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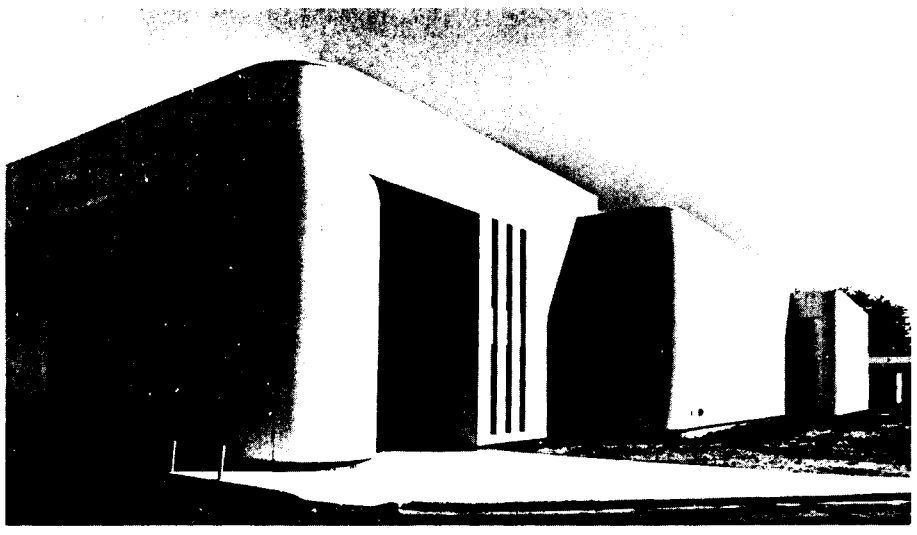
BROOKHAVEN NATIONAL LABORATORY

1981 In Review



National Synchrotron Light Source, 75 Brookhaven Avenue.

National Synchrotron Light Source

Late in 1981, the NSLS officially began operations, bringing to a close an intensive four year period of design and construction. By year's end, the injector linear accelerator and booster synchrotron accelerator were operating routinely, the VUV storage ring had circulating beam at 600 MeV and commissioning efforts were in progress to circulate electrons in the X-ray storage ring. As with all complex research machines of this type, there is a period of many months of machine studies between initial circulating beam in the storage rings and an optimum, uninterrupted flow of photons for experimental usage.

During the latter part of this year, the linear accelerator and booster have been operated around the clock from midday on Tuesdays until midnight on Saturdays in order to carry out beam studies in the booster, booster to VUV transfer line and in the VUV storage ring. With routine booster accelerator operation at 600 MeV, beam transfer from booster to VUV storage ring is now regularly carried out and recent studies have concentrated on increasing the maximum circulating current in the VUV ring.

Meanwhile work continues on the commissioning and testing of the magnet power supplies and r.f. power system of the X-ray ring. All of the components of the X-ray ring and of the booster to X-ray ring transport line are installed and tested. Booster to X-ray storage ring transfer studies will be resumed early this year, when adequate stored beam is available in the VUV ring for early experimental utilization.

The myriad of optical components in the eight beam lines now nearing completion on the floor of the VUV storage ring area make a dramatic sight. Scientists and technicians from BNL's NSLS, Biology, Chemistry and Physics departments, have been joined by counterparts from Bell Labs, IBM, and SUNY Stony Brook in the rush to have their beam lines in place to catch the first photons. Soon, other VUV groups from Cornell, the University of Pennsylvania, and Xerox will begin installing their experimental equipment.

Similarly, a high level of activity is going on at the X-ray storage ring. By the spring of 1982 many of the 19 beam lines under construction will be installed by BNL personnel and groups from such universities as North Carolina State, Connecticut, Pennsylvania, MIT, SUNY, and Purdue; from Oak Ridge National Laboratory, the Naval Research Laboratory, and the National Bureau of Standards; and such industrial laboratories as Bell Labs, IBM, and Exxon. It is expected that the NSLS will host more outside experimental groups than any other research facility at BNL.

Physics

High Energy

A breakthrough in the theory of strong interactions has been achieved during the past few years by applying numerical techniques, known as Monte Carlo simulations, to the analysis of quantum chromodynamics. Most of the earlier efforts, in which research done at BNL played a leading role (see Jan. 9, 1981, issue of the Bulletin), were devoted to understanding the properties of the gluonic matter which binds quarks. Extending the analysis to include dynamical quarks poses considerable problems arising mainly from the anticommuting nature of the fermionic fields.

To overcome these difficulties, a two-stage approach has been devised. In a first approximation, the quarks are made to propagate in the background of the gluonic field with its own quantum fluctuations. Although the gauge field exhibits quantum behavior and binds the quarks, the dynamical reaction from the quarks onto the gauge field is neglected. This approximation appears to work exceedingly well. The pion emerges naturally as a light mass object (always a difficulty for models of hadrons) and using this mass as input to fix the value of the light quark masses one finds:

$$m_\rho = (800\pm100)\ \text{MeV},$$
$$m_{A_1} = (1200\pm100)\ \text{MeV},$$
$$m_\Delta = (1300\pm100)\ \text{MeV},$$
$$m_\delta = (1000\pm100)\ \text{MeV},$$
$$m_p = (950\pm100)\ \text{MeV},$$
$$f_\pi = (95\pm10)\ \text{MeV}.$$

This is in very good agreement with the experimental data. These results, which have been obtained by members of our theory group, collaborating with colleagues in the University

(Continued on page 2)

Accelerator

ISABELLE

For the ISABELLE project, 1981 was a notable year. Of major interest throughout the year were the superconducting magnets for this 400×400 GeV proton-proton intersecting storage accelerator, but other aspects of the project also enjoyed substantial progress.

Magnets — In September, Robert Palmer's magnet design, incorporating Fermilab-style cable conductor, was chosen as the ISABELLE magnet design after early small models reached fields over 50 kG on the first quench. In October a full-size, large aperture, superconducting cable magnet reached 52.5 kG on its first quench. In all cases, magnets reached short sample on the first quench and exhibited virtually no training. When later tested at the ISABELLE design temperature of 3.8° K, the magnets reached fields in the vicinity of 58 kG. The magnet's performance under ramp conditions was excellent and its field quality was close to ISABELLE specifications. Efforts are now concentrated on producing quantities of these magnets with adequate field quality to construct the first sextant of ISABELLE.

Vacuum — The vacuum group has completed the hydrogen-deuterium facility for leak checking in a helium environment. An 18-foot long, high temperature furnace for conditioning vacuum vessels has been purchased.

Cryogenics — The first two of five cold boxes are completed. Bids have been received on the compressor station, and technical evaluation was begun. Helium transfer lines with the large diameter required by ISABELLE were built and successfully tested, showing a heat load well within the design allowances for ISABELLE.

Injection — Quadrupole magnets for the right bend of the proton injection system are 75% complete while dipole coils are 85% finished. Negotiations are under way to select a vendor to construct yokes and assemble the magnets.

Power Supplies — Prototypes have been tested and are close to ISABELLE's exacting specifications.

Controls — This group has developed conceptual and preliminary designs for RELWAY, a data communications system for ISABELLE controls. A prototype RELWAY was also designed as a pilot project in the ISABELLE injection line and for the AGS polarized proton project.

Construction — The tunnel is essentially complete as are experimental areas at the 4 and 6 o'clock positions. The small angle hall (2 o'clock) and the major research hall (8 o'clock) are both more than half finished. Work on the remaining two halls will be deferred until experimental proposals are received and designs specific to some of those proposals can be made.

ISABELLE Workshop — A very well-attended workshop was held in July to examine the physics opportunities offered by ISABELLE in the context of the most current picture of high energy physics. The consensus was that the physics prospects of ISABELLE are even more promising and exciting than had been thought.

AGS

The AGS (Alternating Gradient Synchrotron) is a proton accelerator facility that provides highly energetic particles (protons, neutrons, pions, kaons, etc.) for experiments designed to probe the interplay of forces and the structure of matter.

The accelerator ran for 25 weeks in 1981, delivering beams in two modes: a slow extracted mode that served seven counter experiments, along with about 13 different test beam groups; and a fast extracted mode, where all the internal beam was dumped on a target to produce a high flux of neutrinos that were the subject of study in one major experiment using a 100-metric ton detector. Experiments spanned many areas of high energy physics, from the weakly interacting force and symmetry breaking reactions, to strong interactions and resonance and charm production in hadronic reactions.

A number of improvement projects were initiated last year. For future use of the AGS as an injector for ISABELLE, internal beam studies were carried out to understand the spacial beam characteristics, orbit stability and control of the beam energy to an accuracy of one part in ten thousand.

Much effort went into the installation of a new H^- ion source to replace the present H^+ source. This cleaner, more efficient beam will reduce demands on the linac injector, save some rf power, and heighten the intensity of AGS beams. H^- beams have been successfully accelerated through the linac and the source should be ready for experimentation next summer.

Work is under way to accelerate polarized protons in the AGS. This project requires a new polarized pro-

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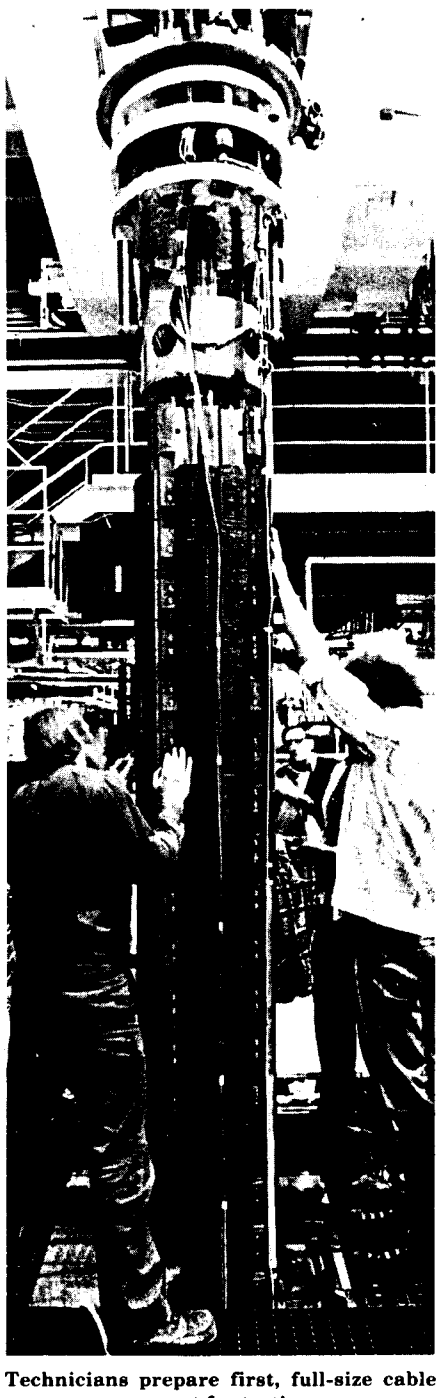


Technicians prepare first, full-size cable magnet for testing.

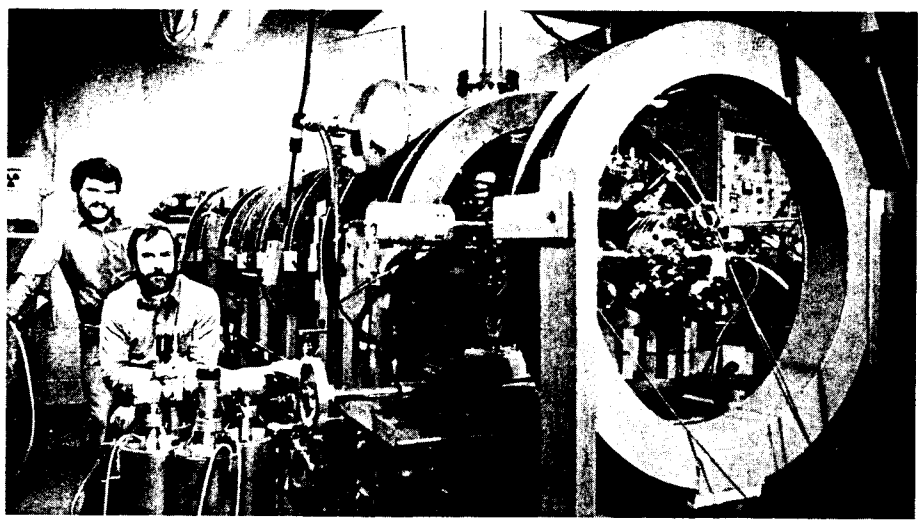
High Energy Phys (Cont'd)

of Rome, have been extended also to states of the charmonium system. The next step is to incorporate the dynamical feedback from quarks. A study of models of reduced dimensionality has shown that it is possible, and work in this direction is in progress at BNL.

A Yale-BNL collaboration has done a sensitive search for violations of time reversal invariance. Such violations are predicted by theories which give elegant explanations of the violations of CP invariance which was discovered at the AGS (1980 Nobel Prize in Physics). In $K \rightarrow \pi\mu\nu$ decay the component of the μ spin perpendicular to the decay plane changes sign under time reversal. Thus time reversal invariance requires that the μ spin cannot have a component in this direction. AGS experiment 735 measured the direction of the μ spin for this decay. After observing over thirty million K decays they found the spin component in the forbidden direction is $p_n = 0.0024 \pm 0.0041$. The muon spin direction is thus found to be entirely in the allowed plane, as required by time reversal invariance.

A BNL, Massachusetts, Michigan, Minnesota collaboration (AGS Experiment 744) has studied the production and polarization of Λ and Σ° particles produced in proton-proton collisions. It is known that Λs produced in pp collisions have their spin oriented preferentially perpendicular to the production plane. This preference in spin direction implies an underlying simplicity in high energy collisions which was not anticipated. The spin direction is deduced by analyzing the decay processes: $\Sigma^\circ \rightarrow \Lambda\gamma$ and $\Lambda \rightarrow p\pi^-$. This experiment has found that about two thirds of the Λs are produced directly while the rest come mainly from Σ° decay. Results on the spin behavior of the Σ° are eagerly awaited — especially since it has recently been found that Σ^+ particles are also produced with a net polarization — but in the opposite direction of the Λ. These and other unexplained spin effects have led to a planned program for polarized proton beams at the AGS.

AGS experiment 734 is studying the extremely rare elastic scattering of neutrinos and electrons. The unified weak-electromagnetic theory SU(2) $\times$U(1) makes precise predictions for this scattering process. Only about one event for every 10^{16} neutrinos traversing the 150-ton detector is expected. An initial run with the neutrino beam took place in the early summer and an extended run with the whole detector started in mid-November. The initial data look good, and the major task of understanding the detector in detail has started. Many tens of events in both $\nu_\mu e$ and $\bar{\nu}_\mu e$ elastic scattering are anticipated in the present running period, coming close to the present sample available worldwide, with the expected low background that this detector offers.



One of the two positron beams built at BNL.

Solid State

Solid-state physicists recognize that imperfections both on the surface and within solids often control the properties of those materials. Solid-state physicists at BNL are utilizing sources of antimatter originally of interest only to elementary particle physicists — in particular, the positron, to determine the type and behavior of these defects, and to unravel their role in determining the properties of solids.

Positrons, positively-charged electrons that are emitted during decay of certain radioisotopes, are sensitive to very small concentrations of certain kinds of defects which are created when a solid is subjected to an environmental change such as an increase in its temperature. When positrons annihilate with electrons in the solid, gamma rays are emitted, which, when measured, provide information about the positrons' history while in the solid. Another process discovered at Brookhaven — monitoring changes in the relative numbers of free positrons on a surface — provides unique information about surface conditions.

With improved techniques for creating small, intense variable energy positron sources, BNL scientists have built two useful beams of low-energy, nearly monoenergetic, positrons which do not penetrate very far into a solid.

In the first system, slow positrons are transported to a target by a magnetic field. This has led to the development of a quantitative model for one-dimensional diffusion of positrons to the surface and experimentally verified that positrons form surface states on metals and semiconductors. Using this model, scientists have deduced vacancy formation enthalpies, positron surface states, and positron trapping rates into defects for several well-characterized metals. It has also been demonstrated that the structural transition of a thin amorphous aluminum-oxide layer to a crystalline phase could be detected with slow positrons.

In its initial three months of operations, the second beam, where slow positrons are guided and focused by an electrostatic field, has opened up the possibility of observing positron diffraction, energy loss, channeling and other phenomena which would be perturbed by the presence of a magnetic field.

The ultimate goal of the program is to develop a positron microprobe at the High Flux Beam Reactor as a new means for investigating surface layers and interfaces and for imaging surface defects.

Nuclear Physics

Nuclear Physics is studied experimentally at the HFBR, the AGS and at the Tandem Van de Graaff.

One piece of research at the HFBR deals with gamma ray transitions in deformed nuclei, in particular transitions from the beta-band to the gamma-band. The beta-band may be pictured as a surface vibration of the cigar-formed, ground state of the deformed nucleus, such that the axial and median-plane reflection symmetries of the cigar-form are preserved. The gamma-vibration, on the contrary, breaks the axial symmetry of the shape by developing a bulge on the middle of the cigar. Transitions from one type of motion to the other must then change a symmetry-condition and, therefore, test theoretical concepts in a fundamental way. Painstaking measurements at the HFBR have attempted to answer these questions: Are the symmetries those of the geometrical models of Bohr and Mottelson (as described above)? Or are they those of the boson-models of Iachello and Arima? The data tend to favor the latter.

Experiments at the Tandem accelerator (and at other labs world wide) deal with the behavior of nuclei under fast rotation: How is the physics in a world where the centrifugal and Coriolis forces are about to take over? When a cigar-shaped nucleus is set in fast rotation by being struck by another heavy nucleus in a collision process, the subsequent gamma-radiation can tell about how the single protons or neutrons in the spinning nucleus experience the carousel tour. The picture that emerges is that those neutrons or protons which originally moved in an orbit along the long side of the cigar-shape are the first to become dizzy when the rotation is started. They break loose from their orbit with a constant angular momentum in the direction of the axis of the cigar-shape and, instead, align their angular momentum with that of the main rotation, which is perpendicular to the axis of the cigar. With its recently improved performance (achieved by upgrading terminal voltage from 14 to 17 million volts) the Tandem Van de Graaff should be helpful in answering more questions about nuclear behavior.

At the AGS, nuclear physics has dealt with the simplest pattern of motion in nuclei: motion of a single particle around the core of a spherical nucleus. However, in the AGS experiments the nuclear particle was not a proton or a neutron, but a strange particle, a lambda meson. When the average interaction between the lambda and the nuclear core was measured, it was found that the coupling between the intrinsic spin of the meson and its orbital motion around the nucleus was very small in contrast to the strong spin-orbit coupling for protons and neutrons, a result anticipated by the Nuclear Theory Group.

Safety & Env. Protection

The Safety and Environmental Protection Division conducts research in areas related to both occupational and environmental safety. Ionizing radiation, strong magnetic fields, and toxic materials are currently being studied in laboratory and field work.

A new whole-body counter, which measures small amounts of radioactivity in people, was recently constructed by Plant Engineering for the Marshall Islands and Internal Dosimetry Group. Located on site it provides a counterpart to the two field units located in the Marshall Islands.

Marshall Islands' activities completed this year include the assessment of radionuclide body burdens in residents of Rongelap, Utirik, and Enewetok Atolls through whole-body counting and through urine, fecal, and breast milk sampling programs.

The Center for Assessment of Chemical and Physical Hazards (CACPH) continues to provide comprehensive industrial hygiene assistance to the DOE community under the Toxic Material Advisory Program. This program forms the principal mechanism within DOE to develop interim exposure guidelines and work practices, and to provide consultation in the functional areas of toxicology, physiology, workplace sampling, health assessment methodologies, risk assessment and hazard analysis. Last year, CACPH developed toxic material advisory reports for acetylacetone and 1-mercaptoethanol. Interim exposure guidelines of 25 ppm and 0.5 ppm were proposed for acetylacetone and 2-mercaptoethanol, respectively.

Industrial hygiene assistance provided by CACPH included activities for the Laramie Energy Technology Center, and technical liaison for the Kosovo (Yugoslav coal gasification plant) health effect study.

Research in Radiological and Chemical Physics, using the BNL Tandem Van de Graff, has led to the development of a special beam monitor for use in accurate (1%) determinations of charged particle currents. This device stops a portion of the beam completely and passes a known fraction to the experiment. It is especially useful in applications where the beam is stopped in the experimental apparatus and/or enters equipment operated at pressures too high ($>10^{-4}$ torr) for use of the usual Faraday cup devices.

Accelerator (Cont'd)

ton source with its own transport line, as well as special laminated guadrupole magnets that will be installed in the main ring to prevent depolarization of the beam. Polarized proton beams, where the spins are preferentially pointing in one direction, will help experimenters studying high energy physics reactions.

A new fast extraction beam kicker magnet was built and installed in the H5 region of the main ring. This magnet can go to full power in 170 nanoseconds (ns), fast enough to rise between proton beam bunches spaced 220 ns apart. The kicker, which will eventually deliver bunches from the AGS to ISABELLE with minimum distortion, is now used to extract beam into the neutrino area.

A fourth target station (D) was built and its associated beam line, which will carry an intense proton beam to a polarized target, is near completion. An experiment is being set up to measure the asymmetry between protons scattered off others with spins aligned up (compared to those with spins aligned down). The results will be used to build and calibrate a polarimeter to measure the polarization of the future polarized protons in the AGS.

Two superconducting cables about 430 feet long were fabricated and installed at the test facility of the Power Transmission Project, the largest of two projects of the Division of Advanced Technology Applications. The flexible cables used in this 1000 MVA-rated system have a niobium-tin conductor. The cooling system has been operated and terminations are now being connected to the cables in order to carry out full-power electrical tests.

Efforts of the Neutral Beam Development Group have been directed toward design, fabrication and testing of multi-megawatt steady state neutral beam systems for plasma heating and current drive in future fusion devices. The BNL approach is based on neutralization of H^- ions that have been extracted from a source and accelerated to energies of several hundred keV or more. In the past year, for the first time anywhere, negative ion sources were studied in a true steady state operation, with runs lasting many hours without interruption. The first of the sources, the Mk V magnetron, was designed to deliver 1 A of negative hydrogen ions. So far, more than 0.1 A of negative hydrogen ions have been extracted from the source at reduced power levels and far from optimum operating conditions.

Energy and Environment

The Department is organized into four areas: energy sciences, environmental sciences, energy technology, and energy analysis.

Energy Sciences

Programs in basic and applied materials science have included the investigation of the reaction of hydrogen with metals, the investigation of superconducting materials which can be used in magnets operating at 16 Tesla or higher, and the study of hydrogenated amorphous silicon films and solar cells made from them.

In the study of photosynthetic mechanisms, the first crystallographic determination of a bacteriochlorophyll derivative — methylbacteriopheophoride *a* (a model for a primary electron acceptor in bacterial photosynthesis) — may provide a model for bacteriopheophytin *in vivo*. Also, the first structural determination of a Chlorobium chlorophyll — methylbacteriopheophoride *d* (found in green bacteria) — may be a model for the phototrap or "special pair" chlorophyll dimer.

In the flash pyrolysis of coal in a methane atmosphere, significant quantities of ethylene were produced. A valuable feedstock for the chemical and plastic industries, its production from natural gas and coal instead of from imported petroleum would be a valuable advance. In the use of calcium silicate cements for desulfurization of fuel gases, it was found that agglomerated portland cement pellets remove more than 90% of the sulfur.

Energy Technology

A major study was completed on the feasibility of converting a 12-story loft building in New York City to an apartment house, with reliance on passive solar heating. The study led to a DOE design award presented at the Fifth National Passive-Solar Conference.

A workshop on coal-water slurry fuel technology brought industrialists, educators, and DOE managers together to discuss the potential for this fuel form and provide the basis for development of a DOE coal-water fuel program plan. BNL work has shown that coal-slurry fuels have a strong potential for reducing the use of petroleum.

The thrust of activities in hydrogen technology development will aim for long-term advances to reduce electrical energy requirements for water-splitting by use of high temperature and/or selected additives to electrolytes.

The Brookhaven thin-film solar collector has been developed to the point where operation in the 150-200° F temperature range for solar cooling applications looks promising. The ground-coupled Energy House was operated through the winter of 1980-81 using a water-source heat pump, which proved adequate as the only heat source throughout the winter.

Environmental Sciences

As a result of flue gas measurements at an oil-fired power plant, the emissions of sulfuric acid and metal sulfates were correlated with the operating and control parameters of the boiler. The study provides utility operators with guidelines for controlling emissions for compliance with regulations.

An aerosol growth theory developed for multicomponent inorganic salt aerosols was applied to a practical problem, namely, the light scattering properties of the well-known Los Angeles aerosol, which is composed mostly of sulfates and nitrates.

Several photothermal dual laser schemes have been developed to perform *in situ* infrared absorption measurements of trace gases and aerosols. All are similar, in that light from a tunable infrared laser is absorbed by the species of interest and induces photothermal changes which are subsequently probed using a visible laser.

An extensive, nation-wide field study on "acid precipitation" (called OSCAR for Oxidation and Scavenging Characteristics of April Rains) was conducted during April as a part of the interlaboratory Multistate Power Production Pollution Study (MAP3S).

Two experimental growth shelters 30'x90' were used to evaluate impacts of acid rain on soybeans grown in the field. Simulated rains of different acidities are applied twice a week, and rain acidity equal to that which actually occurs in this region of the Northeast reduced yield by 11%. The sensitivity of surface waters of the Eastern United States to acid deposition is being evaluated by examining the relationship between surface water chemistry and regional geochemistry. A water quality data set created at BNL, the Acidification Chemistry Information Database (ACID), has been used to identify over 3,500 surface waters which are sensitive to acidification and over 600 stations with statistically significant long-term acidification. A study was completed in Speonk, N.Y., which focused on lateral movement of human virus from a subsurface septic system through a shallow, sandy soil groundwater system.

Energy Analysis

At the National Center for Analysis of Energy Systems, an analysis of biomass fuel use in the Northeast was completed, and a study of land use changes around nuclear power plants was begun for the Nuclear Regulatory Commission. Studies were initiated on the technical and economic feasibility of solar and energy-efficient technologies in a number of countries in the Caribbean, Latin America, and Southeast Asia. The fourth Energy Management Training Program, supported by the Agency for International Development (AID) to train energy planners from developing countries, was held in conjunction with the Institute for Energy Research at SUNY-Stony Brook.

The Utilities Analysis Project determined the value of substantial amounts of power from photovoltaic cells to the utilities serving Long Island, Madison, WI and Albuquerque, NM. The Geothermal District Heating Program, which is developing a method to determine the economic feasibility of district heating, is being used to assist several cities now considering installation of district heating under a HUD/DOE program.

From April-August, scientists from DEE's Oceanographic Sciences Division conducted an experiment to establish oceanographic conditions in the Bering Sea. Here, aboard the research vessel Thomas Thompson, they retrieved electronically operated, multiple nets for capturing plankton.

Chemistry

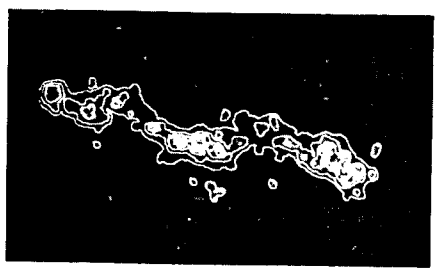
Chemistry plays a central role in the field of science and, in the BNL Chemistry Department, research activities range from the study of enzyme mechanisms to the investigation of nuclear reactions in the sun's core.

Chemistry Department members have been active in the design and construction of four beam lines for use at the National Synchrotron Light Source. Three of these -- a windowless gas-phase beam line, a beam line for time-resolved fluorescence spectroscopy and related experiments, and a beam line for photoelectron spectroscopy applied to the study of solids and surfaces — will be installed on the vacuum ultraviolet ring, soon to be commissioned. The fourth Chemistry beam line, to be set up at the X-ray ring, will be devoted to structural studies using X-ray diffraction methods.

An ongoing research program is concerned with the production, acceleration and detection of high molecular weight ions, formed by the clustering of neutral molecules around a singly charged ion in the gas phase. Accelerated beams of such ions have applications in many areas of basic research, as well as potentially important practical applications for heating plasmas used in controlled fusion reactions. A technique has been developed for the expansion of a hydrogen plasma at low temperatures through a supersonic nozzle to produce a beam of pure hydrogen cluster ions with relatively narrow mass distributions.

Sensitive analytical techniques for the analysis of radioactive gases, originally used at BNL to detect solar neutrinos, have been recently applied to the carbon-14 dating method. By using very small counting tubes and methods to minimize background counts, it is possible to work with as little as 10 milligrams of carbon in the form of carbon dioxide. The ability to use such small samples has important applications in the fields of archaeology, oceanography, climatology, glaciology, environmental studies, and the authentication of museum objects. For example, to date a Neolithic cooking pot, an archaeologist may only be able to use the soot blackening its exterior.

Scientists of the Atomic Energy Research Authority at Harwell, England have recently used counting tubes constructed here at BNL to help establish the age of massive gold and silver belts that were attributed to the Avars, a barbarian people who dominated eastern Europe about 1400 years ago. Using as the source of carbon tiny bits of flax (presumably from linen wrappings) clinging to some of the pieces, it was possible to establish a date of 640 ± 100 A.D., consistent with the style and reputed origin of the work.



A contoured picture of fibrinogen imaged by Biology's Scanning Transmission Electron Microscope (STEM), which has been used to study specific labeling of biological molecules with heavy atom clusters and quantitative electron microscopy.

Biology

The research of the Biology Department is aimed at understanding how biological systems function so as to be able to predict the effects of energy-related pollutants on them, and how to use such systems for energy production. An essential part of the research is devoted to determining the relations among the structures and functions of cellular components, such as toxins, proteins, DNA, chromosomes, ribosomes, membranes, chloroplasts, and vacuoles in cells, as well as the interaction of bacterial and mammalian viruses with cells.

Genetic and biochemical studies of bacteriophage T7 and its DNA carried out here at BNL and elsewhere have provided a great deal of important information concerning gene expression and mutagenesis. In order to exploit the full potential of this biological system, it seemed certain that the DNA of T7 would have to be described at the level of its nucleotide sequence. This goal has recently been completed with the recent determination at BNL of the entire 39,930 base pair long sequence of T7 DNA (molecular weight: 26×10^6).

Radiochemical micro-protein sequence analysis is being used to refine and align the physical, functional and genetic maps of genomes of human virus pathogens. Studies in collaboration with colleagues at the State University of New York, Stony Brook, on the sequence of poliovirus proteins has allowed us to align the sequence of each major virus protein with the known nucleotide sequence of the poliovirus RNA genome.

Haemophilus influenzae is a bacterium that is responsible for a large fraction of acquired mental retardation in the United States. Treatment of infections by this microorganism has been recently severely compromised by the spread of antibiotic resisance. Work in the Biology Department on the mechanism of this process has shown that plasmids, which are independently replicating circular pieces of DNA in the cell with the ability to transfer from one cell to another, can contribute part of their DNA to the cell's chromosome, thereby conferring antibiotic resistance on the cell even if the plasmids are lost. By recombination, a plasmid can also acquire DNA from the cell's chromosome, and thus can spread the antibiotic resistance character of one cell to that of another cell previously sensitive to the antibiotic.

Para-amino benzoic acid (paba) is a major component of sun-screen preparations used to protect human skin. Paba is similar in structure and properties to other chemicals that act as sensitizers for the formation of pyrimidine dimers (mutagenic and tumorigenic products) in DNA by sunburning wavelengths in sunlight. Thus it was hypothesized that paba plus sunlamp exposure might sensitize pyrimidine dimer formation in human cellular DNA. Research in the department has found that sunlamp irradiation of human skin cells in the presence of paba greatly increases the yield of pyrimidine dimers. Also, irradiation of human cells in the presence of paba increases by about ten-fold the frequency of transformation to anchorage-independent growth, which is a correlate of tumor-forming potential.

Medical

Toxicological studies in the Medical Department are supported by DOE, EPA, NIH and private foundations. Recently, several new projects were initiated which are concerned with the problem of estimating biological effects of low level radiation. Ultimate results from studies such as these should account for the interactions of chemical compounds with radiation. In terms of the "initiation" stage of carcinogenesis (the irreversible commitment of some cells to a precancerous state), carcinogenic chemicals and radiation appear to be additive. However, chemicals that are "promoters" (agents that gradually convert initiated cells into cancers) may interact synergistically with initiators, including radiation.

An example of this type of synergism is seen in C.J. Shellabarger's work with mammary tumor induction in rats.

The intent of this study was to investigate the relationship between the dose of diethylstilbestrol (DES) and its synergistic interaction with x-irradiation for mammary carcinogenesis in ACI rats. In addition, the role of pituitary prolactin secretion in this synergism was studied.

Increasing the dose of DES alone (without radiation) increased the incidence of rats with an adenocarcinoma as well as the number of cancers per rat, while at the same time decreasing the mean time to appearance of tumors. Multiple carcinomas were found only in rats with the two highest doses of DES and this response appeared to be DES dose-dependent.

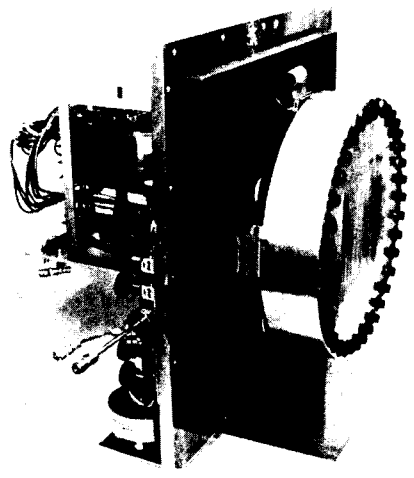
Combining radiation with DES treatment (except at the lowest DES dose) produced synergistic increases in the incidence of rats with individual and multiple mammary adenocarcinomas and in the number per rat, and it decreased the time to appearance. Rats receiving x rays alone had only a few late-appearing mammary adenocarcinomas while none were seen in the cholesterol control group. Almost all the rats in the three highest-dose groups had pituitary tumors, while in all other groups, only about one-half of the animals had these tumors. There appeared to be a definite relationship between the dose of DES and both the initation and the degree of plasma prolactin elevation for all DES doses except the lowest.

These data suggest that in female ACI rats, mammary adenocarcinoma induction by DES alone or by the synergistic interaction of DES and x irradiation is highly DES dose-dependent.

Medical Department programs in pulmonary toxicology, nuclear medicine, determination of elemental body composition, cytogenetics, and free radical mechanisms continue to investigate health effects of energy-related pollutants and to develop new or improved methods of medical diagnosis and treatment.

Instrumentation

The Instrumentation Division conducts research and development in scientific instrumentation with the objective of providing new tools and methods for high precision measurements in scientific research. Principal areas of research activity are the detection of charged particles, neutrons and photons with gaseous and liquid detectors and with semiconductors, processing of signals from detectors, low noise electronic devices and circuits, systems for acquiring data and for control of scientific experiments, and application of nuclear and atomic techniques in elemental analysis. In addition, the division provides some special services in vacuum deposition technology, printed circuit fabrication, scientific instrument repairs, and maintenance of computerized on-line data acquisition and experiment control systems.



This two-dimensional position-sensitive detector for thermal neutrons has an active area of 20×20 cm². A position resolution better than 2 mm and a position accuracy of 1 part/1000 have been achieved. Such detectors are used in neutron diffraction experiments at the HFBR to determine molecular and crystal structures in biology and solid state physics.

In 1981 emphasis has been on position-sensitive detectors, on multiprocessor data acquisition and experiment control systems, and on development of technologies for these areas. A new direction is the development of semiconductor position-sensitive detectors with a position resolution in the range of 10 micrometers for use in high energy physics and in research with synchrotron radiation. All recent advances in detectors are interconnected with new developments in signal processing electronics and in data acquisition systems.

The new x-ray detectors developed here have a much higher position accuracy and a capability to count photons at higher rates than others known so far. These detectors will be used in low angle scattering studies of molecular and crystal structures at the National Synchrotron Light Source.

Our recent development of low noise amplifiers which can "see" smaller and smaller signals from gas proportional and other detectors, offers new possibilities in the advancement of such detectors.

Nuclear Energy

The program areas with which the Department of Nuclear Energy (DNE) is involved are advanced fission and fusion reactor systems; safety of fission reactors; compilation and evaluation of nuclear data; nuclear waste management; and nuclear materials safeguards. DNE received 60% of its funding in 1981 from the Nuclear Regulatory Commission (NRC), and 20% from the Department of Energy.

Nuclear safety programs sponsored by the NRC consist of research to improve the understanding of the behavior of various types of reactors under hypothetical accident conditions, development of computer codes for accident analysis, risk assessment studies, LWR materials corrosion studies, waste management studies, and technical assistance to support day-to-day NRC reactor licensing requirements. Studies on three generic reactor types, light water, high temperature gas-cooled, and fast reactors, include both analytical and experimental work. The department has also been working with the NRC to identify and analyze safety problems for nuclear power plants, both operating and under construction.

A program in nuclear waste management provides technical assistance and confirmatory research to NRC in areas of high level waste, transuranic waste, unprocessed spent fuel, and low level waste. The program should assist NRC in developing criteria and standards for the best method of isolating high level and low level radioactive waste. One aspect of this program deals with the current technological problems being generated by the de-contamination of the Three Mile Island-2 facility.

A recommendation of the "President's Commission on the Accident at Three Mile Island" was to extend the capabilities of the state-of-the-art training simulators used to qualify nuclear power plant operators. Partly to meet this requirement a new program has been started, to apply new computer techniques to solving the complex thermal-hydraulic and neutronic processes in reactors in off-normal circumstances.

A significant growth of activity took place this year in probabilistic risk assessment (PRA) of nuclear power plants, providing both additional technical assistance and research results to NRC.

The Technical Support Organization (TSO) acts as an advisory group to DOE, providing advice on a spectrum of safeguards activities, both domestic and international.

The U.S. continues to maintain a strong program in support of the International Atomic Energy Agency, toward improving the effectiveness of international safeguards. The support program is under technical management of DNE's International Safeguards Project Office.

The National Nuclear Data Center (NNDC) continues to provide improved reference nuclear data to the basic and applied research communities, including data on reactions induced by neutrons and charged particles, and nuclear structure and decay. At the request of DOE and Oak Ridge National Laboratory (ORNL), the NNDC has assumed responsibility for the data base and publication activities previously performed by the ORNL Nuclear Data Project.

Reactor

In 1981, new developments at the High Flux Beam Reactor focused on safety and economy of operation. The Reactor Division continued to press for approval to begin operating at a power of 60 megawatts, which will increase the neutron flux available for experiments by 50%. However, delays in reviewing the safety of the proposed operation by the Department of Energy have extended the anticipated date for beginning operation at that power until early 1982.

The dual heat exchangers, installed nearly two years ago to permit operation at the higher power level of 60 MW, have been used to reduce the cost of operation. At the present power level of 40 MW, only one of the two new heat exchangers and one of two large coolant pumps are required to remove the heat from the reactor. This means that the other heat exchanger, with its associated coolant pump, could be placed on standby. The savings from running only one of the two main coolant pumps amounted to nearly $900 per day in 1981.

Meanwhile, safety reviews have suggested several improvements which could be made to the equipment at the HFBR which would increase the margin of safety by adding back-up or reserve capability to existing systems and components. Last year several such items of additional safety equipment were installed. For example, a second set of air inlet valves has been added to the HFBR building to guard against leakage of radioactive material from the HFBR in the event of an accident. (This set of valves doubles the assurance of a tight seal, and provides adequate protection even if one of the valves should fail to close tightly.) An auxiliary water line has been added which will supply water to cool the reactor, even if an earthquake were to hit the Laboratory site. Refinements such as these are the product of constant safety reviews, and represent fine-tuning of the safety systems to provide an ever-increasing margin of safety.

Applied Math

The objective of the Applied Mathematics Department is to ensure that the best possible resources and expertise in the areas of mathematics, statistics, and computing are made available to the research programs at the Laboratory. To achieve this, its activities comprise three components: a basic research program, a consulting and applications program, and the Central Scientific Computing Facility.

Research in mathematics continues to emphasize problems relating to the solution of partial differential equations. In 1981 significant improvements were achieved in methods for solving the electromagnetic field equations which arise in connection with magnet design. The improvements allow for more complicated designs, greatly increased speed, and a better understanding of the reliability of the results.

In statistics, the research emphasis is on analysis of observations of subjects which are valuable, irreplaceable and not easily reproducible. This description applies to human health studies, and to studies of nuclear reactors or other large scale engineering structures, earthquakes, etc. Particular areas of work include survival analysis, sequential methods and clinical trials, and Empirical Bayes tecniques. In 1981, new approaches for the analysis of time-to-failure were developed and the problem of simultaneous estimation of variances in data drawn from different normal populations was studied.

Computer-related research has focused on two lines of development which will be increasingly important over the next few years. The networking of multiple computer systems is becoming widespread at all levels, from tightly coupled processors exchanging data at high speeds, to loose geographically distributed networks. Many questions about the optimum way to plan, implement and operate such networks remain poorly understood. In another direction, the application of computers to problems of engineering design, especially of complex digital circuits, is being pursued.

The activities of the Central Scientific Computing Facility continue to evolve more to the support of distributed computing, although the major part of the effort is still associated with the central computers. The MASSTOR large mass storage system is partially installed and the development of software interfaces with the central CDC equipment and VAX computers is proceeding. A VAX 11/780 computer was installed as a development machine but is already contributing to current usage.

BROOKHAVEN BULLETIN

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BROOKHAVEN BULLETIN

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BROOKHAVEN NATIONAL LABORATORY

Local Artist In BERA Benefit Concert

In a benefit concert for BERA, pianist Jeffrey Marcus will perform on Wednesday, January 27, at 8:30 p.m. in Berkner Hall.

Mr. Marcus is a well-known local artist who also teaches privately in the area. He is a graduate of the Juilliard School and of SUNY/Stony Brook, where he was a teaching assistant.

His performance career includes recitals at Alice Tully Hall and Carnegie Recital Hall in New York City, and he does a European tour every year.

Mr. Marcus has given television and radio concerts in thirteen countries, including broadcasts for England's BBC, WQXR and WNYC in New York, and Nord Deutsche Rundfunk in West Germany.

For the January 27 concert at Brookhaven, he will play a program of Domenico Scarlatti sonatas, Schubert's Sonata in A Major, D. 959, and a selection of Chopin pieces, including the Polonaise Fantasie, Op. 61.

Tickets for the performance will be available at the door on the night of the concert. Adults are $3; those under 18, $2.

Celebrating Black History

Saundra Dunson-Franks *is* Harriet Tubman. That's what most audiences think when they watch Dunson-Franks perform in Hats, the one-woman, dramatic, biographical tribute she wrote about the famed Underground Railroad conductor.

Hats is only one of five outstanding events the BNL Afro-American Culture Club will present in February to celebrate Black History Month. This is a rare opportunity to see black artists in a variety of performances which will include:

- *Gospel Extravaganza, Saturday, February 6, 7 p.m., $5.* Four Long Island choirs will join the nationally acclaimed Institutional Radio Choir of Brooklyn, a top gospel group for more than 25 years.
- *Elvira Green In Concert, Thursday, February 11, 8 p.m., $3.* Green, a mezzo-soprano who served in the company of the New York Metropolitan Opera for nine years, will perform operatic works by Black female composers.
- *The Many Facets Of Lindamichellebaron, Thursday, February 18, 8 p.m., $2.* The poet will present original works in a dramatic, rhythmic poetry recital.
- *Hats, Saturday, February 20, 8 p.m., $6.* Saundra Dunson-Franks, as Harriet Tubman, will reminisce about the dark nights of slavery and the joy of freedom.
- *Bill Mackey Dance Theatre, Friday, February 26, 8 p.m., $8.* This new and rising, Boston-based group in American dance will perform Afro/ethnic, jazz and modern dance.

All events will be held in Berkner Hall. Subscription tickets for all five events cost $20. Tickets can be purchased from Berthel Becton, Bldg. 750, Ext. 4432; Mary Durham, Bldg. 902, Ext. 7982; Renee Flack, Bldg. 460, Ext. 3316; Michele Henderson, Bldg. 555, Ext. 4303; and Deidre Seymore, Bldg. 462u, Ext. 5037. Or send a check, payable to BERA, to Afro-American Culture Club, P.O. Box 441, Brookhaven National Laboratory, Upton, N.Y. 11973. For more information, call 286-2673 from 9 a.m. to 5 p.m.

Guess Who? Win Two!

Can you identify this dynamic performer? If you can, you might win a pair of tickets to the BERA Winter Dance. Just send your guess to Contest, Bldg. 134, by Monday, January 18, when a drawing will determine the winner. This entertainer will again take the spotlight on January 29, as part of the Showtime Revue at the Winter Dance.

When not watching this theatrical treat, dance-goers will either be in the cafeteria, dancing to the music of Charlie Zein and the Newports, or doing the disco with Mr. "T" (Eddie Taylor) in Xenon 488 (Room B).

If you fail to win this little contest, don't despair. You can buy your tickets at the BERA Film Service in Berkner Hall or from one of the 23 other ticket sellers on site.

Ice Damaged Trees

Ice storms can do considerable tree damage says the Cooperative Extension Association. Knowing what to do when one hits could mean the difference between saving your favorite tree or chopping it up for firewood.

The greatest storm injury is likely to occur on the faster growing trees:- poplars, maples, willows, black locust, and Chinese and Siberian elms. Here's what to do if you have to straighten a toppled tree or mend broken or split branches.

Remove all broken branches. Do all cutting with sharp tools — saws, knives, and wood chisels. Make cuts either at a good side branch or nearly flush with the mother branch.

Make smooth, fast-draining wound surfaces. Remove splintered, rough, or loose wood from all parts of any wound with a wood chisel or sharp knife.

Trim off all bark not solidly attached to the wood. Use a sharp knife, exposing injured bark on all edges of the wound.

After the wood has thawed, lift, straighten, and support trees, shrubs or evergreen trees with wire encased in a hose wherever it touches the bark. Supports should remain a full season. Cover exposed roots with soil and mulch with leaves or straw.

Patents Awarded

U.S. Patent #4,268,353 has been awarded to **James Powell, Shih-Yung Hsieh** and **John Lehner,** all in the Department of Nuclear Energy, for developing a demountable externally-anchored low-stress magnet system for fusion reactors. The magnet design is such that it can be made in coil segments, shipped to a reactor site and assembled. The construction process eliminates on-site coil winding processes heretofore required.

U.S. Patent #4,269,728 has been issued to **Donald Schweitzer** and **Cesar Sastre,** Department of Nuclear Energy, and to **Warren Winsche,** Director's Office, for inventing a method for storing radioactive spent fuel in repositories containing sulfur as the storage medium. Sulfur is noncorrosive and not subject to radiation damage, thus, storage periods of up to 100 years are possible.

BERA Nominating Committee Named

A nominating committee has been appointed by the BERA Executive Board to select a slate of four candidates for the 1982 BERA Board election. Those appointed were: Marie Brenner, Emil Caiazza, Barbara Carreras, Dru Hanrahan, Lewis Jacobson, Richard Larsen, James Petro, Steve Schwartz, Gail Williams and Madeline Windsor.

Any employee who wishes to suggest a candidate for consideration may do so by calling a member of the nominating committee before January 22. The committee will meet on Wednesday, January 27 to discuss and judge the qualifications of all candidates selected by the membership as well as those proposed by employees.

NYC Train Trips

The Hospitality Committee is planning a group LIRR trip to New York City on Wednesday, February 3. Departure will be at 7:55 a.m. from the Patchogue LIRR station. Round-trip fare for adults is $3.50; children under six years ride free.

Reserve a ticket by sending your fare through the U.S. mail to P.O. Box 322, Upton, New York 11973, no later than Thursday, January 28. Make checks payable to "Brookhaven National Laboratory," and put the date of the trip on your check. Your tickets will be given to you on the train. Refunds will be made only if cancellations are received by the Monday preceding the trip.

The LIRR trips to the city during 1982 have been scheduled as follows:

February 3 and 17
March 3 and 17
April 7 and 21
May 5 and 19
June 2 and 16
July 7 and 21
August 4 and 18
September 1 and 8
October 6 and 20
November 3 and 17
December 1, 15, and 29

The Hospitality Committee is planning on scheduling a few Saturday LIRR trips to the city during the year. When the exact dates have been decided, a notice will appear in the Bulletin.

Campers Meeting

Employees interested in camping are invited to join the members of the BNL Camping Club at their first meeting of the year on Thursday, January 21, at 8 p.m. in the Recreation Building.

Following a short business meeting, refreshments will be served and a movie will be shown. For information call chairman Chuck Watson, Ext. 5317.

Women In Science

Dr. Betsy Sutherland will speak on "Sunlight, Skin Damage, and Cellular Transformation" at the Women in Science dinner meeting on Thursday, January 21, in Berkner Hall, Room A. Reservations are requested for the dinner which starts at 5 p.m. Send check for $6.50, payable to BNL-WIS, to Ellen Gannon, Bldg. 801 (Ext. 4513) by January 18.

R/C Airplane Club

The next meeting of the R/C Airplane Club will be held on Tuesday, January 19, at noon in Berkner Hall. Items to be discussed include dues, new officers, the season's agenda and an indoor show. New members are welcome.

Volleyball

Standings, Open League, as of 1/6/82

Spikers	20- 0
Toga	16- 4
Burnouts	13- 7
Line 1	10-10
Brew Masters	7-13
Roga	4-20
Pick Ups	2-18

Line One over Pick Ups, 15-12, 15-11, 15-4, and 14-16. Toga over Roga, 15-2, 15-2, 15-6, 15-5. The Brew Masters forfeited to the Burnouts.

Arrivals & Departures

Arrivals

Bruce E. Miller ..... Nuclear Energy
David E. Moncton ..... Physics
Lynn E. Roberts ..... Physics

Departures

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

Cyrus Baktash ..... Physics
Brian W. Bures ..... Accelerator
Douglas E. Hof ..... Chemistry
James F. Fynch ..... Energy & Env.
Alan B. Packard ..... Medical
Frank A. Speciale ..... Accelerator

Lecture Reminder

Meteorologist, S. SethuRaman will give a Brookhaven Lecture on Wednesday, January 20. His talk, entitled "Between Wind and Water — Meteorology at the Interface," will begin at 8 p.m. in Berkner Hall.

King Film, Part II

Part II of the documentary film, "Dr. Martin Luther King, Jr.... An Amazing Grace," will be shown today in Berkner Auditorium at 12 and again at 12:35.

The film is free of charge and sponsored by the Afro-American Culture Club.

Bowling

White League

Team standings remain the same with the Dips still in first place. M. Stoeckel bowled a 202, N. Roesler 170, J. Roesler 196/188/211/595 scratch, D. Adams 190/200/206/596 scratch.

Red League

High games were bowled by R. Sick 212, H. Marshall 220, T. Prach 202, E. Gill 200, J. Morris 222/201, J. Connelly 224, J. Petro 212, C. Neuls 217, R. Barberich 210.

Purple League

C. MacDougall rolled a 190/199/558 scratch, G. Riker 182, K. Riker 200, W. Milian 210/211/590 scratch.

Pink League

D. Johnson rolled games of 167/162/183, R. Rosati 168, F. Scesny 197, J. Thiede 181.

Cafeteria Menu

Week Ending January 22, 1982

Monday, January 18

Beef barley soup	(cup)	.55
	(bowl)	.65
Salisbury steak & 1 veg.		1.70
Spaghetti and meatballs w/garlic bread		1.70
Hot Deli — Roast beef	(bread)	1.75
	(roll)	1.85

Tuesday, January 19

Pork and cabbage soup	(cup)	.55
	(bowl)	.65
BBQ spare ribs & 1 veg.		1.75
Beef hash & 1 veg.		1.70
Hot Deli — Grilled Reuben		1.75

Wednesday, January 20

Split pea soup	(cup)	.55
	(bowl)	.65
Western type chili over rice		1.70
Corned beef and cabbage		1.75
Hot Deli — Country-style pork sandwich	(bread)	1.75
	(roll)	1.85

Thursday, January 21

Chicken vegetable soup	(cup)	.55
	(bowl)	.65
Sweet and sour pork over rice		1.75
Roasted turkey breast and stuffing		1.75
Hot Deli — Veal pattie and pepper hero		1.80

Friday, January 22

Manhattan clam chowder	(cup)	.60
	(bowl)	70
Fish and chips		1.70
Baby beef liver w/onions & 1 veg.		1.70
Hot Deli — Meatloaf w/BBQ sauce	(bread)	1.70
	(roll)	1.80

Classified Advertisements

Autos & Auto Supplies

72 DUSTER - 3 spd floor shift, 6 cyl, high mi., dependable. $500. Jim, Ext. 7669.

78 CAMARO - 305 V8, a/c, a/t, p/b, p/w, instr, am/fm, s/s snows, A1 mech. cond, recent major tune-up and brakes, excel mpg. Ext. 7766.

72 DODGE DART - Swinger, (good). $600. (Have to go into service, Feb.). 399-0864.

78 CJ7 JEEP - 6 cyl, turbo charged, low mileage, stereo, extras. $5,000. Firm. 732-4728 eves.

69 KARMANN GHIA - 30 mpg, good commuting auto. $700. Helen, Ext. 3069.

75 OLDS CUTLASS SUPREME - Spt. coupe, auto 260 V8, stereo cassette, swivel front seat, powder blue, white int., immaculate, must see. Asking $3,000. Ext. 3381 or 286-1024.

79 JEEP - ¾ ton pickup, 4 w/d, 10,000 mi, new snow plow, a1 cond. $7,500; also '76 GRANADA FORD - p/s, p/b, a/c, good cond. $1,600. 728-3364.

66 MUSTANG COUPE - 200 cu, 6 cyl, rebuilt 3 spd trans, clutch, pressure plate and parts,$250; exhaust system, 6 cyl. $65. 732-8316 after 2 p.m.

76 MUSTANG COBRA - 302, p/s, p/b, a/c, am/fm 8 track, 68,000 mi, excel cond. $3,700. 727-1429 eves.

SNOW TIRE - GR78-15 Delta Dura steel w/w, like new. $25. 744-1429.

69 CHEVY - 4x4 ¾ ton truck w/snowplow, $1,000; '68 VW conv., poor cond. $250. 589-9103 eves.

80 FORD BRONCO - 4x4, p/s, p/b, 10,000 mi, 302 V8, auto, steel belted radials, many extras, excel cond. $8,200. Financing available; fiberglass liner and toolbox for pickup truck w/8 ft. bed. Ext. 4751 or 473-1967.

NEW TIRE - and rim for Datsun F10 ('78), $35; also repair manual, $7; jack, $5. John, Ext. 3292 or 286-1348.

CAMPER - fifth wheel Midas 31 ft. excel, less than 10,000 mi, must sell. Asking $9,000. Ext. 7130 or 929-8323.

79 CHEVY - pickup, 4 w/d, short bed, 350 4 spd, dual tanks, Scottsdale package, rear sliding window, rust-proofed, economy rear, 10,000 mi., like new. $7,200. Ext. 7130 or 929-8323.

66 SCOUT - 4 w/d, 4 cyl, 3 spd trans, good tires, runs OK, needs some work. $550. Ken, Ext. 2350.

AUTO ROOF CARRIER - new 37"x37". $20. Jag, Ext. 5080 or 751-1884.

TIRES - (2) G78x14 glass belted rads w/w, new $130. Asking $100. Carol, 289-3917 after 4 p.m.

78 MAZDA GLC SPORT - 5 spd, am/fm cassette stereo, radials. $3,900. Paul, Ext. 2071 or 928-8171 eves.

73 PONTIAC LEMANS - sta. wgn, new clutch, 3 spd, excel mech cond, good mpg. 698-7428.

DISC BRAKE ROTORS - (2) w/bearings, 1974 Ford Torino, good cond. $30. Dan, Ext. 2021 or 698-7322.

81 KDX 175 - runs excel, head light, brake light, street legal. $1,050. Hank, Ext. 3848.

CAR RADIO - 12 volt, am/fm, 4 speakers, 3 mos old, from Toyota. $40. Stan, Ext. 3284 or 286-1062.

TIRES - (2) s/b radial-snows, GR78-15 mounted on 5 lug GM rims, practically new. $65 for both. Joe, 289-1442 or 289-0876.

67 PONTIAC LEMANS - in wreck, sell for parts, good rebuilt 326, drive train good, too. Asking $150. 289-3917.

68 KARMANN GHIA - needs some body and electrical work. Runs. Inspected. Best offer. 286-3851.

67 PLYMOUTH - good 2nd car, new brakes, new starter, needs battery. Asking $250. 473-8749 after 3 p.m.

TIRES - (4) Bridgestone 155SR13 radials, 1,600 mi. only, like new, orig. equipment from 1982 Civic. $100 for all. Chris, Ext. 4367.

TIRES - (2) new size 15. Asking $75 neg. (leaving for Air Force, Feb.). 399-0864.

Boats & Marine Supplies

23' ALLMAND - fiberglass 150 hp Mercury i/o cuddy cabin w/trailer. $3,800. 475-2679 eves.

18' GARVEY - and 40 hp Johnson outboard, good cond. Both for $800. John, Ext. 3292 or 286-1348.

Free

ABOVE GROUND POOL - Ext. 3492.

BAGGED HORSE MANURE - free, you pick up, Sayville vicinity. 589-7316.

Miscellaneous

WALNUT END TABLE - 2 tiers, Traditional, 22h x 26 dia., $50; wrought iron andirons, 20h x 18 deep, $25. 928-7826 eves.

SKI BOOTS - "Hanson" used twice, sz 10½-11, new cond. $65. Walt M., Ext. 3256.

MOVIE CAMERA - Argus regular 8 mm, battery operated, automatic aperture, OK for beginner. $10. Ext. 4745.

HALLICRAFTER - 540A, $25; fireplace hydrograte, $30; Morsan skis 195 cm, no binding, $10. Frank Rumph, Ext. 4581 or 588-3565.

KENWOOD AUDIO - Purist System, Preamp, Tuner, Mono Amps, List $2,725. All new for $1,300. 732-9433 eves.

REFRIG - 17 cu. ft. GE w/ice maker, excel cond. $175; dressmaker's adjustable form, new $25. 744-0843.

FREEZER - Sears upright, 15.4 cu. ft., excel cond; Base station CB w/antenna. Don, Ext. 2225.

SKIS - 195 cm w/Salamon bindings, $55; ski boots sz 11, $30, good cond. Ext. 4748.

REFRIG - GE Deluxe, no frost, 19 cu. ft. Avocado, Best offer. Ext. 4959.

BABY LAMP - wooden figures, music box type, $20; desk, wooden w/fold down top, 3 drawers, needs refinishing. $45. 286-0422 after 6 or Ext. 2888.

P.A. SPEAKERS - S.G. (2) 12" in each column, $75/pr. Univox Echo, hardly used. $30. Joe, Ext. 4661.

TV - Zenith portable w/stand, excel cond, $100; color antenna, $10. 878-8933.

FREEZER - $200; B&W TV, needs repair, $25; shag rug, $40; girl's bike, $45. Paul, Ext. 4156.

SKI RACK - rain gutter clamp MTG for 4 pr. skis. $30. Nick, Ext. 4615 .

STOVE - wood burning, brand new welded steel plate w/cast iron doors, 25"x26"x33". $295. Haeg, Ext. 4863.

FIRE WOOD - seasoned oak, 4ft. x 8ft. x 16-18" long. $50 . 924-3236.

GE RECORD PLAYER - attached speakers, $15; boy's 5 spd bike, $35; boy's 3 piece blue suit sz 12, $15; boys ice skates, figure sz 6; hockey sz 5-7, $5. ea. 475-2998.

ATLAS WOODSHAPER - excel cond, new bearings & motor Inc. $300. worth of cutters. $600. 286-1369.

STOVE PIPE - 8" elbow, triple wall, 30° off-set, new, Sears. $20. 589-1069.

PLAYPEN - 40" sq., new pad, v.g. cond, $25. Tom, Ext. 4084 or 878-1060.

REEL MOWER - push type (hand power) "Save Energy" $10; fireplace doors, also a hanging screen, $25. for doors (cost $50) $12. for screen. John, Ext. 3292 or 286-1348.

CONVERTIBLE COUCH - Unusual Mediterranean design, Naugahyde, excel cond. $85. Firm. Ext. 3593 or 286-3540 eves.

GE PORTABLE ROOM COOLER - $100; lawn mower 21" ½ HP, $25. 821-9346.

GIRL'S BIKE - 16" w/training wheel, $30; big wheel, $6; trikes 821-9346.

ELECTRONIC MEDICAL THERMOMETERS - brand new, $10. C. Nielson, Ext. 3935 or 325-0968.

WING CHAIR - black, excel cond, $85. Ext. 3652 or 744-5866 eves.

TV - 16" RCA black & white portable w/stand, $15. Ext. 4372 or 282-3032.

GE - 4 burner electric top & oven & hood & sink. $200. Takes all. Ext. 2964.

FISH TANK - 30 gal. completely set up, many hand made assy. plus stand. $50. Bob, 289-3917.

PIPE THREADER - 1¼" Ridgid #111-R, $20. Walter, Ext. 3397 or 567-9025.

TV ANTENNA - mast & tripod, good cond. but surface rust, $15. Bill , Ext. 2378 or 286-0243.

FLUTE - Purcelle, excel cond, $150; trumpet w/mouthpiece, $200; 12 string guitar Classical, $75. Paul, Ext. 2961.

OIL BURNER - 5 yrs. old, new xformer, excel cond. $30. Ralph, Ext. 2388 or 928-6654.

WALNUT DINING ROOM TABLE - 4 chairs, black naugahide seats, cane backs, leafs, pads. 878-8933.

ELECTRIC WOK - Westbend, silversotne finsish w/cookbook, Christmas gift unopened sells for $40. my price $25. Ext. 3632.

SPLIT SEASONED OAK - Full cord. $125. 286-3235.

ELECTRIC STOVE - heating elements, one small, one large, new. $30. Hank, Ext. 3848.

AUTO FLOOR JACKS - (2) $50; Genie door opener, $100; stereo console, $50 . 878-8933.

COAL STOVE - Haas & Sohn, 38,000 BTU, used only 3 wks, Best offer over $550. Al, Ext. 2072 or 929-8411.

CONVERTIBLE COUCH - recliner; misc. bdrm & living rm furniture; Osterizer; lamps; etc. 289-8182 after 5 p.m. or wkends.

CHANDELIERS - 2 table lamps; Deming water pump w/30 gal. tank & press switch, buffet ; medicine chests; bath vanity; headboards; brass twin size bedframe. Jake, Ext. 4532.

MATCHING FIELDCREST COMFORTER - $30. & Springmaid sheets (3) & p.c. $20. 928-7826 eves.

MEN'S JACKET - Macy's leather works; brown sz 46, 2 mos. old. Cost $175. Asking $100. 589-1069.

Real Estate

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

For Sale

MATTITUCK - 3 bdrm, 2 baths, wood/coal stove, taxes $1,300, deeded beach rights on Peconic Bay, fenced back yard, lg. patio, playroom. $70,000. 298-4398.

MILLER PLACE - contemporry ranch house, 4 bdrms, eik, l/r, den, fenced yard, excel cond. Rustic Acres. $78,500. 331-3724

WADING RIVER - 3 bdrm older brick home, adj. to Wildwood Pk. & priv. beach. Beautifully renovated, HW floors, pvt. 1 bdrm apt on sep. floor, pvt. ent ($250-300/mo), landscaped, wooded lot, 80'x100', quiet treed street, nice neighborhood, low taxes, Riverhead schools. $55,500. 929-4180 before 10 p.m.

For Rent

MIDDLE ISLAND - 1 bdrm, apt. priv. utilities incl. Single male preferred. By appt. 732-9851.

E. SETAUKET - 1 bdrm, l/r, bath, kit., furn., modern new apart. Immediate occupancy. 331-9349.

PATCHOGUE EAST - Bayview Ave., 2 bdrm, eik, l/r, bath. $325/mo. Incl. heat. Walt, Ext. 2913 or 2907 or 698-0576 after 6 p.m.

ROCKY POINT - 1 bdrm apt., new kit, w/w, $350/mo. incl. utilities. 751-9561 after 4:30 p.m.

STONY BROOK - 3 bdrm house, 5 min. to Univ. stores & LIRR, overlook LI Sound. $550/mo. plus util. 928-8522 after 6 p.m.

PT. JEFFERSON VILLAGE - spacious 2 bdrm apt. in apt. complex, available March 1. $480/mo. plus Security. Heat incl. Peter, Ext. 2744 or 2734, 928-2469 eves.

POCONOS CHALET - in Priv. Community, indoor pool, ski Tanglewood, $110/weekend. Bob, Ext. 4551 or 289-2159 eves.

STONY BROOK - 4 bdrm, 2½ baths, l/r, d/r, f/r, Colonial, 2 car garage, all appliances, partially furn. walk to Univ. $750/mo. plus util. Ext. 4273.

MASTIC - 1 bdrm. $265. pays all. Two mos. sec., refs. 281-7844.

Wanted

BABYSITTER - Reliable, person to care for 2 mo. old infant. Weekdays 8:30 to 5:00. Must be on site or in very close proximity. Sue, 751-5829.

CB ANTENNA - for mobile unit. Fred, Ext. 3521 or 286-1688 after 6 p.m.

COLOR COMPUTER PROGRAMS - have radio shack TRS-80. Will trade programs. Dick, Ext. 2911, 698-5298.

ROLL TOP DESK - barbie doll collection; organ note books; vacuum cleaner. 924-4991.

TRAINS - Lionel, any "O" gauge or "027" gauge cars, track & equip. Frank, Ext. 3120.

HI CHAIR - dark wood, good cond. Kelly, 744-3069.

STEREO CASSETTE RECORDER - good cond, reasonable price; also 8 MM projector in good cond. John, Ext. 3292 or 286-1348.

FULL SIZE BABY CRIB - mattress; high chair, in good cond. 286-1214.

RANGER HOCKEY TICKETS - (4) for any game. Price no object within reason. Charlie, Ext. 3950.

VIOLIN - ½ size please call Lee, Ext. 3294.

AMBITIOUS PERSON - $200 - $300/mo.; 6-8 hrs./wk. 698-5861 after 7:30 p.m.

BABY BASSINET - used, good cond. Ext. 7760 or 744-5256 eves.

EXERCISE BICYCLE - any cond, reasonable. Rick, Ext. 3803.

TRAINS - Lionel, American Flyer, accessories, any cond. brings good price. Carole, Ext. 3362 or 924-4067 eves.

BAG - for bowling ball. Susan, Ext. 4267.

PERSON TO WORK PART TIME - w/people, great income potential. 732-6647 for interview appointment.

SCHWINN EXERCYCLE - Ext. 3575.

FEMALE BOWLERS - for Tues. night ladies league in Shirley. Andrea, Ext. 4308.

BROWNIE UNIFORM - for 8 to 10 yrs. old girl, esp. the beanie. Ext. 3175.

TABLE MODEL JIG SAW - that can cut ¾" pine. Ext. 3965.

ROOMMATE TO SHARE - 2 bdrm. Condo in Holtsville, 5 appliances, female please. $225/mo. incl. all. Ext. 3199 or 475-6622.

Car Pools

BAYPORT/BLUEPOINT AREA - want to join exisitng car pool or start new one. Rick, Ext. 3932.

BABYLON/WEST ISLIP - driver needed for 4 person car pool. Ext. 2493.

SOUTH BAYPORT - Mon. to Fri. join existing car pool or form new one. Ken, Ext. 3574 or 472-3329.

Lost & Found

LOST - ladies watch, "Citizen," white metal band, on Jan. 12, between 4 and 5 p.m., possibly near Biology. Inan, Ext. 3293.

FOUND - small pen knife in Bldg. 510 parking lot. W. Kane, Ext. 3841.

Services

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

FIREWOOD - split, seasoned oak 4'x16'x18". $110. delivered. 924-4284 or 924-3919.

HOUSE PAINTING - interior/exterior, professional, quality materials, insured. Bob, 289-7657 after 6 p.m.

VINYL SIDING - aluminum trim, free estimates. Licensed and insured. Wayne, 878-8459 after 6 p.m.

LIMO SERVICE - luxury chauffered for proms, weddings, airport, all occasions. Roy, Ext. 4662 or 744-8779.

CERAMIC TILE WORK - also cement work. Reasonable prices. Donald, 281- 8848 or John, Ext. 3292.

BURGLAR ALARMS - Shop at home service. Equipment only, or installed. Free survey. Custom systems. 399-3806.

SMALL APPLIANCE REPAIRS - vacuums, typewriters, sewing machine, etc. 654-3900.

CARPETS INSTALLED - repaired, quick, dependable service. Free estimates. Jim, 821-0187 after 5 p.m.

PROFESSIONAL INCOME TAX SERVICE - by experienced preparer, year round service. Jack, Ext. 7942 or 864-2236.

PLUMBING & HEATING - lab discount. John, 654-8189.

FIBER RUSH - and caning. Reasonable rates. Jim, Ext. 5025 or 821-1704 eves.

Classified Ad Policy

Deadline is 4:30 p.m. Friday for publication Friday of the following week.

1. The Brookhaven Bulletin s classified section may be used only by active and retired Laboratory employees.
2. All items for sale or rent must be the advertiser s property.
3. Ads for material acquired for resale in association with a full or part time business cannot be accepted.
4. Ads for the sale or trade of firearms will not be accepted.
5. Ads not carried because of space restrictions will be held for publication in the next issue.
6. Ads are run only once and must be resubmitted if they are to be repeated. One ad per person per week.
7. **Property for sale or rent cannot be accepted on this form. Special Real Estate Ad Forms are available at the office of the Brookhaven Bulletin, Building 134.**

☐ For Sale: Autos & Auto Supplies ☐ For Sale: Boats & Marine Supplies ☐ For Sale: Miscellaneous ☐ Car Pools ☐ Lost & Found ☐ Services ☐ Wanted ☐ Free

Please print your ad below in 15 words or less using one word per block. Include name and phone number to call.

Note: The following must be completed for your ad to appear.

NAME (Please Print) .....

Employee s Signature ..... Life No. ..... Ext. .....

Send to: Brookhaven Bulletin, Building 134 (Ext. 2345)

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