

Glueballs: Early BNL Research Supports New IBM Calculations

A *New York Times* article of December 19, 1995, announced "448 Computers Identify Particle Called Glueball," but as the following series of quotes shows, by the early 1980s, BNL's experimental physicists had seen signs of glueballs and BNL theorists had developed the tools for evaluating their properties:

"These results are in qualitative agreement with recent theoretical predictions of gluon-gluon bound states."

— **1 May 1982**, *Physical Review D*, Volume 25, Number 9, "Evidence for two new 0^{++} mesons and a possible scalar decuplet," a paper summarizing results of Alternating Gradient Synchrotron (AGS) experiment 705 performed at the Multi-particle Spectrometer (MPS)

"... these techniques have made it possible to estimate such QCD predictions as the glueball mass ..."

— **May 13, 1983**, Brookhaven Bulletin, "Lattice Supports QCD Theory," an article describing how BNL physicists had used lattice gauge theory to demonstrate aspects of the theory of quantum chromodynamics (QCD)

"It is generally believed that QCD predicts the existence of glueballs ... Whether such states have been identified so far in experiment remains ambiguous ... the identification in experiment of states with large glueball contributions is difficult if not impossible in the absence of a reliable evaluation of the properties predicted for glueballs by QCD. We believe the lattice formulation of QCD provides the most reliable method now available ..."

— **18 December 1995**, *Physical Review Letters*, Volume 75, Number 25, "Numerical Evidence for the Observation of a Scalar Glueball" by IBM Physicists James Sexton (now at Trinity College in Dublin), Alessandro Vaccarino and Donald Weingarten.

It took two years for IBM's Sexton, Vaccarino and Weingarten to complete the research cited above, which

Glueballs are the subject of discussion for BNL Physicists: (from left) Erich Willen, William Love, Ronald Longacre, Michael Creutz, Kenneth Foley, Alfred Saulys and Venetios Polychronakos.

Photo by Roger Stoutenburgh



involved continuously running 448 computers and solving one million trillion arithmetic problems. But their 1995 results bolstered two BNL efforts that began more than a dozen years before.

In 1979, BNL Senior Physicist Michael Creutz, joined by then Physics Department members Laurence Jacobs and Claudio Rebbi, started applying Monte Carlo computer-simulation methods being worked on by Robert Swendsen, then of the Physics Department's solid-state physics group, within a lattice framework proposed by Kenneth Wilson of Cornell University.

Creutz used this unique combination of mathematical techniques to study the way that quarks are confined in groups of twos or threes by the force called the strong interaction. Quarks are generally believed to be fundamental particles that are not made up of any smaller entities, though

a recent paper resulting from an experiment at Fermi National Accelerator Laboratory has questioned this.

Creutz's work on quark confinement resulted in the most cited paper in physics for 1980. Since then, his methods, which play an important role in the physics of BNL's Relativistic Heavy Ion Collider (RHIC), have been applied to QCD calculations — such as the IBM glueball search — and Creutz is universally seen as the person who made the field of QCD lattice simulation possible.

While Mike Creutz was immersing himself in lattice-gauge theory, BNL physicists Asher Etkin, Kenneth Foley, Sam Lindenbaum, Ronald Longacre, William Love, Satoshi Ozaki, Venetios Polychronakos, Alfred Saulys and Erich Willen were among those confident that they had detected glueballs at Experiment 705 at the MPS. Lindenbaum is also affiliated with City College of New York, as is Martin Kramer; collaborators also came from Tufts University, the University of Arizona and Vanderbilt University.

Glueballs, as predicted by QCD, are a direct result of strong interactions. The strong force resides in gluons, fundamental particles that are the "glue" responsible for quark confinement. QCD predicts that gluons self-interact to form glueballs, so the detection of glueballs — and hence gluons — is an important confirmation of QCD.

When it first began operating in 1974, the MPS used detectors called spark chambers to detect significant events, or interactions, from among the millions that result from each burst of protons released from the AGS ring. In 1982, the spark chambers were replaced with narrow-cell drift chambers, which offered an increase in precision and sensitivity. Throughout these changes, the spectrometer's core — a 700-ton, C-shaped magnet — remained untouched.

In 1982, the members of E705 were using the MPS to study the reaction: $\pi p \rightarrow K_s^0 K_s^0 n$, where a particle called a negative pion (π^-) collides with a proton (p), and this interaction yields three particles — two short-lived neutral kaons (K_s^0) and a neutron (n).

In analyzing their data for $\pi p \rightarrow K_s^0 K_s^0 n$, the physicists found that some of the $K_s^0 K_s^0$ came from the decay of unstable scalar mesons with unusual properties. These results were in qualitative agreement with theoretical predictions of gluon-gluon bound states, or glueballs.

However, because the properties theorized for glueballs were not expected to be much different from the properties of other particles known as singlet bosons, some question remained as to whether glueballs had really been detected.

Throughout the 1980s, the group continued to believe that they had indeed discovered glueballs, with BNL hosting a Workshop on Glueballs, Hybrids and Exotic Hadrons in 1988.

Meanwhile, Ron Longacre worked on pinning down the many param-

(continued on page 3)

Committee Investigates Employee's Concerns

Under BNL's Environmental Safety and Health Review Program, employees are encouraged to use Employee Concerns Reporting Forms to alert BNL management of a condition or conditions adverse to employee safety and health or the environment. Last December, two such forms were submitted by an employee of the Safety & Environmental Protection Division who accepted voluntary retirement last week and has sought official "whistleblower" status from the U.S. Department of Energy.

None of the concerns expressed by this employee presented an immediate threat to the employee, or to other workers, the public or the environment, concluded a committee that BNL Deputy Director Martin Blume appointed in January to review the employee's 28 concerns.

Chaired by John Baum, head of the Radiological Sciences Division in the Department of Applied Technology, the committee also included Raymond Karol, Reactor Division, and Frederick Haywood of Radian Corporation, located in Oak Ridge, Tennessee.

"Our mandate, which was clearly stated by Dr. Blume, was to freely examine all of the employee's concerns without prejudice and draw our conclusions accordingly," said Baum. "We felt no pressure to draw conclusions that would be favorable to the Laboratory."

The committee was allotted 20 working days in which to conduct its investigation, which included meeting with the employee for a two-hour interview and tours of the Lab's Hazardous Waste Management area and Bldg. 811 liquid-waste collection and treatment areas. Fifteen other staff members were also interviewed.

In addition to finding that the employee's concerns pose no immediate threat to people or the environment, the committee presented recommendations for further consideration or follow-up action on specific findings related to the employee's concerns. Touching on areas ranging from technical matters to management issues, these recommendations have been circulated for review among Lab management and other appropriate staff and should be resolved next week, Blume said.

Groundwater Tops Forum Agenda

Groundwater was the focus of the community forum meeting held on site last Thursday, February 29. Close to 50 people, including civic leaders, concerned local residents and BNL employees, attended this latest meeting of the forum, which was organized in January to provide a setting in which members of the local community can communicate directly with BNL staff on various issues of concern, particularly environmental issues.

The group queried Michael Hauptmann, Office of Environmental Restoration, on groundwater contamination from Operable Unit I, which includes BNL's two inactive landfills and the waste management area. Groundwater contamination — specifically, volatile organic compounds — from these areas in the Lab's southern portion have moved beyond BNL's property, though at depths that are below the level at which domestic wells draw potable water.

The group also got an update on the public water hookup process from Angela Harvey of the U.S. Department of Energy's (DOE) on-site office. Harvey said that the hookups will be completed by October of this year. Already, five homes have been hooked up. As of press time, 378 domestic wells in east Yaphank (previously iden-

tified in the Bulletin as North Shirley) have been analyzed; six have tested at or above the New York State Drinking Water Standard for particular chemicals, though none of the contaminants is believed to have come from BNL. About 450 homes in the area are being offered public water hookup.

The group then discussed at length the need for some independent environmental monitoring of the Lab, with some members citing trust of BNL's own data as an important issue to address.

Upcoming forum events were reviewed, and plans now include a meeting to develop the group's mission statement, two sessions on regulations and permits, a session on well monitoring, a health symposium and an overview from BNL on the Lab's research reactors.

The meeting concluded after a short BNL update from Sue Davis, Associate Director for Reactor, Safety & Security, and brief presentations by Michael Bebon, Assistant Director for Management & Physical Plant, on the sewage treatment plant upgrade (see Brookhaven Bulletin, March 1, 1996) and by Michael Brooks, Deputy to Davis, on a possible future shipment of spent fuel from the High Flux Beam Reactor.

— Mona S. Rowe

Scientists Respond to Negative Press By Spelling Out BNL's Contributions

On January 28, 1996, The New York Times *LI Weekly* section ran an article entitled "Angry Neighbors Fight Brookhaven on Water." In response, two BNL scientists sent long, thoughtful letters to Stewart Kampel, editor of the section.

A letter from John Axe, Scientific Program Head for the High Flux Beam Reactor, was printed in part in the Letters to the Editor column of the *LI Weekly* on Sunday, February 25, 1996, under the headline, "Brookhaven Work Entails Risk."

Axe explained, "When Stewart Kampel called to tell me that they intended to publish an edited version, I offered to edit it myself, to his space requirements. But I was told it's not their policy. And, obviously, I had no part in thinking up the provocative and misleading headline."

The letter is printed here in its entirety, with those parts that were omitted shown in italics:

February 2, 1996

Dear Mr. Kampel:

As noted recently in your pages (*LI Weekly*, January 28, 1996), over the past weeks some of our neighbors have expressed concerns about radioactive emissions that occur as the result of the operation of two research reactors at Brookhaven National Laboratory. BNL has operated research reactors almost from the time of the Laboratory's founding in 1947, and their operation has always been an important part of the BNL mission.

Our largest research reactor is very small in terms of the nuclear fuel used — about one ten-thousandth of that of a large nuclear power plant. But small or not, and no matter how stringent our precautions, it is simply impossible to operate reactors without introducing small amounts of radioactive material into our surroundings. Radioactive materials are a source of ionizing radiation, which in large doses is bad for us, unless we are sick, in which case its benefits may outweigh its risks. In small doses, ionizing radiation may or may not be bad for us — no one knows. But we do know that at low levels it is everywhere and unavoidable, naturally present in our food, soil, and air.

Research reactors operate under conditions that produce very small, but measurable, increases to this natural background radiation level. The highest concentrations of such additional radiation occur in or close to the reactors themselves, where my colleagues and I work daily. These emissions are closely monitored, and we accept these conditions because we



John Axe

understand and assume the risks and because they are necessary for us to carry out our research. *All of us make similar choices of the same magnitude almost unthinkingly as, for example, when we opt for the convenience of an airplane flight in spite of the additional cosmic ray exposure, or when we expose ourselves for hours to the x-rays*

that come from our TV sets (lower risk but lower reward).

That is all very well, you say, but I voluntarily accept the risk of flying because I receive the reward. What is my reward for accepting the additional risk, however slight, of enhanced radiation levels living near research reactors? Now we are finally at the nub of the question.

In fact, in the risk-reward balance, society as a whole has benefited enormously from the operation of research reactors in general, and the BNL reactors in particular. Without such research there would be no nuclear medicine. Of the estimated 12 million nuclear medicine procedures carried out annually in the U.S., over 85 percent involve the use of the radioisotope technetium-99m to visualize organs from outside the body and to diagnose their diseases or abnormalities. Work carried out at BNL discovered the ingenious way this isotope is presently produced for use in local hospitals.

Anyone who has had a thallium stress test can thank BNL scientists for the development of medical uses of thallium-201 to diagnose damage to the heart muscle. These two isotopes alone, which were discovered some years ago, have already saved many millions of lives. A more recent discovery, tin-117m, holds the promise of relieving, without the use of narcotics, the excruciating pain suffered by the 320,000 patients who develop metastatic cancer in the bone annually in the U.S. Altogether, more than 300 different radioisotopes have been produced at BNL reactors and used for medical research purposes.

In addition to producing medical radioisotopes, reactors produce beams of neutrons, which are put to various beneficial uses. Neutrons can be used directly to kill tumors in organs that have been treated with special chemicals to selectively increase their abil-

ity to absorb them. Proved successful in laboratory animals, new developments in this technique are now being evaluated at

BNL on patients afflicted with an advanced and hitherto untreatable form of brain tumor (glioblastoma).

Neutron beams are also used to probe the structure of biological molecules that control life at the cellular level. Most of what is known of the structure of ribosomes, the molecular machinery that manufactures proteins in all living cells, has come from neutron scattering studies carried out at one of the BNL reactors, as has the understanding of the structure of plasminogen, a naturally occurring molecule that dissolves blood clots.

Other recent biological studies have helped to understand trypsin, the enzyme involved in the digestion of food, and special molecules that protect human cells from invasion by flu viruses. Other studies are helping to understand how muscles contract. It is in the nature of scientific research that we cannot be sure whether or how these studies will eventually contribute to better anti-clotting drugs, flu vaccines, or weight-lifters. But they have already contributed to the pool of knowledge from which all such advances must be drawn.

Research on magnetic materials at our reactors may or may not lead to smaller, more powerful electric motors, but a major U.S. automobile manufacturer has bet research dollars that it will. There is similar promise for detergents with potential uses that include recovering oil from unproductive wells and cleaning oil spills being studied by a major U.S. oil company. They hope soon to study polymer additives that cause asphalt to resist potholes. Each year over 300 scientists from major government, industrial and university laboratories come to our reactors to perform experiments. (Incidentally, persistent rumors to the contrary, no classified research is or ever has been done at our two operating reactors.)

To summarize, the risk-reward equation vis-a-vis research reactors looks like this: On one side are the demonstrable benefits for the nation and the world of our past research and the yet-to-be-proven benefits of ongoing research. We and our neighbors of course share these benefits, but also bear some additional potential risks (so small as to be truly unquantifiable) arising from the proximity of these reactors to where we live and work. We recognize that there are those who feel this situation is inequitable. Our responsibility to them and ourselves is to work to reduce radioactive emissions to as low a level as imperfect human ingenuity permits. But, as trained scientists, engineers and technicians who are entrusted with powerful and unique instruments for the improvement of the human condition, we feel global as well as local responsibilities. We believe that most thoughtful local residents continue to support, as they have for nearly half a century, the work that we perform.



Suresh Srivastava

Sincerely yours,
John Axe

Suresh Srivastava, who heads the Radionuclide and Radiopharmaceutical Research Program in the Medical Department, sent the following letter, which has not yet been published:

Dear Mr. Kampel:

For some time now, we have been embroiled in controversy about facil-

ity operations at Brookhaven National Laboratory. (See, for example, *The NY Times*, *LI Weekly*, January 28, 1996.) Whereas an open dialogue is always healthy, it is unfortunate that the positive side of BNL operations has not received much emphasis: Fundamental research at BNL has yielded immense benefits for humankind.

For example, we have made many significant contributions in the area of nuclear medicine. The U.S. Department of Energy's national laboratories — and BNL in particular — are considered the birthplace of nuclear medicine and the sites for its continuing growth and development. As a result of research at BNL, nuclear medicine procedures have become routine and reliable diagnostic tools in patient management, not only in the U.S., but worldwide.

About 85 percent of all diagnostic nuclear medicine procedures — about 40,000 per day in the U.S. alone — employ technetium-99m and thallium-201, two isotopes (among about a dozen important ones) that were developed at BNL. A kit for labeling patients' red blood cells with technetium-99m to diagnose cardiovascular disease and gastrointestinal bleeding disorders was developed at BNL and is being used to diagnose 200,000 patients each year. The thallium-201 stress test, a benchmark diagnostic technique, is routinely used to diagnose hundreds of thousands of cardiac patients.

A new compound for relieving pain from the spread of cancer to bone, tin-117m-DTPA, was recently developed at BNL, using the Laboratory's High Flux Beam Reactor. In Phase I/II clinical trials sanctioned by the U.S. Food and Drug Administration, about 80 percent of the 40 cancer patients treated with a single dose of the tin compound experienced substantial relief from their pain. Some patients became completely pain free for as long as a year. Phase III trials under commercial sponsorship are to begin later this year. Tin-117m-DTPA has many advantages over other currently used methods and may very well become the agent of choice for relieving excruciating metastatic bone pain, thus improving the quality of life for hundreds of thousands of cancer patients.

These are only a few examples of the myriad beneficial research projects at BNL that have improved the quality of life, patient health care, and the well-being of our society. It is time that we look at the big picture and emphasize positive developments rather than use misunderstood isolated instances to inflict blame on our unique national laboratories, and BNL in particular.

Sincerely yours,
Suresh Srivastava

Remember: Precertify Hospital Stays

All active employees and those who retired after December 31, 1991, and who have Connecticut General Medical Insurance coverage are reminded to obtain hospital precertification from Intracorp. If you are retired and covered by Medicare, you *do not* have to precertify.

This precertification is mandatory for a one-or-more-night's stay in the hospital, but not for ambulatory surgery procedures for which patients are admitted to and released from the hospital the same day.

If an employee, retiree or family member fails to notify Intracorp regarding precertification or emergency hospital admission, medical insurance benefits will be reduced to cover 50 percent of the amounts otherwise payable, with a maximum penalty of \$500.

Expectant mothers *must* call Intracorp before the end of their first trimester to precertify their maternity hospital admission. They or a family member *must* also call within 24 hours following admission into the hospital for the delivery.

For hospital preadmission certification, call Intracorp at 1 (800) 772-3261 before admission to the hospital or within 48 hours of an emergency admission. Employees and retirees should advise their families of the precertification requirement, so, in case of an emergency, they can make the required telephone call to Intracorp.

For a medical insurance ID card listing the Intracorp telephone number, or for more information, call the Human Resources Division, Ext. 2877.

'95 FSA Deadline Near

To deplete your 1995 Dependent Care Reimbursement Account and/or Health Care Reimbursement Account, you must submit documentation of those respective expenses incurred in 1995 to Connecticut General by Friday, March 29. Reimbursement forms for both accounts are available in the Human Resources Division, Bldg. 185.

Please note: Prepaid services are only reimbursable once those services have actually been provided. For example, though day care or summer camp are often paid, respectively, before the start of the month or the summer, these expenses can only be reimbursed through the Dependent Care Reimbursement Account after the start date of those services. For items that must be ordered, the date the order is placed is the date the expense is incurred for the purpose of the Health Care Reimbursement Account.

Glueballs (cont'd.)

eters of the glueball state by gathering and analyzing all the world's data in this area. Lindenbaum and Longacre published these results in *Physics Letters B*, Volume 274, 16 January 1992.

Included in this paper devoted to unstable, fleeting particles are data for a particular scalar meson resonance known as $f(1710)$ — the state that the three IBM physicists believe to be "largely a scalar glueball." In their recent paper, the IBM team drew

this conclusion by comparing the results of their lattice-gauge analysis with the data presented by Longacre and Lindenbaum.

The publication of the IBM paper prompted some 13 BNL physicists to meet in the Physics Department in early January to discuss the findings and the significance of Brookhaven's contributions.

While the December *New York Times* article reporting on the IBM findings announced "2-year calculation finds numbers that match a theory," Physics Department Chair Peter Bond suggested that the headline was backward, and, based on the early research at the MPS, it should read, "2-year calculation finds a theory that matches numbers."

Regarding the use of his technique, Michael Creutz said, "This particular calculation is something we thought we could do with lattice-gauge theory from the very beginning, but there were problems — not the least of which was the sheer amount of computing power required. The IBM physicists overcame the obstacles and, with their results, it seems that glueballs really do exist."

Vinnie Polychronakos observed that the two years required to do the IBM analysis with their computers working flat out took as long as the MPS experiment of 1982. But, as Satoshi Ozaki, who is now Head of the RHIC Project, pointed out, the time involved in all the experiments that went into Lindenbaum and Longacre's analysis was considerably longer.

Of the early BNL experiments, Ken Foley said, "We did hard experiments and complicated analysis. The IBM results are a vindication of our doing a good job of measuring, and it's nice to find out that the results are so relevant over a decade later." — Anita Cohen

Tonight: BNL/FBI Training Exercise

From 5 p.m. through midnight today, the BNL Police Group and the Federal Bureau of Investigation (FBI) will conduct a joint training exercise in the areas of Railroad Avenue by the warehouses, the cottages in the apartment area, and the North and South Rooms of the Brookhaven Center, Bldg. 30. The rest of the Brookhaven Center will be open for employees' usual evening use.

During the drill, passers-by to those areas may see people in uniform carrying replica weapons and flashing lights, and may hear sirens and gunshots, though no live ammunition will be used.

All those who are not involved in the drill are asked to stay out of the three training areas during the seven hours of the operation. Those who must enter any of those areas during the drill are requested first to call BNL Police Headquarters, Ext. 2238, so a BNL patrol officer may assist in gaining access.

Computing Corner

The Computing & Communications Division (CCD) is sponsoring several upcoming programs:

Computer Training

For PC —

- 3/13 Harvard Graphics-Beginner
- 3/20 Windows-Basics
- 3/22 Word-Beginner
- 3/26 WordPerfect/Windows-Beginner
- 3/28 WordPerfect/Windows-Intermediate

For Macintosh —

- 4/25 System 7

For more information and to register for a class, call Pam Mansfield, Ext. 7286 or email: pam1@bnl.gov.

For UNIX

- 4/15-19 UNIX Fundamentals, 8:30 a.m. to noon, fee \$300
- 4/15-19 PERL Programming, 1-4:30 p.m. fee \$300
- 5/13-17 Solaris System Administration Ver 2.5, 8:30 a.m.-4 p.m., fee \$600

To register for a UNIX class, send an ILR for the appropriate amount to Mansfield, Bldg. 515, by March 25.

MIX Meeting

The next Monthly Information eXchange (MIX) meeting will take

place on Wednesday, March 13, at 11 a.m., in Room B, Berkner Hall. Network Management at BNL with Spectrum and RAID — high-performance storage systems — will be among the topics discussed. All are welcome.

OS/2 Users Meeting

The next meeting of the OS/2 users group will be on Wednesday, March 13, at 1 p.m., in the CCD seminar room, Bldg. 515.

DBExpert for OS/2 will be demonstrated, and WIN32s will be clarified.

Anyone interested in an OS/2 mailing list can e-mail to os2-request@dekarn.ccd.bnl.gov with "suscribe" as the body of the message.

Send questions to Timothy Reaves, Ext. 7056 or e-mail treaves@bnl.gov.

Software Demos

The Personal Computer Resource Center has scheduled two demonstrations next week in Bldg. 515:

- **Pegasus Mail for Windows** — Tuesday, March 12, CCD training room, in two sessions, 10-11 a.m. and 2-3 p.m. For reservations or information, contact Donna-Ree Rodriguez, Ext. 7261 or e-mail donnaree@bnl.gov.
- **Exploring the Worldwide Web With Netscape** — Thursday, March 14, 2-3 p.m., CCD seminar room. For more information, contact Laurie Pearl, Ext. 5520, e-mail pearl@bnl.gov.

On Thursday, March 14, beginning at 9 a.m. in the CCD Seminar room, Bldg. 515, representatives from Research Systems will give a technical session on their products **IDL** and **ENVI**. IDL is a visualization, analytical/graphics package that runs on a variety of platforms. ENVI is a remote-sensing/image-processing package. Bring your data sets on floppy discs to display using IDL. For more information, contact John Spiletic, Ext. 4112.

Camp Upton Featured at Exhibit — 'World War II and the Home Front'



Long Island played a critical role in the U.S. victory World War II. Once widely known as the "Cradle of Aviation," the Island was home to major manufacturers of fighter planes, such as Grumman Aircraft Engineering, Republic Aviation and Sperry Gyroscope Corporation. Long Island was also home to Camp Upton — the current site of BNL — which, during World War II, was an Army induction center for new recruits. Later, the camp expanded to become a convalescent hospital and rehabilitation center until it was phased out in 1945. Through the efforts of Janet Tempel, Supervisor of Museum Programs in BNL's Public Affairs Office, an exhibit sponsored by the Suffolk County Historical Society includes many photographs and memorabilia from the World War II days at Camp Upton. Called "World War II on the Home Front," the free exhibit at 300 West Main Street, Riverhead, is open to the public from 12:30-4:30 p.m., Tuesday-Saturday, through March. Among the photos in the exhibit is the one above, which shows the Women's Army Corps enjoying a Christmas dinner at Camp Upton's mess hall. For more information about the exhibit, call the Suffolk County Historical Society at 727-2881. — Diane Greenberg

50 YEARS AGO THIS WEEK

This series, which recounts the earliest days of Associated Universities, Inc. (AUI), and BNL, will run as appropriate throughout 1996 and 1997, the 50th anniversary years of AUI and BNL, respectively.

• **March 9, 1946** — Following Columbia University Dean George Pegram's sending a letter to Leslie Groves, Commanding General of the Manhattan District, on behalf of the institutions seeking a laboratory in the northeast, Henry Smyth, Chairman of the Physics Department at Princeton University, confers with Groves's representative Col. Kenneth Nichols and

the Scientific Advisory Committee of Manhattan District.

As the informal discussions with the Manhattan District proceed, it becomes apparent that the most effective arrangement for operating the new laboratory will involve participation by several institutions, rather than a single institution.

(To be continued on March 15.)

Bake Sale Next Week

The Upton Nursery School (UNS) will hold its annual Spring Bake Sale on Tuesday, March 12, from 11:30 a.m. to 1:30 p.m. in the lobby of Berkner Hall. Proceeds will be used to buy much needed equipment for the school.

UNS is a nonprofit, cooperative preschool, which holds classes on site three mornings a week from September through June. For more information, call Janice Steski, 929-3859, or Sue Ellen Gerchman, 929-3732.



Coming Up

The next BERA Concert, to feature outstanding young musicians from the State University of New York at Stony Brook, will be held on Tuesday, March 19, at 8 p.m. in Berkner Hall. The suggested donation is \$6 per person.

Michael Brennan, a physicist in the Alternating Gradient Synchrotron (AGS) Department, will give the 314th Brookhaven Lecture in Berkner Hall, on Wednesday, March 20. His talk on "Accelerating High-Intensity Beam at the AGS" will begin at 4 p.m.

LIANS Meeting

Kamal Bandyopadhyay, a civil engineer with BNL's Department of Advanced Technology, will speak on "High-Level Radioactive Waste at Hanford," at the Long Island Section of the American Nuclear Society (LIANS) meeting on Thursday, March 14, at the Radisson Hotel, Islandia. Bandyopadhyay's talk will follow cocktails at 6 p.m. and dinner at 7 p.m. For reservations, call Vera Meier, Ext. 7702, by March 12.

BROOKHAVEN BULLETIN

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The Brookhaven Bulletin is printed on paper containing at least 50 percent recycled materials, with 10 percent post-consumer waste. It can be recycled.



Be Social Saturday

Tomorrow, Saturday, March 9, from 8 p.m. to midnight, all are invited to the North Ballroom of the Brookhaven Center to dance the night away at the next Saturday Social sponsored by the BNL Ballroom, Latin & Swing Dance Club. The suggested contribution is \$1 per person for the club's music fund. For more information, call John Millener, social chairman, Ext. 3853.

BERA Walks & Travels

For more information on these BERA activities, call M. Kay Dellimore, Ext. 2873, or Andrea Dehler, Ext. 3347.

Walk for WalkAmerica

Join the BNL-BERA team for the 26th March of Dimes WalkAmerica for Healthier Babies on Sunday, April 28. Pick up a WalkAmerica sponsor sheet at the BERA Sales Office in Berkner Hall, weekdays 9 a.m. to 1:30 p.m.

If you cannot walk but would like to make a donation, make your check payable to the March of Dimes and mail it to the Recreation Office, Human Resources, Bldg. 185, or drop it off at the BERA Sales Office.

Travel to Disney World

Openings are still available for BERA's sixth annual 7-day, 6-night trip to Walt Disney World in Orlando, Florida, from October 15-21, for which all BERA employees, retirees and their families are eligible. Those who are still trying to make a decision are invited to drop in to the Recreation Office in the Human Resources Division, Bldg. 185, to see the family collage from previous years or to borrow the Disney Video.

Camera Club

The BERA Camera Club will next meet on Tuesday, March 12, at noon in Room C, Berkner Hall. All employees are invited to attend. The agenda includes nominations for officers and a review of club events and subjects of interest, possibly including: computer imaging, darkroom training, lighting and field trips. For more information, contact Ripp Bowman, Ext. 4672.

Arrivals & Departures

Arrivals

Christopher L. Rissland..... Medical Departures

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

Kenneth B. Dobreuenaski.....SEP
Linda L. Domrowsky.....Comp. & Comm.
Joseph C. Dudek.....Plant Eng.
Michele M. Hale.....Information Services
Paul F. Kemp.....Applied Science
Hong Li.....Biology

Bowling

Red and Green League

J. Griffin 238/215/642 scratch series, G. Weresnick 220/208/620 scratch, R. Eggert 205/205, T. Prach 244, D. Fisher 235/615 scratch, R. Larsen 232/616 scratch, R. Mulderig 225/602 scratch, J. LaBounty 221, E. Larsen 218, K. Koebel 217, F. Wahlert 216, J. Meier 213, J. Goode 212, K. Asselta 210, B. Geib 204.

Purple & White League

K. Botts 223, E. Meier 215, D. Riley 211, Musso 202/173, S. DiMaiuta 201, N. Besemer 193, Doug Fisher 192, J. Blydenburgh 190, R. Picnich 189, J. McCarthy 189, R. Wiseman 185, I. Sperry 178.

Volleyball

Standings as of February 29

Open League		League I	
Monday Maulers	42-12	Bikers n Spikers	43-14
Pass, Set & Crush	40-14	Rude Dogs	43-17
Far Side	24-27	Scared Hitless	33-30
Spikers	21-33	No Names	24-39
Bud Hitters	8-49	Underdogs	10-53
League II		League III	
Spiked Jello	39-6	Silver Bullets	36-9
Safe Sets	37-8	Just 4 Fun	30-12
Fossils	26-19	Joy of Sets	26-16
Monday Nite Live!	23-22	Harlem Knights	27-18
Jolly Veggies	21-24	Upton Ups	24-18
Nuts & Bolts	16-29	High Volley'em	18-24
Volley Folly	11-34	DO-DAT	17-25
Night Court	7-38	New Comers	8-34
		OER	6-36

Rifle & Pistol Club

The next scheduled meeting of the Rifle & Pistol Club is Wednesday, March 13, in Room 202, Bldg. 911B, at noon. For more information, call Otto Jacobi, club president, Ext. 3471.

Classified Advertisements

Placement Notices

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

Each week, the Human Resources Division lists new placement notices. The purpose of these listings is, first, to give employees an opportunity to request consideration for themselves through Human Resources, and second, for general recruiting under open recruitment. Because of the priority policy stated above, each listing does not necessarily represent an opportunity for all people.

Except when operational needs require otherwise, positions will be open for one week after publication. For more information, contact the Employment Manager, Ext. 2882, or call the JOBLINE, Ext. 7744 (344-7744), for a complete listing of all openings.

Current job openings can also be accessed via the BNL Home Page on the World Wide Web. Outside users should open "http://www.bnl.gov/bnl.html", then select "Scientific Personnel Office" for scientific staff openings or "Employment Opportunities" or "BNL Human Resources Division" for all other vacancies.

SCIENTIFIC RECRUITMENT - Doctorate usually required. Candidates may apply directly to the department representative named.

POSTDOCTORAL RESEARCH ASSOCIATE - Trained in physical sciences, with experience in synchrotron radiation, ultrahigh vacuum technology, and soft x-ray spectroscopy. Knowledge of computer-based data acquisition and experience with instrumentation development are also required. In the soft x-ray area, the successful candidate will assist in the implementation of new detector technology, which will allow the nondestructive study of adsorbed species on real powdered catalyst surfaces under actual reaction conditions. In the hard x-ray area, the successful candidate will assist in the design, implementation and data analysis of *in situ* catalysis studies using EXAFS. Contact: D.P. Siddons, National Synchrotron Light Source Department.

POSTDOCTORAL RESEARCH ASSOCIATE - Trained in high energy theory, to conduct research in elementary particle physics. Current research activities include electroweak studies, perturbative QCD, collider phenomenology, lattice gauge theories, and finite temperature field theory. Junior scientists with postdoctoral experience in these areas may be considered for appointment at the Assistant Physicist level. Contact: William Marciano, Physics Department.

POSTDOCTORAL RESEARCH ASSOCIATE - Trained in experimental particle or nuclear physics, with experience in data acquisition and triggering electronics. Knowledge of real-time operating systems, assembly language programming and computer architecture is required. The successful candidate will participate in the study of rare K decays at the AGS. Contact: Laurence Littenberg, Physics Department.

LABORATORY RECRUITMENT - Opportunities for Laboratory employees.

DD 3833. DATA SERVICES POSITION - (term appointment) Requires experience in R:Base database applications, WordPerfect for Windows 6.1 and generating data reports. Familiarity with hazardous-material documentation, including control forms and shipping manifests, desirable. Responsibilities will include maintaining files, document control, and general clerical and secretarial support for DOE Legacy Project for characterizing and disposal of materials. Safety & Environmental Protection Division.

OPEN RECRUITMENT - Opportunities for Laboratory employees and outside candidates.

NS 0484. MACHINE MAINTENANCE MECHANIC A - Under minimum supervision is responsible for inspecting, maintaining, troubleshooting, repairing and performance of major overhaul of machine tools and similar equipment, including the machining of various parts as required. Fabricates or constructs a variety of special equipment. May direct and coordinate the work of others. Requires substantial experience as machine maintenance mechanic, including familiarity with fabrication equipment, i.e. lathes and milling machines. Experience with CNC equipment a plus. Central Shops Division.

Motor Vehicles & Supplies

95 NISSAN - 2-dr., a/t, \$1,000 firm. John Toner, Ext. 2769.

94 CHEVY S10 PICKUP - low mi., 4-spd., bed cover, many extras, like new, mint cond. 727-3863.

94 GEO METRO - black/gray, 5-spd., 50 mpg, 28k mi., ac, am/fm/cass., 3 yrs. left on factory warr., \$6,500. Al, Ext. 3992 or 331-1003.

92 MITSUBISHI 3000 GT SL - red, gray leather, a/t, full power, 47k mi., bal. of 6 yr./100k mi. warr., \$16,000 neg. Paul, Ext. 2447 or 378-1486.

91 AEROSTAR VAN - 59k mi., 7-pass., showroom cond., \$6,500 firm. 281-5827.

89 SOUTHWIND MOTOR HOME - class A, 34', 6.5 kW gen., queen bed, asking \$20,000. Ken, Ext. 4423 or 924-6893.

88 FORD F-250 - red, 302 eng., 33k mi., eng. overhauled, new tires, shocks, & exhaust sys., like new, must see, \$10,500 neg. 727-8433.

88 FORD E350 VAN - 1-ton, 89k mi., navy blue, 2'6" exten., 8-cyl., a/t, util. veh., cast. racks, pkwy. windows, sliding dr. w/window, \$4,500. Kenny, 475-9027.

88 CHEVROLET SPECTRUM - 5-spd., new brakes, high mi., runs well, \$1,600. Ext. 3884.

88 MITSUBISHI MIRAGE - white, 4-cyl., 4-dr., a/t, ac, am/fm, 70k mi., excel., \$3,500. Shin'ichi, Ext. 5898.

87 TOYOTA CAMRY - 4-dr., a/t, 136k mi., orig. owner, good cond., \$2,700. Gail, 727-8308.

87 PONTIAC GRAND AM - 6-cyl., 2-dr., sunroof, needs eng., \$600. Ext. 4211 or 671-6463.

86 PLYMOUTH COLT - 77k mi., excel. running cond., \$750. Doug, Ext. 4484.

86 NISSAN 300ZX - red, T-roof, a/t, well maint., brand-new cover, 126k mi., \$4,500. Kay, Ext. 2873 or 472-5510.

86 HONDA ACCORD - 5-spd., 2-dr., p/s, p/b, 84k mi., sunroof, alarm, new clutch, tires, asking \$3,100 obo. Ext. 5507.

84 LINCOLN-MERCURY COLONY PARK WAGON - new tires, brakes, timing chain, 302, runs well, no rust, body in good cond., \$1,350. John, Ext. 7340.

84 PONTIAC FIREBIRD TRANS AM - black w/gold trim, 5.0 liter eng., V-8, 5-spd., \$1,700 neg. Rich, Ext. 5893 or 744-4816.

84 BUICK CENTURY - s/w, high mi., looks good, runs well, \$1,250 firm. Judi, Ext. 7430 or 286-6492.

84 CADILLAC ROADSTER - V-8, full power, top & grill, 53k mi., mint cond., \$3,700. Brett, 727-5956.

84 VOLVO WAGON - diesel, m/t, ac, great mpg, \$900 obo. Tony, 298-1932.

84 FORD BRONCO XLT 4x4 - rebuilt eng., high mi., \$1,500 neg. 286-8523 eves.

81 YELLOWSTONE TRAILER - sleeps 4, stove, refrig., full bath, new tires, brakes, 20' single axle, mint cond., \$2,600. 924-0705.

72 MERCEDES 220 - black, 4-dr., clean, needs head gasket, some tranny work, \$500 obo. Steve, Ext. 4414.

STRUTS - for '79-'81 Honda Accord, front & rear, new, \$60. Dennis, 878-0071.

Boats & Marine Supplies

33' HOUSEBOAT - 1969, fg, 318 Chrysler i/o, w/Dana o.d., both rebuilt, refrig., oven, stove, head, shower, v.g. cond. in/out. Tirre, Ext. 3288 or 281-0360.

30' SLOOP - 1973, modified full keel, Bill Trip design, fg, rebuilt Atomic Four engine, sails, cradle, trailer, \$10,000. Dennis, 765-3012.

23' PEARSON SAILBOAT - 1979, fixed keel, head, galley, sleeps 4, \$5,300. John, Ext. 2788.

Furnishings & Appliances

AIR CONDITIONER - 7,500 Btu, window mount, 115 Vac, runs well, \$75. Artie, Ext. 7934.

CHEST - cedar, circa 1915, \$125; twin bed, dresser, mirror, French prov., \$150; Boston rocker, \$40. all v.g. cond., 472-4559.

DINING TABLE - 4 chairs, china cabinet, \$550; lawn mower, \$100; bedroom set, tools appliances, more. 689-7462 eves./wknds.

DINING TABLE - w/leaf, 4 chairs, light oak; futon, solid pine, black & white fabric, excel. cond., best offer. 821-6856, leave message.

DRAFTING TABLE - w/machine, metal, excel. cond., \$300. 924-0705.

LIVING ROOM SET - v.g. cond., \$300. Pete, Ext. 4581/5105 or 399-2813 after 5 p.m.

PATIO SET - 6 chairs w/cushions & matching umbrella table, 40"x96", Scotchguard & pvc, all covers, orig. \$2,000, now \$1,000 obo. John, 395-5922.

REFRIGERATOR/FREEZER - Kenmore, 3 yrs. old, w/ice cube maker, 20 cu. ft., \$350. 929-6932.

STOVE - elec., Weilbitt, apt.-size, 24"x24", 4-burner w/oven, 11k watts, good cond., \$50. 363-6940 after 5 p.m.

WALL UNIT - 3 sections, dark wood, ea. 18"x d x 30" w x 72" h, one w/glass doors, all w/lower storage, orig. \$1,200, ask. \$350. Tirre, Ext. 3288 or 281-0360.

Tools, House & Garden

CHAIN SAW - Sears Craftsman, 21" bar, auto oiler, 3.7 C.I.D., w/spare chain, excel. cond., \$125. Bart, Ext. 2005 or 924-6761.

CHAIN SAW - McCulloch, 3 1/2-h.p., 2-cycle eng., asking \$120. John, Ext. 7340.

LAWN MOWER - Sears Craftsman, used 1 yr., excel. cond., \$160. 821-6856.

HOT WATER HEATER - Beacon Morris, room in-wall, 4,000 Btu, \$75. Dennis, 878-0071.

ROTO TILLER - 6-h.p.; chipper, shredder, Tomahawk, 5 1/2-h.p.; 2 Kenmore washer & dryers, like new; Toro lawn mower, rear bagger, 21". 579-0297.

STOVE - Vermont Castings Resolute, wood & coal, complete w/side shelf & heat shields, uses nut coal, ask. \$350. Bill, Ext. 2022.

TABLE SAW - Sears Craftsman, 10', older model, works well, many extras, \$250. John, 395-5922.

TREES - spruce, white pine, cedar, Doug. fir, b&b, sheared, excel. for yd./priv. 4'-8", \$20-\$75 ea., depending on selection, quantity. Tom, 878-1060.

Sports, Hobbies & Pets

BICYCLE - indoor, training stand, \$50. Joe, Ext. 4139.

BIKE - mountain, \$70; twin or full, wood headboard, \$30; canopy, \$30; CB radio, \$40. David, Ext. 7073 or 286-1633.

PIANO - Steinway upright grand, restored, excel. cond., \$2,000. Darcy, Ext. 3362 or 286-8523 eves.

PHOTO DUPLICSCOPE - make negatives from slides, \$30. Pat, Ext. 3275.

SKI BOOTS - Koflach, size 9 1/2, front-entry, 4 buckles, used 5 times, excel. cond., paid \$300, now \$50 obo. Don, Ext. 7237 or 929-6571 after 5:30 p.m.

TREADMILL - Pro Form 920, like new, \$300 neg. Don, 924-6049.

Audio, Video & Computers

CAMCORDER - Sony 8mm, model CCD-F33, w/2 batt., soft carry bag, excel. cond., \$250. Bart, Ext. 2005 or 924-6761.

CAMCORDER - Sharp Slim Cam, gently used, \$400. Kathy, Ext. 2267.

COMPUTER - IBM PS/2 model 55SX, 386 SX, 4MB RAM 30MB HD, VGA color, floppies, mouse, \$300, w/8MB RAM, \$400. Dorian, Ext. 7316.

COMPUTER - 486SX-25, 8 MB RAM 340 HD, CD-ROM, sound card, speakers, 14.4 modem, 14" monitor, \$725. Gary, Ext. 2550 or 399-7355.

RECORD COLLECTION - 1940s through 1960s, make offer. 363-6217.

TV - two: 5" port. color, ac/dc operation, charger, great picture. \$85; Hitachi, 27", M.T.S. stereo monitor, on-screen displays, \$75. Artie, Ext. 7934.

VIDEO GAME - Nintendo, deluxe joystick, NAS advantage controller, 18 games & TV monitor, like new, \$350. John, 395-5922.

WORKSTATIONS - 586DX - 100 MHz; 486DX4 - 100 MHz; 486DX2 - 66 MHz; 486DX - 50 MHz, make offer. 732-7634.

WORD PROCESSOR - Brother, w/monitor & 5/4" disk drive, like new, \$150 neg. Sue, Ext. 7235 or 399-7997.

Miscellaneous

DOUBLE STROLLER - \$15; Kohlcrafft stroller, \$10; Graco doorway jumper, mint, \$20; Evenflo infant's car seat, \$10; wagon, \$10. Leslie or Paul, 286-7127.

DIAMOND ENGAGEMENT RING - Marquis, 1 1/2k, best offer over \$3,900; 7-piece Colonial living room, best offer; Atari, \$15; tapes. Pam, 474-2792.

FOX COAT - full-length, size 14-16, excel. cond., \$475. 473-5063.

PERSIAN RUGS - 2, antique, good cond., \$85 ea.; child's rollerblades, size 7, \$13; Mac Imagewriter, Seikosha, like new, \$100 obo. Dejan, 929-5742.

TICKETS - Broadway musical *Sunset Boulevard*, 4/27, 8 p.m., 2 orch. seats, 15th row, center, \$70 ea. Don, Ext. 5533.

Real Estate

Real Estate advertised for sale or rent is available without regard for the race, color, religion, sex, age, national origin, disability or veteran status of the applicant.

For Rent

BELLPORT - house to share, own room, full kitchen, large l/r, bsmt., laundry, refrig., oven, yard, \$400/mo. + util. David, 286-1633.

HUNTINGTON STATION - new 1-bdrm. bsmt. apt., new kit. appl., bath, carpet, priv. ent., own thermostat, large closets, single, nonsmoker, no pets, \$675 all. Bob or Ed, 385-8075.

MANORVILLE - 2-bdrm. townhouse, 1 1/2 bath, gar., fp, cac, d/w, w/d, skylights, pond view, very bright, 1 yr. old, \$1,125 + util. Eric, 582-6230.

MILLER PLACE - two apts.: own bdrm. in big Colonial home, nonsmoker; large studio in professional area, nonsmoker. 744-8386.

ROCKY POINT - 3 bdrm. ranch, l/r, d/r, kit., bath, full bsmt., large fenced yard, immed. occupancy, close to public bus & shopping, \$825/mo. Rich, Ext. 4095.

WADING RIVER - lg. studio apt., unfurn., full kit., near beach, driveway park, quiet neighborhood, 15 min. to Lab, elec. & heat incl., \$500/mo. Bill, 722-4489.

YAPHANK - 2-bdrm. townhouse, bsmt., attached gar., lease transfer for 3 mos. or extended period, \$900. Ramesh, 924-8113.

HILTON HEAD, SC - condo, sleeps 6, furn., 2 bdrms., 2 baths, \$350/week. Guy, Ext. 3147 or 689-5378.

For Sale

FARMINGVILLE - 2-bdrm. house, modern kit., new appl., new bath, new carpet, new windows, siding, 1/2 bsmt., w/d, OHW, detached gar., taxes \$2,430, \$104,000. Mark, 654-0268.

MILLER PLACE - 4-bdrm. Col., 0.53 acre, 2 1/2 baths, eik, l/r, d/r, fp, den, remodeled kit. & baths, 16'x32' ig pool, deck, sunstone patio, gar., full bsmt., cul-de-sac, N. of 25A, \$189,900. Nick, 744-5021.

N. SHIRLEY - 3-bdrm. ranch, 2 baths, lg. eik, l/r w/ cathedral ceilings, full bsmt., fenced 1/2 acre, 2 large decks, pool, all new. John, 395-5922.

RIDGE - 3-bdrm. ranch, 2 1/2 baths, country kitchen, den, mud room, fenced yard, 3 mi. to Lab, \$114,000 or rent w/option to buy. Carol, 744-8632.

ROCKY POINT - 2-story chalet, 1.23 acres, very priv., 22 Prince Rd., \$169,000, appointment only. Ext. 7774 or 929-6235.

ROCKY POINT - Tides custom 3 bdrm., 2 1/2 bath, 2 1/2 gar., full fin. bsmt., large fenced backyard, all large rooms, new kit., all new appl., priv. deeded beach, asking \$162,000. Ext. 2012 or 821-2743.

ROCKY POINT - 3-bdrm. ranch, l/r, eik, fin. bsmt., OHW, public water, 100'x100', \$115,000. Mike, Ext. 3434.

SETAUKET - 2-story Col., 4-bdrm. bi-level decking, cac, igs, hot tub, screened porch, new cus. kit., wood floors, cul-de-sac, more, \$349,000. 751-3298 eves.

SHOREHAM - 3-bdrm. ranch in park-like setting, 100'x150' prop., 8 rooms, l/r, d/r, playroom, eik, 1 1/2 bath, fp in den, 2 1/2 gar., 23'x32' deck, SWRS, N of 25A, \$149,900. 821-9547.

SOUND BEACH - 3-bdrm. cedar ranch, new windows, doors, skylights, cathedral ceilings, l/r w/tp, detached gar., 80'x125' landscaped fenced yard, MPSD. 744-5387 eves.

HOMASASSA, FL - 3-bdrm. ranch, large rooms, Florida room, 2 acres, residential neighborhood, near beach, great fishing, \$49,990. Ken, 281-5565.

PORT CHARLOTTE, FL - 1/4 acre bldg. lot, developed neighborhood, ready to build, \$9,000. 929-8323.

N. CAROLINA - 1.13 wooded acres, waterfront community, pool, marina, 35' boat slip on Pamlico River, off Intercoastal waterway, \$38,000. Ken, 281-5565.

Lost & Found

FOUND - cat, by firehouse, identify. Joe, Ext. 4259.