4 dr., a/t, am/fm cass., 114k mi., needs ring job, $1,000 firm. 288-5059.

76 JEEP CJ-7 RENEGADE - V8, a/t, p/s, new soft top, many new parts, runs well, clean in/out, $2,800. Ext. 4142 or 345-3915 eves.

67 MERCEDES - p/s, p/b, p/w, needs some work, $400; 68 Corvette, completely rebuilt, T-top, 327 4 speed, new tires, $7,000. Bill, 399-0506.

YAKIMA CAR RACK - gutter clamp, plain alum. bars, good cond., $25; Thule ski rack, gutter clamp, like new, locks, $50. Rau, Ext. 3864.

REPAIR MANUAL - for 80 Datsun B-210. Ext. 3941.

CYLINDER HEADS - reconditioned for VW Bug; Weber carb. & assorted studs, all for $100. Fred, Ext. 4407/4435.

69 VW BUG - totally rebuilt, new paint & engine, excel. cond., $1,600 firm. Becky, 325-1703.

79 FORD WAGON - 6 cyl., very good cond., $750. 878-4865.

77 PEUGEOT 604 SEDAN - rare car, new parts, needs some work, asking $2,100. Dave, 878-8541.

82 DATSUN 200SX - 5 speed, a/c, SL pkg., 99k mi., excel. cond., asking $2,800., John, Ext. 7770/4480.

VW PARTS - 4 fenders, hood, windows, wheels & tires, more. $25 takes all. Ext. 3536 or 289-7615

83 TOYOTA SR5 PICKUP - 4wd, sunroof, loaded, excel. cond., $6,300. 584-7350.

52 DODGE PICKUP - ½-ton, solid North Carolina truck, runs well, excel. $1,700. 281-8031.

79 HONDA CIVIC - 4 speed, good gas mileage, runs well, $850 neg. 732-8216.

77 OLDS REGENCY - brown, good tires, full power, good cond., $550; 77 Buick Skylark, new tires, runs well, 1 dent, $500 neg. 399-0537 eves.

65 MUSTANG - hardtop, a/t, excel. in/out, many extras, $3,000 firm. 929-4701.

79 OLDS CUTLASS - new tires, exhaust, brakes, a/c, am/fm cass., high mileage, $800. Sally, 281-0206 after 6 p.m.

81 CHEVY CHEVETTE - new brakes, exhaust, clutch, no rust, am/fm cass., sunroof. Mark, Ext. 4132 or 924-4328.

80 RABBIT - am/fm, automatic sunroof, new tires & brakes, good cond., $1,500. 579-2612.

87 KX80 DIRT BIKE - professionally maintained, excel. cond., must see and ride, $750. Bob, Ext. 4672 or 929-4753.

Boats & Marine Supplies

21' MARATHON WEEKENDER - 1986, 170 h.p. Mercruiser, Shoreline galv. trailer, stand-up head, full galley, extras, $16,500. Ext. 3341 or 981-9474.

22' SEAFARER SAILBOAT - 1974, 3 sails, Volvo outboard, full keel, asking $4,000. Fred, Ext. 4407/4435 or 499-1214.

32' PACEMAKER - twin 220 h.p., wood hull, flying bridge, sleeps 6, full head & galley. Bill, Ext. 2807 or 281-0557.

16' ALUMACRAFT BOAT - like new, $700. Ext. 4312.

Miscellaneous

SCREENS & STORM WINDOWS - wood, 14 each, good cond., $50. Ext. 3794.

BOY'S BEDROOM SET - headboard w/frame, dresser w/mirror, night table, good cond., $100. 286-0422.

STAMP REPLICAS - Gold Leaf, w/first day of issue stamps, 2 handsome albums. Ext. 3846 or 4493.

COFFEE TABLE - new, solid oak, 3'x3', glass top, $200. Doris, Ext. 3427.

SKIS - Rossignol 160 cm, Salomon bindings, Nordica boots, size 8½, poles, excel. for beginner, 1 year old, $150/all. Richie, Ext. 2175 or 734-7342.

CAPTAIN'S BED - w/matching 5-drawer, 2-shelf dresser, excel. cond., $175. 473-8750 eves.

SEARS KENMORE DRYER - gas, old but good, $50; table saw, working, best offer. Ext. 3499 or 435-4316.

SEARS GENERATOR - portable, 1350 watts, excel. cond., $300. Joe, Ext. 2898.

SKIS - 2 pr., Hart 160, Tyrolia bindings, Caber boots, 8½, $130; Hart 170, boots, 10, $70. 744-9812.

FULL-SIZE DESK - for college student, good cond., reasonable. Annamarie, Ext. 2352 or 473-9016.

BOYS' BEDS - 2, Colonial pine frames, $125. 584-7350.

CARRIAGE/HI-CHAIR/STROLLER - $100 firm; girl's spring dresses, Easter outfit, misc., 2 yr.-3T, excel. cond. 744-3069.

UPRIGHT FREEZER - old, $75; dog transporter, large, new, $50; rototiller, works well, $50. 472-4518.

WALL UNIT - 6'x6', black laminate & dark wood, matching couch, loveseat, chair, traditional, green/black, excel. cond. Sue, 289-7218.

FISH TANKS - 2, 10 gallon, w/gravel, light, pumps, power filters, thermostats, plants, etc. $25. Ray, Ext. 3536 or 289-7615.

NINTENDO ENTERTAINMENT CENTER - new, still in box, orig. $140, sell for $100. 399-6729.

PING PONG TABLE - fold-up, w/paddles, $50. Ext. 3057.

WOMAN'S SKI BOOTS - Salornan SX60, fits 7½-8½, worn 2 years, $35. Vicki, Ext. 5205.

KEROSENE HEATER - Kerosun Omni, $25; assorted baby items. 744-9677.

SOFA - full-size, floral print, w/matching chair, very good cond., $75. 744-5077.

IBM SELECTRIC TYPEWRITER - $50; electric hamburger cooker, $5; decorative wall flower set, $2. Jim, Ext. 2432.

SKI RACKS - Barre Crafter, lockable, like new. 727-0499.

LOVESEAT & CHAIR - 6 months old, $350; Hoover Spirit vacuum, brand-new, $50. 475-7535.

HAY - for mulch, $2/bale. Ext. 3841 or 286-9450.

GIRL'S BEDROOM SET - Lea French country white, single headboard, 7-drawer dresser & mirror, $100. 924-3756.

FUR JACKET - Mouton lamb, size 14, excel. cond., $65. 475-1826 after 6 p.m.

LEICA PHOTO MAGAZINES - 1948-68, $25; Leica manual, $10; Carousel projector lens, 4", $10. Susan, Ext. 4267.

EDISON HUMIDIFIER - wood grain console, 4 gallon, $30; kitchen table w/leaf & 3 chairs, $30. Tony, 698-9274.

ORIENTAL RUG - Harachi, 6x9, handmade, wool, asking $2,500. Sheldon, Ext. 3499.

IBM COMPUTER TABLE - excel. cond. 584-7350.

BECKETT BURNER - high efficiency, flame retention, 3 circulators & fittings. Walt, Ext. 7154.

BICYCLE HELMET - Bell VI-Pro, s/m, white, new, $35. Bill, Ext. 4434.

SATELLITE TELEVISION SYSTEMS DISH - 6', w/electronics, $750; 10½' dish, w/electronics, $1,275. Ext. 5400 or 878-6098.

FURNITURE - living room set; bedroom set, w/queen size Sealy Posturepedic firm bed; Whirlpool apt.-size washer/dryer, $300. 727-0578 eves.

Lost & Found

FOUND - blue glove, right hand, Gardini, parking lot of Bldg. 197B. Ext. 2950.

Free

LOVING KITTEN - 8 mo. old, long-haired, black & white, spayed. Fern, Ext. 3969.

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

YAPHANK - small 3 rm. bungalow, single preferred, $400/incl. elect. 924-3946.

HILTON HEAD, SC - 2 bdrm. condo, sleeps 6, beach, pool, golf, tennis, winter rates, $320/wk. 585-9149.

STONY BROOK - rm. w/priv. bath, use of kitchen, quiet house, non-smoker. 862-7998.

CATSKILLS - 3 bdrm. chalet w/sleeping loft, fully furn., great skiing, near Hunter & Windham Mtns. Bea, Ext. 3642 or Kay, Ext. 4501.

PINE HILLS - studio apt., pool, tennis, avail. immed., $470/mo. incl. heat & water. Ext. 2873.

RIDGE - 3 bdrm. L-ranch, full bsmt., ⅓ acre, 4 min. to Lab, all appliances, $995/mo. Vanie, 727-5745 or 727-5771 eves.

EAST SETAUKET - 3 bdrm. hi-ranch, 1½ baths, d/r, l/r, economical coal stove, avail. immed., $925/mo. + util. & sec. Ext. 3791 or 928-7154.

NORTH SHIRLEY - 2 room apt., brand-new, priv. ent., w/w, cable, no pets, non-smoker, one person, 5 min to Lab, $450/mo. incl. util. Ext. 4512.

SHIRLEY - new 1 bdrm. apt., w/w, new appliances, mature working woman, non-smoker preferred, $575/mo. incl. all. 281-1840 after 4 p.m.

SHIRLEY - 2 bdrm. house, 10 min to Lab, $600/mo. + util. Ext. 2204.

SHIRLEY - studio apt., priv. ent., $450/mo. Ext. 2204.

For Sale

MANORVILLE - lovely 3 bdrm. ranch, on quiet cul-de-sac, 1½ baths, new carpet, 1+ acre, immed. occupancy, South Manor schools, $145,000. Ext. 5400 or 878-6098.

ROCKLEDGE, FL - block & stucco, 2 bdrm., 2 baths, d/r, kitchen, l/r, family rm., 12x25 combination porch, excel. location, $64,500. 305-631-2840.

SETAUKET - north of 25A, hilltop setting, private, 3 bdrm. ranch, 2 baths, open l/r, f/p in den, 2 car garage, patio, beautiful landscaping, Ext. 7560 or 689-7494.

HILTON HEAD, SC - 3 bdrm. condo, sleeps 8, 2 baths, washer/dryer, wet bar, 6 tennis courts, whirlpool, 3 swimming pools, golf, ocean view, asking $89,000, will rent. 929-8912.

MANORVILLE - off Eastport Manor Road, 1 acre, 175x200, all wooded. 821-3955.

CENTEREACH - 1 acre, 3 bdrm. ranch, eik, formal dining rm., f/p, large 2 car garage, dead end, asking $175,000. 585-7342 after 3 p.m.

MASTIC BEACH - 1 bdrm. ranch, city water, large property, OHW heat, excel. cond., $78,500. 281-8040.

EAST QUOGUE - ½ acre, 3 bdrms., living rm. with f/p, d/r, eik, finished bsmt., 2 car garage, 20x40 inground pool, beach rights. 728-8771 eves, leave message.

PORT JEFFERSON - 4 bdrms., 2½ baths, family rm., deck, bsmt., wooded ⅓ acre, quiet neighborhood, $198,000. 928-0281.

RIVERHEAD - mobile home in adult park on Peconic River, 2 bdrms., 1½ baths, new carpeting & floors, new bath, wood burning stove. 369-2838.

Wanted

ALUMINUM "JOHN" BOAT - approx. 4'x12', light, complete, good cond. Ext. 3794.

WOOD/COAL STOVE - rear exit flue, decent cond., reasonable. 281-4501.

KARATE UNIFORMS - men's sizes small & medium. Pete, Ext. 2465.

WOOD/METAL WORKING MACHINES - antique, by restorer, any cond. 475-5688.

PASTA MACHINE - Osrow, Simac or similar. 928-0281.

TAPE RECORDER/DICTAPHONE - cheap, to transcribe taped interviews. Ext. 3091 or 5303.

BENCH SEAT - for van. Paul, Ext. 4212.

BABY ITEMS - high chair, walker, swing, etc., good cond. Ext. 7192.

TRAINS - Lionel, American Flyer, accessories, any cond., brings good price. Carole, Ext. 7100 or 924-4097 eves.

PEOPLE FOR PRAYER GROUP - Tu./Th., noon-12:30, Chapel, Bldg. 490; singing, discussion, prayer. P. Meltugh, Ext. 3297; M. Cooper, Ext. 4105.

On-Site Services

FRIENDLY BROOKHAVEN GULF SERVICE - With our contract renewed, we can now accept credit cards again. We apologize for any inconvenience.

Services

Services are listed as a courtesy to BNL employees. They are neither screened nor recommended by the ***Bulletin****.*

CHEMISTRY TUTOR - for HS regents program, 25 years experience, wrote text. 286-8119.

TAXES PREPARED - by tax consultant, your home or mine, reasonable. Bea, Ext. 3642 or John, 732-2472.

SHEETROCKING & SPACKLING - free estimate. Kevin, 874-2386.

DRESSMAKER - or alterations. Anne, 345-3579.

CHILD CARE - my home, Port Jefferson station. 331-0367.

LANDCLEARING - using excellent rake on JD 450 track loader, $60/hr. w/operator. Tom, Ext. 4084 or 878-1060.

MAGICIAN & VENTRILOQUIST - balloon sculpture, package deals, Lab discount. 395-3963.

HOUSECLEANING - good, reliable, reasonable rates, references avail. 589-9258.

SEAMSTRESS - clothes made & altered, reasonable prices. Donna, Ext. 4430 or 924-1684 after 5 p.m.

HOME DELIVERY - brings the grocery store to your door, free delivery, competitive rates. 696-2346.

3T'S PLUMBING/HEATING - complete boiler/water heater installations, free estimates, licensed & insured. 821-3495.

FIRESIDE CHIMNEY SWEEPS - fireplaces, wood/coal & oil flues, stainless steel, prefab. & fireplace caps. Mike, 821-9690.

BRICKWORK - patios, walks, swimming pools, Belgian block, landscape ties, 20 years experience, Lab discount. Tony, 698-9274.

RUG SHAMPOOING - clean for spring, very reasonable, Lab discount. 924-6019, leave message.

CALLIGRAPHY - for all occasions, envelopes, invitations, place cards, etc. Andrea, 821-0260.

JEWELRY REPAIR - gold and silver, rings, chains, etc. Dan, Ext. 2319.

HOME MOVIES - transferred to video, excel. quality, reasonable price. 467-8297 after 6 p.m. & wknds.

SPACKLING - free estimate, excel. work, references. John, Ext. 2259 or 281-3342 after 6 p.m.