BROOKHAVEN BULLETIN

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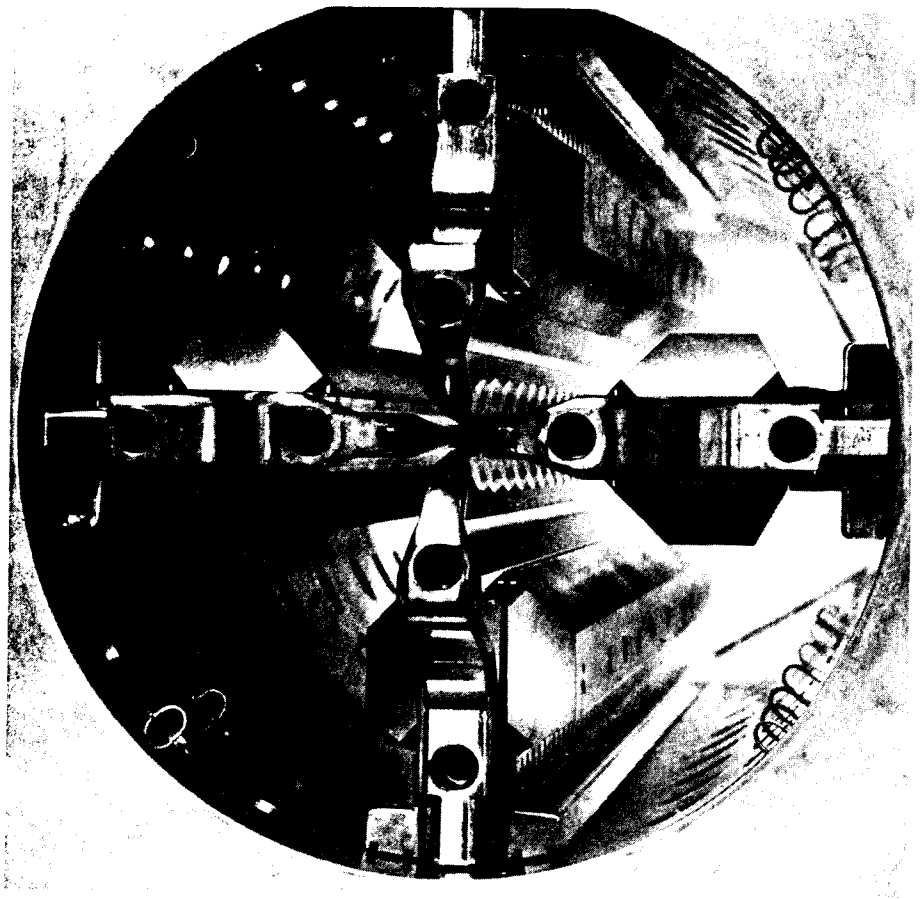
BROOKHAVEN NATIONAL LABORATORY



RFQ Linac preinjector for polarized proton acceleration in the AGS.

High Energy Facilities

To understand the fundamental nature of matter, physicists must look at its basic constituents, including heavy ions and elementary particles. Ironically, this requires large facilities, capable of driving these minute entities to very high energies.

Existing Facilities

The versatility of the Alternating Gradient Synchrotron (AGS) was evident in 1983, as the Accelerator Department reached for new plateaus. The AGS and Experimental Planning & Support Divisions worked on:

- Experiments — Nineteen experiments ran on the AGS in 1983; twelve were completed.
- H^- Injection — During this first year of operation with H^- injection, AGS intensities reached record heights, climbing to 1.62×10^{13} in December. For increased operational reliability, a second Cockcroft-Walton preinjector was converted to H^- injection.
- Single Bunch Extraction — The January commissioning of this third operational mode opened up a new realm of experimentation at the AGS.
- Polarized Protons — In June, a new ion source for providing a polarized H^- beam achieved record intensities in excess of 12 mA. At year's end, the newly-constructed radio-frequency quadrupole (RFQ) preaccelerator, which will accelerate polarized protons to 750 keV before injection into the Linac and AGS, was undergoing tests. With special quadrupole magnets installed in the ring and construction of other systems fast-approaching completion, everything looked good for the circulation of a polarized proton beam in the AGS early in 1984.
- RF Improvements — In May, experimenters found their data-taking capability increased when slow beam spill quality was improved by shorting rf cavity gaps during flat-tops. Then in August, beam loading compensation for the rf acceleration system was tried successfully. This will increase the reliability of high intensity performance.
- Experimental Areas — A new experimental area, about one kilometer north of the AGS, was constructed this year for the study of neutrino oscillations. Newly renovated, the target station on the B-line has all quick-change features, while the D-line now boasts a stopping muon beam. A test earlier this year of the stopping $-K^+$ beam led to the acceptance of a proposal to search for rare $K^+ \rightarrow \pi^+ \nu\nu$ events. And a new high energy, high intensity test beam, which became operational in April, has been in great demand.

The Advanced Technology Applications Division continued to center its attention on the Power Transmission Project. The superconducting system was operated on three occasions this year, each lasting about two weeks, during which the cables were tested up to 500 MVA per phase, with voltages as high as 110 kV to ground. On the last run, the system ran unattended, apart from computer monitoring. Also in 1983, a new ambient temperature cable was built and installed, using a fully synthetic tape insulation developed by the Division.

Future Facilities

When 1983 began, the Colliding Beam Accelerator (CBA) was the focus of the Lab's future high energy facilities program. In March, the first full cell reached full current in the CBA tunnel, and the eighth full-size superconducting magnet passed its field quality tests with flying colors. By July, having met all design objectives on schedule, the magnet division was ready to begin full-scale magnet production.

But July also saw the High Energy Physics Advisory Panel come to its recommendation to discontinue the CBA Project. It was clear, however, that this recommendation did not reflect upon the project's recent progress. Quite simply, the sense of the high energy physics community was that the important physics had already passed CBA by. With the discovery earlier in the year of the $W^{\pm}$ and Z^0 particles at CERN, the community began looking beyond CBA energies to a Superconducting Super Collider (SSC) that could boast energies in the range of 20×20 trillion electron volts (TeV).

Building such a machine by the mid-1990's will require a cooperative national effort, with each Lab contri-

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1983 In Review

There is no doubt that the most significant event in the affairs of the Laboratory during 1983 was the termination of the Colliding Beam Accelerator (CBA) project by the Department of Energy. DOE's action followed a recommendation in July by the High Energy Physics Advisory Panel that CBA be scrapped in favor of a more ambitious nationwide effort to build a superconducting super collider (SSC).

Although the denial of CBA was a blow to the Laboratory, life went on. Task forces were immediately appointed to address such issues as improvements to the AGS, research and development for the SSC and the concept of a heavy ion collider. At year's end, Director Nicholas Samios announced that the Laboratory would pursue the goal of creating a facility for relativistic heavy ion physics research. A feasibility study was submitted to DOE, and a task force appointed to prepare a detailed design proposal for a heavy ion collider to be located in the CBA tunnel.

Related to this proposal was a project to link the Tandem Van de Graaff to the AGS for the acceleration of heavy ions, a facility which could eventually serve as an injector for a heavy ion collider.

In 1983, after 23 years of operation, the AGS reached record intensities, and its versatility was apparent in plans for accelerating both polarized protons and heavy ions.

Brookhaven's other programs in the physical and life sciences were sound. The Light Source, in its first year of operations, boasted 92 users from 22 different institutions, and was given the go-ahead on Phase II additions. Biology and medical programs were looking up and applied science research remained stable.

The FY 83 budget (Oct. 1, 1982 - Sept. 30, 1983) included $175,200,000 for operating expenses, $13,300,000 for capital equipment, and $14,400,000 for construction.

In the same period, the Lab did a lot of business; 27,688 contracts were let for a total of $59,250,831. Of this amount, $2.8 million went to minority businesses, and $26 million to Long Island firms.

Also during Fiscal 83, the Laboratory hosted 127 conferences at Berkner Hall and the Brookhaven Center. In addition, numerous other workshops and meetings were held in departmental offices.

As of December 15, 3,200 people were employed at BNL. And the Laboratory continued to draw guests and research collaborators; 1,500 held appointments at the close of the year, a number which reflects an increase in the number of industrial participants, principally at the Light Source.

The Office of Research and Technology Applications made progress in its goal of promoting greater interaction with industrial R&D leaders, and transferred five technical products resulting from BNL research. These included an emulator of a CDC 6600 computer and peripherals; polymer concrete material; a high speed memory device; a fast closing valve; and an atmospheric sampler.

Over 14,000 people took advantage of the tour program to find out about the Lab's research. They included college and professional groups, high school students and visitors on Summer Sundays.

National Synchrotron Light Source

The National Synchrotron Light Source (NSLS), in 1983, marked the first anniversary of vacuum ultraviolet (VUV) ring operation and received Congressional approval for Phase II, a three-year expansion project.

Phase II's $19.7 million budget will be used to expand the present NSLS structure and develop six highly advanced experimental beam lines. Five of the lines will incorporate "wigglers" or "undulators." With these magnetic devices, the intensity of the photon beam can be significantly increased, or its frequency can be shifted.

The first NSLS permanent magnet undulator was installed last January in the VUV ring as part of a Free Electron Laser experiment. The undulator will also provide a highly collimated photon beam in the 10 to 100 electron volt region during regular storage ring operations.

Through its first anniversary in August, the VUV ring had 92 different users from 22 separate institutions. Typical beam currents increased from 80 milliamperes (mA) to 200 mA (with a maximum current of 300 mA), while beam energies and lifetimes increased from 600 mega-electron volts (MeV) to 750 MeV and from 30 minutes to two hours, respectively.

Already, participating research teams at the VUV ring have had key results. At the IBM lithography line at port U6, the high intensity and collimation of synchrotron radiation have been utilized to expose a number of photoresists, and features as small as 0.25 microns have been replicated successfully with high aspect ratios. On port U15 a research team from the State University of New York at Stony Brook, in collaboration with the NSLS, has constructed a soft x-ray scanning microscope that is providing the first pictures of the internal structure of living cells in aqueous solutions, while imparting a minimal radiation dose. Spatial resolutions on the 0.1 micron level have been achieved.

Although x-rays were sent down a beam line late in 1982, the diversion of manpower to the VUV ring and unanticipated technical challenges combined to delay the commissioning of the X-ray ring. During late spring and summer, however, a concerted effort was made to upgrade X-ray ring hardware (power supplies, diagnostics, etc.). In early October, beam was successfully stored again in the X-ray ring, with maximum currents of 15 mA and lifetimes of 20 minutes, and light exiting from all ports (X-9

(Continued on page 4)

Physics

In the Physics Department three separate areas of physics are under study.

High Energy Physics

Experimental high energy physics at BNL is centered at the AGS. In 1983 experimenters accumulated hundreds of neutrino and antineutrino electron scattering events to test the electroweak theory at low energy, and began looking for neutrino oscillations with a narrow band beam. Studies of K-meson decay were designed to shed light on charge parity (CP) violation. An experiment looking at the decay $K^+ \rightarrow \pi^0 + \mu^+ + \nu_\mu$ has observed no CP violation, while another study has found no difference in the CP violating $\pi^0\pi^0$ and $\pi^+\pi^-$ decays.

At the Multiparticle Spectrometer II, data taking was completed on two glueball experiments. In one, analysis of new data confirmed the previous discovery of two $\phi\phi$ resonances and detected a third glueball candidate. The other experiment should clarify the status of the E-meson as a glueball candidate.

In the first reported results from the Irvine/Michigan/BNL proton lifetime experiment, no candidates have been observed for the decay $p \rightarrow e^+\pi^0$, giving an upper limit of 1.5×10^{32} years, which rules out the simplest grand unification model of strong, weak and electromagnetic interactions (GUT).

Theoretical work included radiative corrections to $\nu_\mu e^-$ in the Weinberg-Salam theory, mixing between quarks of different generations and CP violation, refinement of supersymmetric GUT predictions and Monte Carlo simulations of quantum field theory. A program called ISAJET was developed to simulate $W\pm, Z^0$ and jet production at high energy.

Solid State

An important part of the solid state program is concerned with the study of surfaces and adsorbed films.

It was shown that x-rays can be used to probe the structure of monolayers adsorbed on single-crystal substrates — well-characterized surfaces of macroscopic dimensions. The first experiments studied xenon on graphite, and provided orientational as well as positional information about the structure.

A new approach to the vibrational spectroscopy of surface molecules was developed. Positrons are injected into the solid substrate and subsequently re-emitted. The change in the positrons' energy gives direct information about the vibrational spectrum of the molecule. First results of a study of carbon monoxide on nickel suggest that this method will be more accurate than equivalent experiments with electrons.

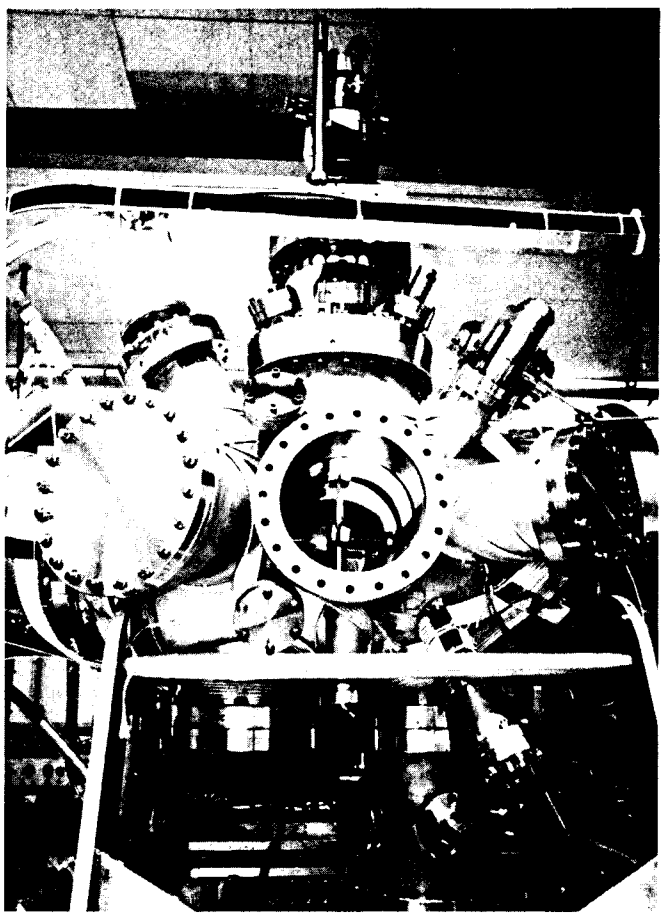
Members of the solid state theory group have obtained the most accurate available description of charge and spin density distributions in nickel films which have hydrogen chemisorbed on the topmost layer. One of the important features established by this work is that hydrogen drastically reduces the surface magnetism of nickel.

Nuclear Physics

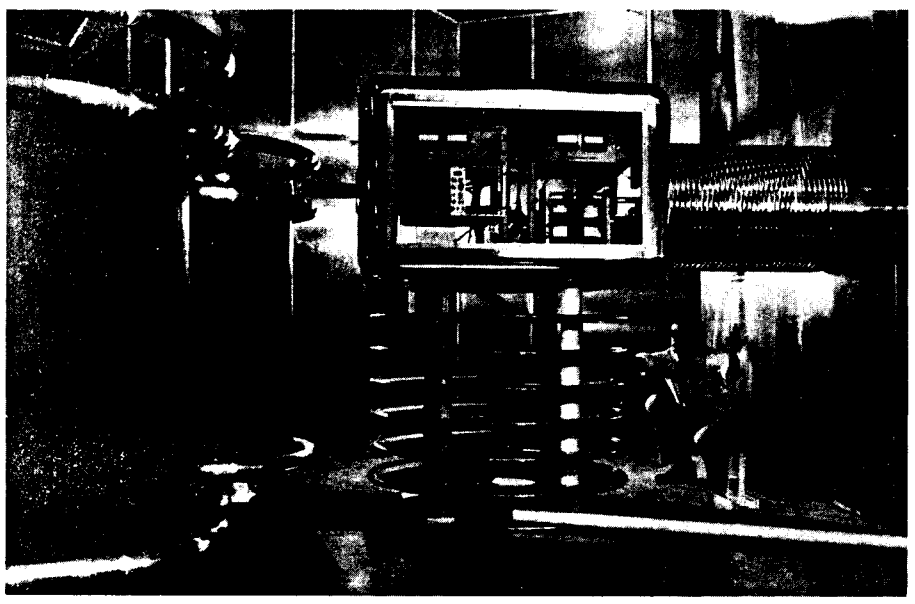
In June, the first beam of radioactive carbon-14 ions was accelerated in the Tandem Van de Graaff facility, permitting study of various neutron rich nuclei. In an experiment performed by a BNL/U. of Washington collaboration at their respective tandems, protons of energies from 11 to 39 MeV were used to bombard targets of ^{27}Al, with subsequent proton capture and formation of ^{28}Si. Studies of the highly excited nucleus revealed that the proton is captured into a single particle orbit, but that moving around, it finally excited the whole ^{28}Si nucleus into a collective dipole motion.

At the AGS, gamma rays from discrete, identified states in hypernuclei were observed for the first time. At the HFBR full operation of the Tristan facility made possible studies of fission product nuclei to test detailed models of nuclear structure.

Nuclear theory at Brookhaven fits into a slot between particle physics and experimental nuclear physics. Interest this year focused on nuclear molecules, reactions with secondary beams at the AGS and the structure of elementary particles. One calculation explained supernovae explosions.



The ultra high vacuum surface analysis chamber housing the Re-Emitted Positron Energy Loss Spectroscopy (REPELS) apparatus (center of open port). To the left (not pictured) is the positron source: an electrostatically focused monoenergetic positron accelerator.



Studying the high voltage post acceleration terminal, is Robert Beuhler, co-principal investigator of the Chemistry Department group that used the apparatus for the detection of clusters and high molecular weight ions.

Chemistry

The use of metal complexes to mediate storage of light energy is a vigorous research area in the Chemistry Department. Excited states of metal complexes are used to generate extremely reactive reductants and oxidants, which in turn bring about water reduction and oxidation. Recently, a detailed sequence of photo-induced reactions, culminating in hydrogen formation, was discovered by the inorganic group. In 1983, substantial progress was made with the complementary process, oxygen formation. Further studies of how metal complexes catalyze reactions which involve the net transfer of several electrons are presently under way, including studies of light-induced reactions using extremely short-pulsed lasers.

Another group used a high voltage post acceleration terminal to study energy transfer in ion impacts on solid surfaces and to detect ions in studies on nucleation phenomena in the free jet expansion of weakly ionized plasmas. Evidence was obtained of especially stable closed shell structures in cluster ions containing as many as 550 or 912 argon atoms or nitrogen molecules.

At the National Synchrotron Light Source, Chemistry operated three beam lines in 1983. Chemists on beam line U7 studied structures of surfaces, and processes which take place on surfaces. On beam line U9A, investigations began on the lifetimes of gas phase excited states and photoconductivity in nonpolar liquids. Studies concerning photoionization of molecules, dimers and radicals at VUV wavelengths started on beam line U11.

Chemistry's multidisciplinary radiotracer research program is exploring the application of positron emission transaxial tomography (PETT) to problems in the neurosciences. Innovation in cyclotron targetry, automation and rapid radiotracer synthesis has led to the development of labeled sugars, neurotransmitter receptor ligands and other biomolecules. PETT studies of neurological disorders, psychiatric disease and tumor growth in humans is strengthened by major collaborative ties with New York University, the University of Pennsylvania, SUNY at Stony Brook, and the BNL Medical Department.

Medical

At the Medical Department, October marked the tenth anniversary of off-site shipments of radiopharmaceuticals produced in the Brookhaven Linac Isotope Producer (BLIP). Now, the Radionuclide and Radiopharmaceutical Research (R&RR) Group, which operates BLIP, is gearing up to meet the projected demand for iodine-123, one of many isotopes they have developed. Perhaps the greatest example of technology transfer in this area is Technetium-99m, a radionuclide which is a key component in a kit for labelling red blood cells. The kit was patented here in 1976 and is much in demand by the medical community.

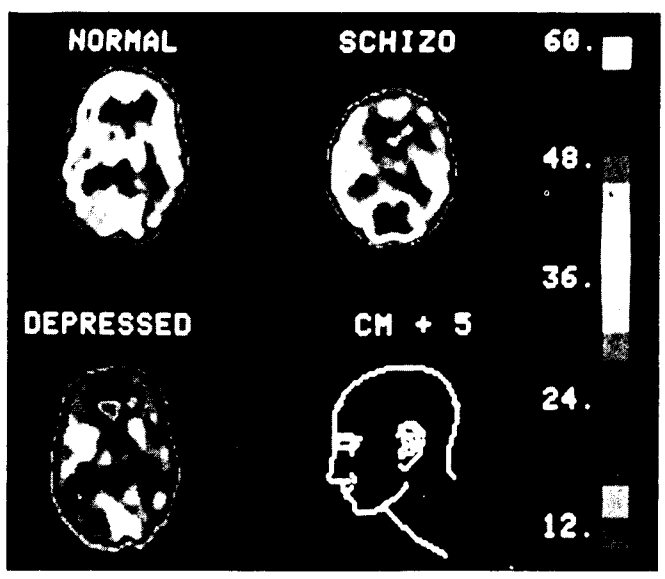
Other research of the R&RR group centered on a program to develop radiolabeled monoclonal antibodies. Techniques using monoclonal antibodies and newly synthesized carriers of boron to tumors were described at a joint BNL/MIT conference held at MIT in October. Eight papers were presented there by BNL participants, indicating renewed research activity in this program, a major effort of the department 25 years ago.

Radioisotopes are also important to noninvasive nuclear medicine procedures, such as the new Universal Nuclear Imaging Construct (UNICON), a machine that tests functional performance of organs.

Testing organ function is one aspect of the complete medical evaluation being given to participants in a new study of the effects of synthetic fuels on industry workers. Funded by the EPA, the study is a collaboration between the University of Pittsburgh and Brookhaven researchers from S&EP, DAS, and Medical.

Another important study concluded this year involved the investigation of chromosome aberrations in residents of Love Canal and a control group from the nearby Niagara Falls area. BNL's researchers found no significant difference between the chromosomes of the subjects in these two groups, but pointed out that, ideally, the results for both groups should be compared to base-line measurements for a normal population. A new departmental study was implemented to create such a base-line.

Weight loss was the subject of another study aimed at analyzing the effects of long term dieting on body composition. Findings indicate that no matter whether the dieter follows a low or high carbohydrate menu, weight losses are approximately two-thirds fat with the rest in water and lean tissue.



These scans were taken by PETT VI for a BNL/NYU study on subjects injected with the radioactive tracer ^{18}F fluorodeoxyglucose. Each scan shows the layer of the brain marked by the line on the graphic (bottom right). The brightest areas indicate glucose metabolism. In a normal subject, glucose is metabolized evenly, In the schizophrenic subject, metabolism is heightened around areas associated with vision, perhaps indicating hallucination. By contrast, little metabolism occurs in the depressed subject.

Biology

New to the Biology Department's research programs in biological structure are two facilities being developed at the National Synchrotron Light Source X-ray ring. One will provide time-resolved one- or two-dimensional measurement of low angle x-ray scattering, suitable, for example, for the study of contracting muscle. The other will provide photographic measurement of x-ray diffraction data from single crystals of biological macromolecules.

Several discoveries have been made in molecular genetics. An enzyme called gyrase is present in the bacterium *Haemophilus influenzae*. When this enzyme is in larger than normal amounts, because of a mutation, there is a remarkable effect on a cell carrying a prophage — DNA of a bacterial virus. The prophage in a cell with extra gyrase is much more likely to form a virus which kills the cell.

DNAs from human cancers — malignant melanoma, basal cell carcinoma, multiple myeloma and acute lymphocytic leukemia — were inserted into normal human cell recipients and transformed to an early step in carcinogenicity.

Pathogenic bacteria frequently carry plasmids (extra chromosomal genetic elements) that give resistance to drugs and interfere with clinical treatment of disease. Recombinant DNA techniques were used to discover previously unrecognized interactions between plasmids and chromosomes in *Streptococcus pneumoniae*. Depending on whether the bacteria were grown in the presence of sulfanilamide or tetracycline, the plasmids they contain recombined with genes of the chromosome to give greater resistance to one or the other drug.

Nobel laureate Peter Mitchell at Glynn Research Institute in England suggested how *b*-type cytochromes might convert electrochemical into chemical energy by a "Q-cycle" mechanism. Research here with a protein complex from photosynthetic membranes has revealed the presence of two *b*-type cytochromes which are thermodynamically comparable to their respiratory counterparts.

In plant sciences research, a potent toxin was isolated and purified from a toxic strain of *Microcystis aeruginosa*, frequently the major component of freshwater algal blooms, which can cause water management problems and animal poisoning. Injection of the pure toxin into mice caused pulmonary thrombosis, a decrease in blood platelets and death.

High sensitivity of the plant *Tradescantia* makes it particularly suitable for determining the mutagenic effects of ambient air pollution and background radiation. Exposing the plant to chemical mutagens alone or in combination with ionizing radiation gives evidence for a synergistic interaction.

Applied Mathematics

In addition to research activities, the Applied Math Department (AMD) supports the Lab with a scientific computing environment. In earlier years, that encompassed both the large central computers at the Central Scientific Computing Facility (CSCF) and programming services. But with the sharply increased capability of low-cost computers, the proliferation of available software packages, and the expansion of data communications and networking technology, AMD's support functions have expanded throughout 1983. Namely:

- Changing technology — An Advanced Scientific Computing initiative was established to help maintain awareness of the rapidly changing technology of computational science and its applications at BNL.
- CAD/CAM — Computer aided design and manufacture was studied by a Lab-wide working group. On its recommendation, funds were committed to support an initial CAD installation.
- Personal computers — On behalf of other Lab departments and divisions, AMD procured a number of IBM personal computers. A step towards compatibility and standardization, this also allowed significant savings through quantity purchasing.
- Off-site computers — A number of BNL scientists used the Cray supercomputer at Livermore's National Magnetic Fusion Energy Computing Center. This led to an increased use of the ARPANET network, as users here accessed and worked with the Cray from their own terminals.
- Modernization of the CSCF — A request for bids on a new interactive computing system was issued. Plans call for installation next summer, to allow the retirement of one of two CDC 6600's, now 18 years old. To increase effective use of the aging CDC 7600, an uncharged background mode was introduced, which allows resources to be absorbed by low priority jobs when no regular work is requesting them.
- MASSTOR — This mass storage system was made available for user access from either the CDC machines or AMD's VAX computer, and thus became accessible by network to other VAX computers on site.

Honors

A two-day conference on Hematopoietic Cellular Proliferation was held in honor of **Eugene Cronkite**, former chairman of the Medical Department. Over 430 of Cronkite's colleagues and former students came from all over the world.

Gordon Danby, Accelerator Department, won the 1983 Boris Pregel Award of the New York Academy of Sciences, for his distinguished contributions in accelerator physics and superconducting magnet technology.

Robert Drew, director of Inhalation Toxicology, Medical Department, was elected to the American Board of Toxicology.

Maurice Goldhaber, AUI Distinguished Scientist, was similarly honored by the State University of New York at Stony Brook.

Joseph Hendrie, Senior Scientist, was named Vice President and President-elect of the American Nuclear Society (ANS). He will automatically become president in June 1984.

Herbert Kouts, chairman of the Department of Nuclear Energy, received the ANS Tommy Thompson Award for reactor safety contributions.

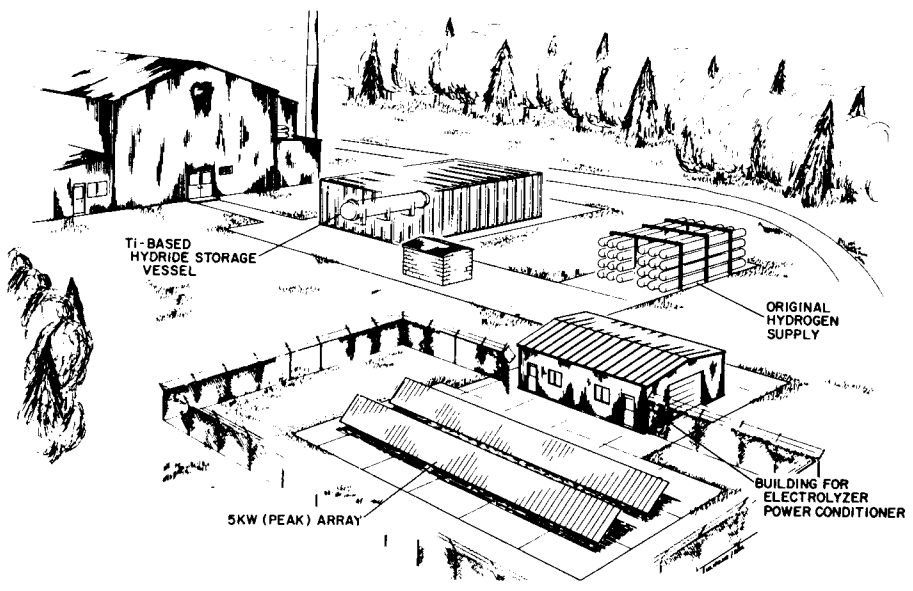
Melvin M. Levine, associate chairman of DNE, was elected a Fellow of the American Nuclear Society.

Roger Newman (DNE), **Hugh Isaacs** (DAS), **Arthur Paskin** (Queens College), **George Dienes** (Phys.) and **Karl Sieradzki** (DNE) were honored by DOE's Division of Materials Sciences for Outstanding Scientific Accomplishment in Metallurgy and Ceramics in the 1983 Materials Sciences Research Competition.

DOE energy awards went to Associate Director **Vincent O'Leary** and **Joseph Rose**, Manager of the Engineering Division, Plant Engineering. O'Leary was cited "for leadership and management of the highly efficient energy conservation program..." and Rose "for individual initiative and effort which resulted in the development of the Alternate Liquid Fuel..."

David Welch, DAS, received the Best Article Award from the International Cryogenics Materials Conference in September. His research was on the interaction of stress with the martensitic phase transition in A15 compounds.

Alfred P. Wolf, chairman of the Chemistry Department, received an honorary Doctor of Science degree from the University of Uppsala, Sweden.



New construction on Rutherford Drive is Building 836, the Integrated Test Bed Facility being built to illustrate hydrogen technology. The five-kilowatt photovoltaic array in the foreground powers an electrolyzer, which splits water molecules to make hydrogen.

Applied Science

In May 1983 the department name was changed from Energy and Environment to Applied Science. The change reflects the broadening of the department's activities. Here are selected highlights of the year:

The Chemical Sciences Division combustion project staff has constructed a shock tube that enables researchers to make gas phase chemical reaction rate measurements over a range of temperatures up to 2200°C. This unique facility uses flash photolysis to create transient species whose reactions with fuel molecules are then measured by absorption spectroscopy. These measurements will help researchers understand the estimated 100 chemical reactions taking place in a simple gas flame.

In the Process Sciences Division, furfuryl alcohol polymer concrete material was developed for the rapid repair of bomb-damaged U.S. Air Force runways. The material was demonstrated at the Tyndall Air Force Base in Florida and at the Cold Region Engineering Laboratory in New Hampshire. These demonstrations showed that repairs could be made during a one inch per hour rainfall, and the patches would support aircraft landings on the runway one hour following repair.

The Integrated Test Bed Facility was built. It includes a five kilowatt photovoltaic array as a source of solar energy and an innovative high pressure water electrolyzer for the production of hydrogen. The facility will be used to demonstrate, on an engineering scale, various novel combinations of technology for the generation, storage and transport of hydrogen, the production of which has been powered by solar energy.

Among the projects in the Environmental Chemistry Division, the cloud chemistry program is getting results on the oxidation of sulfur compounds in clouds, and natural biological chelating agents for heavy metals are being separated and evaluated.

Also, researchers have participated in Captex experiments, which have been carried out in the Northeastern U.S. and Canada as the first phase of a study of how pollutants are carried over long distances by wind currents, contributing to acid rain production downwind of pollution sources. The experiments make use of a sensitive tracer developed at BNL, with sampling done both by aircraft and at ground level.

A six-week internship for graduate students in MIT's Chemical Engineering Practice School was established at BNL in Technology Base Programs. The first internship, with 12 students, was held this summer and will be an annual event.

The Biomedical and Environmental Assessment Division was designated a World Health Organization Collaborating Center for the assessment of health and environmental effects of energy. In December the division hosted a week-long international workshop, with participants from Kenya, Brazil, India, Italy, Austria, Switzerland, Sweden, Finland, France, the United Kingdom and Canada.

Department chairman Bernard Manowitz is chairman of the National Laboratory Consortium of the Interagency Task Force on Acid Precipitation (including BNL, Argonne, Oak Ridge and Pacific Northwest). At the request of the House Committee on Science and Technology, the consortium reviewed the recent report on acid rain issued by the National Research Council.

Nuclear Energy

In brief, principal activities of the Department of Nuclear Energy were:

In April, the National Nuclear Data Center hosted a meeting on basic and applied problems of nuclear level densities. It was jointly sponsored by the International Atomic Energy Agency and the Division of High Energy and Nuclear Physics, DOE.

The Engineering and Risk Assessment Division provided to the U.S. Nuclear Regulatory Commission (NRC) evaluations of the risks from hypothetical severe accidents at several reactor sites in the U.S.

Studies of human factors related to nuclear power plant safety involved analyses of the roles played by various members of reactor plant personnel, including operators, maintenance crew, health physicists, security forces and others.

New programs included fire protection research, systems interactions studies, plant equipment aging studies, emergency planning research and development of guidelines for reliability allocation.

As part of the safety research program being carried out for the NRC, a nuclear plant analyzer has been developed that can carry out reactor transient analyses at very high computer speeds. The computer system has been in operation since March 1982 and is presently being used to simulate reactor transients in one type of boiling water reactor. The unique features of the system — parallel processing and pipelining coupled to a high level simulation language — enable it to perform a large variety of transient calculations rapidly and interactively, changing plant parameters very much like a plant operator would. The system also can be used for accident signature identification, human factor studies and control failure analysis.

In an administrative change during 1983, John Weeks was appointed head of the newly formed Materials Technology Division. This new division combined the Corrosion Science Group and the DOE/EPA Waste Management Group.

H.E. Facilities (Cont'd)

buting in its area of expertise. For Brookhaven, those areas are superconducting magnets and accelerator technology. Task forces on machine requirements and superconducting magnets are now refining BNL's proposals for the SSC. In fact, work is already under way on an ambitious Nb_3Sn, 2-in-1, SSC magnet R&D program.

Other task forces were established to see that the already completed CBA tunnel is put to good use, possibly as the housing for a heavy ion collider. A proposal for this has been submitted to DOE. Already, BNL has received Congressional approval for funds in 1984 to construct a tunnel to allow the injection and acceleration of heavy ions in the AGS from the Tandem Van de Graaff accelerator, and to modify the AGS to accommodate a fixed target physics program with heavy ions. While this will allow interesting physics in its own right, it would also complete the necessary first step for the ultimate acceleration of heavy ions in the CBA tunnel.

Instrumentation

In 1983 research and development in radiation detection produced a high resolution, position-sensitive single photon counting x-ray detector for use at the National Synchrotron Light Source (NSLS). The detector is particularly useful for low angle scattering studies in biology and solid state physics. In addition, an x-ray detector for very high counting rates (10^8 photons/second) was developed for dynamic studies of biological structures. The detector makes possible studies of muscle contractions. Advancements were made in the development of two-dimensional thermal neutron detectors, which are being used increasingly in neutron diffraction experiments at the High Flux Beam Reactor (HFBR).

Accurate detection of radiation depends on the low noise electronics and circuits used to process the signals. In recent years, the division has devoted increasing attention to advancing the level of electronics technology required for this purpose. Work has concentrated on such areas as development of low noise microcircuits and computer-assisted layout of complex printed circuit boards. The new printed circuit design automation system has been used to design complex repetitive electrode patterns for silicon strip detectors, cathodes for induced charge readout in gas proportional detectors and end plates for cylindrical drift detectors.

An advanced data acquisition and control system for Biology's small-angle x-ray scattering station at the NSLS was designed and constructed last year and is now being tested. A recently developed nuclear spectrometer control and data acquisition system at the HFBR has been extensively used by many experimenters. The system acquires data at high counting rates from a high precision, two-dimensional position sensitive neutron detector.

The division's microscopy lab has developed an electron diffractometer based on a silicon photodiode array. This instrument is used to obtain electron diffraction intensity profiles of polycrystalline and amorphous thin films, and it can be used with any electron microscope.

Richard Machnowski working with an interactive printed circuit layout system. The system produces negatives needed for fabrication of printed circuit boards, tapes for automatic control of a drilling press and all documentation needed for circuit assembly.

Administrative Actions

In February, the Employee Suggestion System went into effect. At year's end, 18 employees had received cash awards for ideas which improved the Lab's operations.

Payroll was the first of 16 administrative functions to be processed by the new HP3000 Series 64 Hewlett-Packard computer at the Management Information Systems Division. The systems are being converted from the IBM-360 computer which has been in use since 1967.

Improvements were completed on the Central Steam Plant which made it safer and more efficient to operate. The cost of $2.3 million was expected to be recovered in four years through fuel savings.

Robert B. Palmer, Senior Physicist, was named Associate Director for High Energy Physics, effective May 1.

A Dental Assistance Plan went into effect on June 1. It was made available to all employees who work 20 or more hours per week.

Members of the IBEW, Local 2230, ratified a two-year contract with Associated Universities, Inc.

All employees were asked to reduce their vacation balances to 31 days or less by September 23. This action saved the Lab $2 million.

Herbert Kouts, DNE Department Chairman, was appointed Acting Associate Director for Applied Research. In this capacity, he assumed part of the duties of Deputy Director Warren Winsche, who died in June. A search committee was formed under the direction of Assistant Director Jerome Hudis to find a permanent head of BNL's applied energy programs.

Also, a search committee was named to find a replacement for Victor Bond, Associate Director for Life Sciences, who announced his intention to continue research on a full-time basis. The committee is headed by Richard Setlow, chairman of the Biology Department.

Leonard Emma, Assistant to the Director, was appointed to head a new division — Safeguards and Emergency Services. The division was created in recognition of the increasing importance of protecting government property and to consolidate groups involved in these efforts.

Effective January 1, mandatory employee contributions to the retirement plan were eliminated. At the end of the year, the plan was modified to include tax shelter up to 20% of base salary, 10-year income averaging for tax purposes for beneficiaries, and income tax exemption up to $5,000 in plan benefits paid to an employee's beneficiary.

Safety and Environmental Protection

The Safety and Environmental Protection Division (S&EP) provides broad services in areas of safety, industrial hygiene, health physics, environmental studies and training. The division also conducts research in these and related areas. For example, in 1983 new major areas of research were ground water studies and studies of dose reduction, training and emergency monitoring capabilities at nuclear power plants.

The Long Island aquifer system is the only source of drinking water for Long Islanders. Significant Federal, state and local efforts are devoted to protecting and managing this resource. The U.S. Environmental Protection Agency has asked BNL to assemble data from various sources into a single, computerized management information system. This system will be used to assess the existing state of the aquifer system, as well as impacts which may occur from various sources in the future. A guide book for assessing ground water surveillance data will also be produced for use in other regions. The ground water study is a joint project between S&EP and the Department of Applied Science.

A new study funded by the Nuclear Regulatory Commission examines radiation exposure from various types of nuclear power plants and evaluates dose-reduction techniques, possible plant modifications and effectiveness of dose reduction planning.

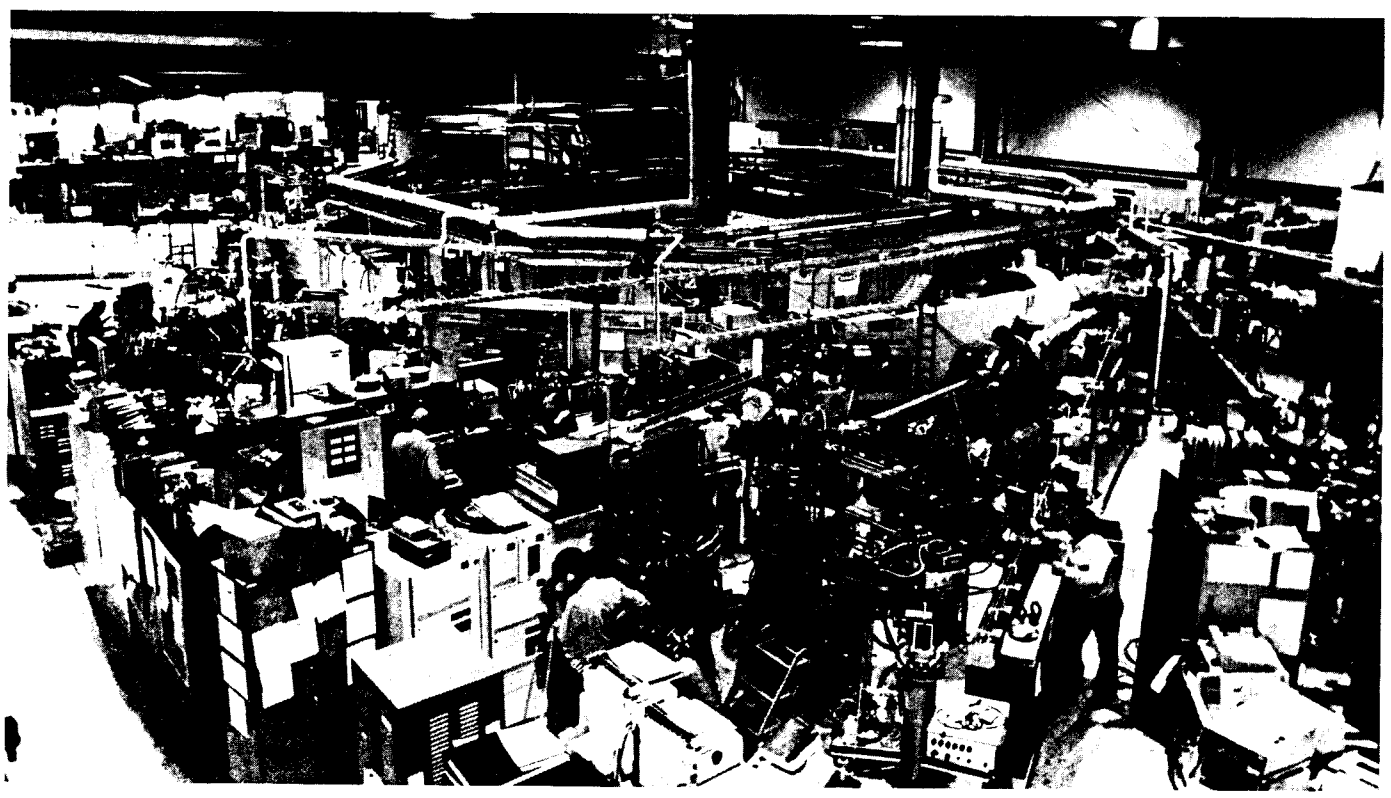
The Center for Assessment of Chemical and Physical Hazards, with the assistance of the Applied Mathematics Department, developed a toxic material "hotline" that will provide on-line access throughout the DOE system to S&EP's computerized hazardous material information data base.

The incidence of occupational injury has been reduced over the past few years. BNL received a DOE Award of Excellence in recognition of its outstanding safety performance in 1982. For that year, the lost time rate was reduced to three-quarters of the average of the three preceeding years.

Light Source (Cont'd)

through X24) was characterized. After a six week shutdown in late October and November, the X-ray ring was much closer to beginning an operational phase during which alignment photons will be available from the x-ray ports.

In November, Department Chairman John McTague agreed to assume the post of Deputy Director of the Office of Science & Technology Policy, in Washington, D.C. During the search for a new chairman, Associate Director Martin Blume is serving as acting chairman of the department.



The experimental floor of the VUV ring.

Reactor

The High Flux Beam Reactor operated throughout the year at a power level of 60 MW and continues to be recognized as the premier neutron beam reactor in this country.

The reactor has been designated as a National User Facility by the DOE to enhance the use of the experimental facilities by external users from universities, industry, national and other government laboratories, as well as by BNL scientists.

A proposal has been forwarded to the DOE for a new Guide Hall addition to the building that will provide a significant expansion of experimental facilities. This will include the installation of new neutron instruments utilizing recent advances in beam optics to extend the beam lines into the new Guide Hall.

BROOKHAVEN BULLETIN

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BROOKHAVEN NATIONAL LABORATORY

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BROOKHAVEN BULLETIN

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BROOKHAVEN NATIONAL LABORATORY

WIS Meeting

Women in Science will hold a dinner meeting on Thursday, January 19, in Room A, Berkner Hall, from 5 - 8 p.m. Dr. Vera Sandomirsky Dunham will speak on "The Image of Women in Recent Russian Literature."

Dr. Dunham, who was born in Moscow and emigrated to the U. S. in 1940, holds a Ph.D. in Russian Literature from the University of Erlangen. In 1944-45, she worked as a research analyst for the Office of Strategic Services, Russian Division in Washington, D. C. Since then, she has taught at various universities, among them Columbia University where she was a visiting professor in the Slavic Department and at the Russian Institute, and at Wayne State University, where she was named Professor emeritus in 1976. She now teaches in the Department of Slavic Languages at Queens College. In addition, Dunham translates Russian authors and writes reviews of modern Russian literature.

Everyone is invited to attend. Dinner will be through the cafeteria line. For information, call Ext. 5271.

Arrivals & Departures

Arrivals

Laura-Li Butler ..... Biology
Barry G. Cunningham ..... Sfgds. & Emerg. Svcs.
Timothy J. Dwyer ..... Plant Eng.
Stephen V. Evola ..... Biology
Jan A. Hrbek ..... Chemistry
Michael J. Jenkins ..... Physics
Shyh-Yuan Lee ..... Accelerator
Jo Ann H. Mugavero ..... Biology
Thomas C. Nehring ..... Plant Eng.
James D. Rush ..... Chemistry
Doreen L. Spiers ..... Sfgds. & Emerg. Svcs.
Ju-Jun Wang ..... Biology

Departures

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

En-Hua, Cao ..... Biology
Douglas G. Clareus .. Instrumentation
Ronald D. Gasser ..... DNE
Malcolm J. Hawkesford ..... Biology
Scott L. Jackson .. Safety & Env. Prot.
Paloma Lopez ..... Biology
Stephanie Muff ..... Medical
Mark N. Sealey ..... Plant Eng.
Margaret P. Van Wormer ..... Contr. & Proc.
Ruth V. Wright ..... Biology

Coming Up

The next Brookhaven Lecture will feature Daniela Sciaky, Biology Department, at 4:30 p.m. on Wednesday, January 18, Berkner Hall. She will speak on "Crown Gall: A System for Genetic Engineering in Plants." See next week's Bulletin for further details.

Competitions

Technology Transfer Awards: The Federal Laboratory Consortium is now seeking nominations for awards of excellence in technology transfer. Individuals and groups from Federal laboratories who have demonstrated uncommon creativity and initiative in the transfer of technology are eligible.

The achievements must have taken place within the last three years; the benefits to private industry, or state or local government must be significant; and the nominees must not have won this award within the past three years.

Documentation consisting of a brief statement of the achievement, and a more detailed statement of not more than one page must be received by the Federal Laboratory Consortium by Wednesday February 1.

Inventor of the Year: Intellectual Property Owners, a non-profit trade association representing patent, trademark, and copyright holders, is currently accepting nomination for its 1983 Inventor of the Year award. The award will be made to an American inventor whose invention was either patented or first commercially available during the 1983 calendar year. The winner will receive $1,000, and a plaque at an award ceremony in Washington next spring.

Nominations consisting of a picture and description of the invention, and a one page biography of the inventor are due at IPO headquarters by 5 p.m. Tuesday, January 31. Last year's winner was Robert Jarvik whose Jarvik 7 artificial heart kept the late Barney Clark alive for 105 days.

For more information on either award, contact William Marcuse at ext. 2103.

Mort Rosen

A reception was held on December 8 in the Physics Department for members of the staff observing recent BNL anniversaries. Seated, from left are Michael Murtagh (10 years), Jacqueline Mooney (10 years), David Alburger (35 years); (standing, from left) Robert Wheeler (20 years), Joseph Russo (20 years), Laurence Passell (20 years) and Myron Stongin (20 years). Absent from photo, Chellis Chasman (20 years), Edward Sperry (35 years) and Iuliu Stumer (10 years).

Cooking Exchange

Japanese cooking will be featured at the Cooking Exchange meeting on Wednesday, January 11. Recipes to be demonstrated and tasted are sushi variations, meat and shrimp cooking in the Japanese way, and some snacks for children.

The Cooking Exchange is open to all on-site employees, visitors and their families. Meetings are held on the second and fourth Wednesday of each month from 12:30 to 2:30 p.m. at the Recreation Bldg. For the $1 admission fee, those present receive copies of the recipes prepared and a sample of each dish along with coffee and tea. Babysitting is provided at 50¢ for each child.

For more information, call Michiko Tanaka, 744-3690, or Dee Polychronakos, 744-3578.

Equipment Demo

Lanier Business Products will demonstrate its new information appliances on January 6 and 13 from 10 a.m. to 2 p.m. in Berkner Hall. The Lanier 1000, a multi-functional workstation for the scientific community, will be featured; this product is designed for personal computing, word processing, and networking.

Winter is Here

All the Laboratory vehicles have been prepared for the season: heaters have been checked, and antifreeze has been added.

The Automotive Maintenance Shop requests that no water be added to cooling systems except in emergencies. If such an emergency occurs, please notify the shop so that antifreeze can be added to ensure continued protection.

CSCF Courses

The Central Scientific Computer Facility has scheduled the following courses:

INTRODUCTION TO VAX EDITORS 2 — 1½ hour sessions, 10:30 a.m. to 12:00 p.m., Tues. and Thurs., Jan. 17 and 19. AMD Seminar Room, Building 515.

INTRODUCTION TO VAX FORTRAN 16 — 1½ hour sessions, 10:30 a.m. to 12:00 p.m., Mon. and Wed., Jan. 23 - Mar. 14. AMD Seminar Room, Building 515. Those who wish to attend must have supervisory approval.

INTRODUCTION TO IBM PERSONAL COMPUTERS — 10:30 a.m. to 12:00 p.m., Tues, Jan. 24, 31, Feb. 7 and 14. AMD Seminar Room, Building 515.

To register for the above courses, call Ronald Wittlock at Ext. 4112.

Call for BNL Crafts

The third BERA Members Crafts Exhibit opens at 5 p.m. on Monday, February 6, and runs until Friday, February 17, in Berkner Hall. The show may be seen from 9 a.m. to 5 p.m. Monday through Friday.

All BERA members including employees, related family 16 years of age and over, and retired employees are invited to contribute their work to the exhibit. Typical crafts might be: pottery, embroidery, crewel, weaving, wood carving, leather and metal works, stained glass, or jewelry. Please note that no pictures or sculpture will be accepted as these were exhibited last year.

The Art Committee will accept only one work from each contributor. This work must be original — no kits, please. In order that a printed catalogue can be ready for the opening, the Committee requests that exhibitors complete one copy per work of the form shown below and return it to the BERA Sales Office no later than Friday, January 27. Extra forms may be obtained by calling Ext. 2343 or 4379.

Exhibitors should deliver their works to Room C, Berkner Hall, from 11 a.m. to 1 p.m. on Friday, February 3. All items must be prepared for hanging or display.

Return to BERA Sales Office - Berkner Hall

Name of Artist .....

Title of Object .....

Medium .....

Telephone # _____ Bldg. # _____

Reminder: On Site College Courses

- **Suffolk County Community College**

Course	Cr.	Day	Hours	Start Date
DP11 — Introduction to Computing	3	M/W	5:15-7:05	1/30
EG13 — Introduction to Literature	3	T	5:15-8:15	1/31
WP11 — Word Processing Concepts	3	Th	5:15-8:15	2/2
BA21 — Business Mathematics	3	W	5:15-8:15	2/1
BA51 — Mgt. Principles & Practices	3	M	5:15-8:15	1/30
BL72 — Business Law II	3	T	5:15-8:15	1/31

- **St. Joseph's College**

Course	Cr.	Day	Hours	Start Date
CH/HA402-BNL-5 — Critical Thinking for Professionals	3	W	5:15-8:00	2/1
HA481-BNL-5 — Introduction to Health Care Administration	3	M	5:15-8:00	1/30

Registration Dates: January 9-13 — Building 185 — (Between the hours of 12:00 noon and 4:00 p.m.)

Tuition Fees: SCCC — $39.00 per credit (for 1st time students there is a $20.00 application fee)
St. Joseph's — $105.00 per credit
(Tuition subject to increase without notice)
Visa, Mastercard/Checks/Money Orders — Accepted.

Aerobic Dance

For many of us, feasting is a holiday tradition and fasting is a post-holiday tradition. To speed up your effort to get back in shape, why not sign up for the new ten-week exercise session being sponsored by the Aerobic Dance Club? Classes in both Aerobic Dancing and Stretchercize will begin later this month under the guidance of instructor Linda Sandberg. Aerobic Dancing will meet twice a week, on Tuesdays and Thursdays. The twenty lesson session costs $60. Stretcherize participants will meet once a week, on Wednesdays, for a total of ten lessons for $30. All classes will meet from 5:15 to 6:15 p.m.

Registration for Aerobic Dancing will be held on Tuesday, January 17, at 5:15 p.m. at the Brookhaven Center, and will be immediately followed by the first lesson. The first lesson will also follow registration for Stretchercize on Wednesday, January 18 at 5:15 p.m. at the Brookhaven Center. Full payment for each class is due at registration.

If you have any questions about either program, call president Lizzy Soenarjati, 878-9520; secretary-treasurer Bonnie Wesolowski, Ext. 4301, or Linda Sandberg, 689-8740.

Bowling

White League

High games were bowled by K. Riker 226, G. Spira 211, J. Griffin 210, B. Glasmann 201, T. Erickson 200, J. Pinelli 175, I. Sperry 172.

Purple League

J. Roesler rolled a 202, D. Adams 202, G. Fales 213, K. Asselta 225, C. MacDougall 211, B. Belligan 224, B. Barberich 233.

Motorcycle Club

A meeting will be held on January 9 at 5:15 p.m. in the Recreation Bldg. Included on the agenda will be the election of officers for 1984. Please attend.

Classified Advertisements

Placement Notices

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

Each week, the Personnel Office lists new personnel placement requisitions. The purpose of these listings is, first, to provide open placement information on all non-scientific staff positions; second, to give employees an opportunity to request consideration for themselves through Personnel; and, finally, for general recruiting purposes. Because of the priority preference policy stated above, each listing does not necessarily represent an opportunity for all candidates. As a guide to readers, the listings are grouped according to the anticipated area of recruitment.

Except when operational needs require otherwise, positions will remain open for one week following publication date.

For further information regarding a placement listing, contact the Personnel Placement Supervisor, Ext. 2882.

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

1986. RESEARCH ENGINEER - Requires a bachelor's degree in nuclear, chemical or mechanical engineering or equivalent capabilities. Will be involved in the analysis of fission product release and transport during severe accidents in light water reactors. Previous experience in off-site consequence analysis is also desirable. Responsibilities will include the review of specific nuclear power plant licensing issues. Department of Nuclear Energy.

1987. RESEARCH ENGINEER - Requires a bachelor's degree in nuclear or mechanical engineering or equivalent capabilities. Will be involved in analyzing the performance of light water reactor (BWR and/or PWRs) plant systems. This includes engineered safety features and associated support systems (e.g., component cooling water, electric power, lubrication, etc.). Knowledge of fluid systems, electrical systems, or heating and ventilation systems is desirable. Experience in the preparation or review of piping and instrumentation diagrams is desirable, reactor operator experience is also desirable. Department of Nuclear Energy.

1988. PHYSICS ASSOCIATE - Requires a bachelor's degree in physics or equivalent capabilities. Will be involved in the analysis of data from a large high energy physics experiment with the emphasis on detector performance and calibration. Familiarity with high energy experiments desirable. Physics Department.

1989. PROJECT ENGINEER - Requires a bachelor's degree in mechanical engineering or equivalent capabilities; plus a minimum of five years' experience. Will be responsible for engineering and project co-ordination in the design and building of experimental equipment and facilities. Functions include: planning, budgeting, scheduling and performing engineering work. Will work closely with scientific staff, co-ordinate procurement, fabrication and assembly, and supervise designers and technicians as required. Candidates must have demonstrated skills in co-ordinating major technical projects ($1 million or larger) as well as solving the engineering problems of support, positioning, assembly, and disassembly of complex detector systems. Physics Department.

1990. TECHNICAL POSITION - Requires extensive experience in industrial-type preventive and breakdown mechanical maintenance. Above average proficiency in technical skills and techniques in areas such as use of test equipment, precision tools and data evaluation required. Ability to obtain "Q" clearance mandatory. Reactor Division.

1991. TECHNICAL POSITION - Requires AAS degree in electronics technology or equivalent and a minimum of five years' diversified technical experience. Responsibilities include troubleshooting and repair of digital electronics and microcomputer systems on a high energy physics experiment. Physics Department.

1992. TECHNICAL POSITION - Requires expertise in the design, implementation and maintenance of computers for data acquisiton and analysis. Experience in maintenance of DEC PDP 11/34, 11/23, DEC VAX 11/730, IBM PC and peripherals such as disk drives required. Must have understanding of DEC, RT11 and RSX operating systems and FORTRAN programming. Will be trained in operating system level programming. Chemistry Department.

Autos & Auto Supplies

75 VW - great potential, great price, $1350. Call Bill, Ext. 2378 or 924-3669.

73 OLDS CUTLASS - 89,000 mi, runs well, some rust, a/c, $600. Wolfgang, Ext. 4571 or Ext. 3107.

74 M.G. MIDGET CONVERTIBLE - good running cond., $400. Hugh, Ext. 4424 or 924-3293.

63 GALAXIE 500 - new tires, exh. sys., 289 V8 manual trans, very good cond. Mike, Ext. 4988.

80 KZ1300 - 3000 mi., mint cond., fully loaded plus extras, must be seen. $5550. Pete, 472-1392.

78 VW RABBIT - 37,000, immac., reg. gas, automatic $2500. Betty, 751-0757.

74 NOVA - p/s, p/b, a/c, V8, runs well. Jain, Ext. 2710 or 924-5966.

78 TOYOTA COROLLA LIFTBACK - good cond., a/t, am/fm cassette, asking $2800. Pat, Ext. 4628 or 286-8490 after 6 p.m.

72 VW SQUAREBACK - runs well, good transportation. 286-1183 or 924-7238.

81 MAZDA GLC - 3 dr hatch, 32K mi, am/fm, orig. owner, clean, 35 mpg. Call 734-7584.

SLIDE ON CAMPER - for 8 ft. pick-up bed, stove, sink, lights, dinette, cabinets. $450. 928-8709.

73 VW BUG - excel. running cond., new front end, brakes, muffler system, $1200 firm. Carol, Ext. 2907 or Brian, 288-5962 eves.

71 CHRYSLER NEWPORT - good cond., 3 new tires, many new parts, $500. Rich, Ext. 4363.

75 CHEVY VAN - 350 eng., stereo cassette, carpeting, durable, new parts. Scott, 751-6820.

81 210 HATCHBACK - 39,000 mi., excel, cond., $4800. Ext. 2705 or 298-9581.

79 FORD FAIRMONT - 4 dr. sdn., p/s, a/c, a/t, 65,000 mi., clean; find something wrong and get it for less than $3495. Ext. 2525.

72 DODGE SWINGER - 6 cyl., automatic, p/s, 2 dr., hardtop, good cond., $650. Rick, 727-7626 after 5:30 p.m.

70 FORD PICKUP - 302 V8, 3 spd., w/cap, am/fm, cassette w/speakers, equalizer, 2 snows. Jack, 727-0499 after 6 p.m.

79 OLDS DELTA - 2 dr., loader incl., a/c, white, $4295. Vic, 541-4318.

70 TOYOTA CORONA - deluxe, 4 dr, a/c, some rust, high mileage, 6 tires, new parts, runs well. $750. 727-6481 after 6 p.m.

VAN SEATS - windows, pedestals, sunroof and running lights all like new. Joe, Ext. 2697.

73 LINCOLN COUPE - loaded, excel. in and out, asking $2000. Call 654-5460.

74 CHRYSLER NEWPORT - a/t, $300; 79 Honda wagon, new radials, exhaust, eng., body excel., 46,000 mi., asking $3000. Jack, Ext 4411 or 929-8287.

74 260Z - good cond., automatic. Ext. 2537 or 473-1658.

73 PLYMOUTH DUSTER - 6 cyl., automatic, p/s, very good cond., $795. Rick, 727-7626 after 5:30 p.m.

FORD TRANSMISSION - 3 and 4 spd for 6 or 8 cyl. 65-66 Mustang, driveshafts, fair prices. Tom, Ext. 4662 or 929-3566.

55 FORD ENGINE AND TRANNY - V8, automatic, will demo., $175; transmission gasket sets, 59-62 Ford-o-matic, No. 5, $5 ea. Tom, Ext. 4662 or 929-3566.

SNOW TIRES - Goodyear, CR-79x13, all winter radials on Mustang rims, good cond., $50. Ext. 7112 or 472-1922.

SNOW TIRES - B78-13, new 1982, used 3 wks., cost $84, sell $45. Ernie, Ext. 2957.

2 15" SNOW TIRES - on 5 lug Ford truck rims, good cond., $30. Artie, Ext. 2697.

RIMS - (2), Ford/Merc, 14", 5 holes, $15. Tony, Ext. 3637/3658.

72 PLYMOUTH - 318 engine, runs o.k., radiator needs recoring, must sell. Ext. 3193.

80 VW RABBIT - 75K mi., a/c, 4 sp., asking $2500. Rich, Ext. 4482 or 277-1129.

Boats & Marine Supplies

MARINE ENGINE PARTS - new, used, recond., large inventory, Johnson, Evinrude, OMC sterndrive. 265-5218 evenings.

Miscellaneous

FORCED HOT AIR HEATER - new, $22. Ext. 3688.

STEREO AMPLIFIER-RECEIVER - Pioneer, 5x636, $90. Ext. 2041.

DRESSER - colonial style, maple, 50"Lx18"Wx 30"H, $100. Ext. 2041.

ANTIQUE STONE GRINDER - excel. cond. Ext. 3688 or 363-7032.

TYPEWRITER - Hermes rocket, lt. wt., portable, works well, $30. Sue, Ext. 3675.

ZENITH TV - 19", color, needs parts, best offer. Bruce, Ext. 5096 or 472-0463.

MIRRORED KNICK-KNACK SHADOW BOX - mahogany trim, $30; glass china closet, mahogany trim, glass shelves, $150; mahogany dinette table and 2 chairs, $125. Call 269-9175.

CROSS COUNTRY SKI BOOTS - by Alpine, 75mm, new, mens size 11, $35. Call 878-0516 after 6 p.m.

IBM ELECTRIC TYPEWRITER - model "B," $100. or best offer. G. Williams, Ext. 3338.

ICE SKATES - black, hockey, boy's size 2, never used, $10 or trade, size 4-5. Eileen, Ext. 4949.

ENGINE REBUILT TO FIT SMALL SIT—ON MOWER - $35. 924-6751 eves.

L.V. SET - contemporary with matching oak tables, must see, excel. cond., $600. 727-7626 after 5:30 p.m.

SKIS - 170 cm, Hart, bindings, mens boots size 10/1/2, poles and safety straps, good cond. $65. 727-7626.

KRAFT R/C SPORT SERIES - 1 yr. old, 6 channels, 6 servos, $125. Tony, Ext. 4095.

BOYS HOCKEY SKATES - size 5, $8; couch, $50, upright vacuum $50; stereo, $50. 289-8212.

60" VANITY - white, marble formica top, beige sink, faucet, medicine cabinet accessories, $125. 331-1638 after 6:30 p.m.

WASHING MACHINE - Crosley, white enamel, semi-automatic. 589-4218.

BARBELL - with 60 lbs wt., $15. John, Ext. 5152 or 281-2471.

PUMP - Starite deep well pump, 1 h.p. w/42 gal. glass lined tank, $100. Ext. 2705 or 286-1062.

BASS GUITAR - Cameo, fender copy, with case, $100. Ext. 4192 or 744-2461 after 6:00 p.m.

ARMSTRONG CEILING TILES - 180 sq. ft., No. 486 trendsetter series, wood grain plank, 9(8-3/16x48), 9(6-5/8x48) 9(5-3/16x48) half in. Ext. 2238.

SEARS TIMING LIGHT - with case, $30. Artie, Ext. 2697.

CAR SEAT FOR CHILD - up to 40 lbs, like new, orig. $50, selling for $30, like new. Jim, Ext. 7772.

BUILT-IN OVEN & COUNTER TOP STOVE - gas, Caloric, 20 yrs. old, still usable, best offer. Ext. 4727.

ATARI 400 COMPUTER - 410 recorder, joysticks, 6 carts/cassettes incl., basic instr. book, $175. Ext. 4676.

SPINNING WHEELS - decorative planters, 1 large, 2 small, $35. Nancy, Ext. 5274 or 281-2767 eves.

EARLY AMER. BEDRM. SET - full bed, dresser/mirror, highboy, 2 night tables; 5 pc. liv. rm. set, couch, loveseat, chair, 2 tbls. Irene, 589-6468 eves.

COFFEE - 100% Colombian, pre-measured, vacuum packed, f/automatic makers, 35¢/pk, full case (48), $16.50, 1/2 case, $8.25. Claire, Ext. 3356.

CARPETING - 75 sq. yds. chestnut brown saxony velvet and padding, 1 yr. old, mint, $525. 751-8240 eves.

SONY TC64D tape deck - $75; hockey skates, size 7, $25; bike 3/4 frame, $50. Ext. 3128 or 928-7344 eves.

KIRBY VACUUM CLEANER - with all attachments incl. power head, excel. cond., $200. 727-7626.

FIRE BRICKS - 25¢, cement blocks, 25¢, 3'x10' formica, $10, crib, $25. Hugh, Ext. 4424 or 924-3293.

SANYO - am/fm stereo turntable cassette w/o speakers, $65; w/speakers, $95. Joe, Ext. 4255 or 289-1831.

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 Rent

MILLER PLACE - 1 bdrm. apt., kitchen/living rm., spare room, private entrance, avail. Jan. 1. Ext. 2537 or 473-1658.

SKI MT. WASHINGTON VALLEY - 3 bdrm. chalet, 2 baths, washer/dryer, selected wks., $450 per wk. Call 928-6921 eves.

For Sale

MEDFORD - 2-3 bdrms., 1-1/2 baths, 2 car garage, 3/4 acre, 15 min to Lab. Ext. 2486 or 325-0681 after 6.

Free

ADORABLE BABY BUNNIES - 6 wks. old Jan. 25, very tame. Carol, Ext. 3630 or 331-1847 eves.

Car Pools

PATCHOGUE - paying rider wishes ride Patchogue to BNL and back. Georgette, Ext. 7665 or 475-8982.

Lost & Found

LOST - black umbrella with wooden handle. Karen, Ext. 2950.

Wanted

ICE SKATES - girls size 8-9, reasonable. Ext. 2964.

MR. POTATO HEAD GAMES - need all parts except potato. Bruce, Ext. 7203.

CRIB - full sized, good cond. Bruce, Ext. 5091, 472-0463.

OUTDATED CALENDARS - pictures to be used as a teaching aid for a handicapped child. Forward to Edy Thornhill, Bldg. 460.

BOYS ICE SKATES - size 4-5, black. Eileen, Ext. 4949 or 924-4922.

SMALL HOME TO RENT YR. 'ROUND - in area of Westhampton Beach. 288-6367.

VOLUNTEERS FOR CHPS MEDICAL CENTER - days, evenings and Saturdays. Raffle at CHPS. Call Joe. Ext. 2897 or 281-7683 eves/wkends.

ENGINE - Ford 1976 or later, 2300 cc, 4 cyl, running cond. Joe, Ext. 2897 or 281-7683.

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

HOME - for beautiful orange Persian cat, male, neutered, declawed, 1 yr. old. 744-6812.

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