

400th Brookhaven Lecture, 1/19

Role of Empirical Rules in Predicting Science Directions

Goldhaber Talk Marks Start of BNL's 'World Year of Physics 2005' Celebration



From experiments, rules can be formulated which are considered to be "proto-theories" because of their predictive power. Interpreting the rules suggest either amendments to existing theories or the need for new theories. Theories, the ultimate aim of science, are concise summaries of aspects of nature and have often reached "final" form only after centuries of research. They have led to many practical applications, and modern technology could not be imagined without input from theory.

Goldhaber will discuss this subject in a general way when he presents the 400th Brookhaven Lecture, "The Role of Empirical Rules in Predicting Directions in Science," on Wednesday, January 19, at 4 p.m. in Berkner Hall. All are invited to this talk, which will mark the start of the Lab's celebration of the World Year of Physics 2005.

Goldhaber will give examples from research conducted by him along with his late wife Gertrude Scharff-Goldhaber and their asso-

ciates, as well as from work of other BNL members.

Goldhaber will be introduced by Distinguished Senior Physicist and former Lab Director Nicholas Samios.

In 1960, the Brookhaven Lecture Series was started by Sharff-Goldhaber, who gave the 100th lecture on March 17, 1971. Goldhaber himself is no stranger to the lecture series, having presented the 11th, 200th, and 300th talks on November 16, 1961; May 18, 1983; and November 2, 1994; respectively.

As one of the world's most distinguished physicists, Goldhaber, with James Chadwick from the Cavendish Laboratory at Cambridge Univer-

sity, was the first to measure accurately the mass of the subatomic particle known as the neutron, in 1934, thus showing that it was not a compound of a pro-

ton and an electron as was believed at the time, but a new particle. Goldhaber later pursued a wide variety of research in nuclear physics, and his work was important in supporting the standard model, the modern theory of fundamental particles and forces.

Born in Austria, Goldhaber earned his Ph.D. in physics at the University of Cambridge in 1936. Two years later, he arrived in the U.S. to join the faculty of the University of Illinois. He came to BNL in 1950, where he became chair of the Physics Department 1960-61 and Laboratory Director 1961-73.

Goldhaber has received numerous awards during the course of his long and extremely pro-

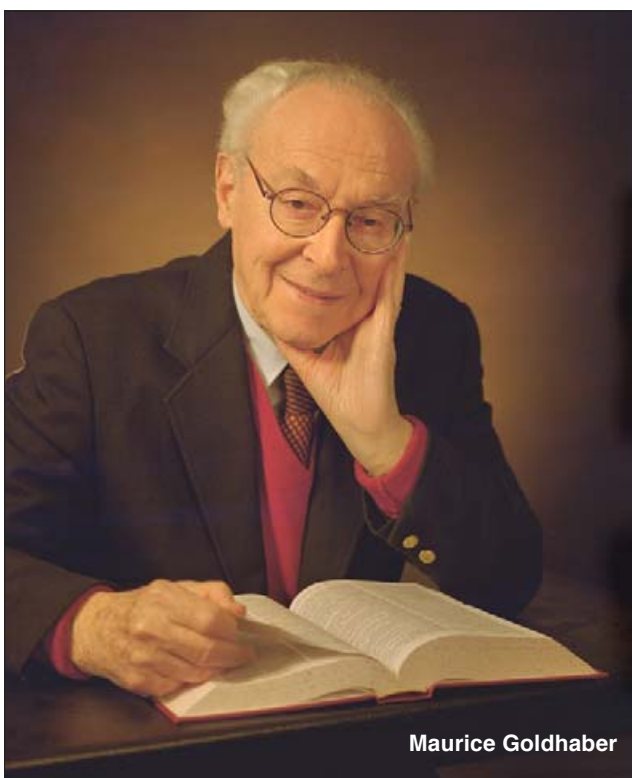
ductive career, including the Tom W. Bonner Prize in Nuclear Physics in 1971, the J. Robert Oppenheimer Memorial Prize in 1982, the National Medal of Science in 1983, and the Wolf Prize in Physics in 1991.

Since his retirement in 1985, Goldhaber, who has been active in physics for more than seven decades, has continued his research at the Lab as Distinguished Scientist Emeritus. To those who see Goldhaber working almost daily at the Lab, he sometimes jokes, "I have no time to age."

The Lab has honored the Goldhabers by creating special fellowships named for them.

Refreshments will be served before and after the talk. Brookhaven Lectures are free and open to the public. Visitors to the Lab age 16 and over must bring a photo ID.

To join the lecturer for dinner at an off-site restaurant, contact Yvette Malavet-Blum, Ext 5591, malavet@bnl.gov.



Maurice Goldhaber

Roger Stoudenburch D020199

BNL Scientists Set Upper Limit on Three-Body Breakup of ⁹Beryllium

Goldhaber's 1952 suggestion results in 2004 experiment

The story begins in 1934 when Cambridge University graduate student Maurice Goldhaber began experimenting with "photodisintegration," a technique that uses photons (particles of light) to split nuclei.

Goldhaber applied this technique to many materials, but an isotope of the element beryllium, ⁹Be, caught his attention.

The ⁹Be nucleus can be thought of as a clump of three particles: two alpha particles, each containing two protons and two neutrons, and an extra neutron that clings loosely to them. ⁹Be can be split up in two ways: the two-body breakup, which results in ⁸Be and a neutron; and the three-body breakup, leading to two alpha particles and a neutron. Both types occur only if the photons have a certain "threshold" energy. In ⁹Be, the three-body threshold is slightly lower than the two-body.

Goldhaber thought that ⁹Be would be a good medium for detecting the "three-body force," a theoretical force that occurs only in the presence of three particles. This force would be very weak, trumped by the primary force binding the nucleus, the two-body force. However, measuring a three-body force in ⁹Be would require observing the three-body breakup of ⁹Be, and the probability of that, according to theory, was very, very low.

In 1952, Goldhaber, then a scientist at BNL, suggested an experiment to Alburger, who ran the Lab's 3.5 megavolt (MV) Van de Graaff accelera-

Working on a suggestion from Maurice Goldhaber, four Brookhaven scientists — chemist James Wishart of the Chemistry Department and retired physicists David Alburger, Robert Chrien, and Richard Sutter — have completed an experiment designed to search for a rare splitting mode of a beryllium isotope. Their experiment, published in the December 17, 2004, edition of Physical Review C, provides the beginning of an answer to a decades-old question.

tor, used for low-energy nuclear physics experiments. Alburger had studied a fluorine isotope, ²⁰F, and Goldhaber suggested that ²⁰F could be used as a source — i.e., use the photons produced when it decays — to break up the ⁹Be nucleus. Alburger did in fact observe some neutrons, but these were likely produced by other radiation and his results were ultimately inconclusive.

Decades later, in 1983, a group of Japanese physicists claimed they had observed neutrons from the three-body splitting of ⁹Be — more neu-

trons than predicted by theory. Goldhaber wanted to try to reproduce the results, but Alburger thought the Japanese experiment likely contained errors resulting from the radioactive source they had used.

In 2004, Alburger, by then retired, joined Wishart, Chrien, and Sutter to address the problem finally.

"Our aim was two-fold," said Chrien. "We wanted to search for neutrons produced by the three-body splitting of ⁹Be, but we also wanted to see if the Japanese group's result was due to other radiation from the source.

It seemed clear that it would be better to use an accelerator, instead of radioactivity."

The experiment, supported by the Office of Basic Energy Sciences within the DOE Office of Science, was performed at the Chemistry Department's 2-MV Van de Graaff, run by Wishart. The researchers directed the accelerated electrons at a gold target embedded within the beryllium blocks. As the electrons struck the gold nuclei, they produced "bremsstrahlung" — German for "braking radiation" — a spray of photons with varying energies. These were the source

photons. Detectors surrounding the beryllium recorded any neutrons that emerged.

The scientists took measurements using photons with energies above the three-body threshold but below the two-body, allowing them to see neutrons produced by the three-body split only.

They detected far fewer neutrons than the Japanese group had done and concluded that the group's result must have been due to neutrons produced by background photons, not source photons. So the present experiment set an upper limit on the number of neutrons resulting from the three-body splitting of beryllium.

The four researchers agreed that this experiment is a wonderful example of how good science can be done for nearly nothing. For example, they had used discarded detectors from the High Flux Beam Reactor, leftover electronics from the Alternating Gradient Synchrotron, and a supply of beryllium blocks from the Lab's former Nuclear Energy Department.

In the future, Alburger, Chrien, Sutter, and Wishart may attempt to make improvements to the experiment that could increase the detection rate of three-body neutrons.

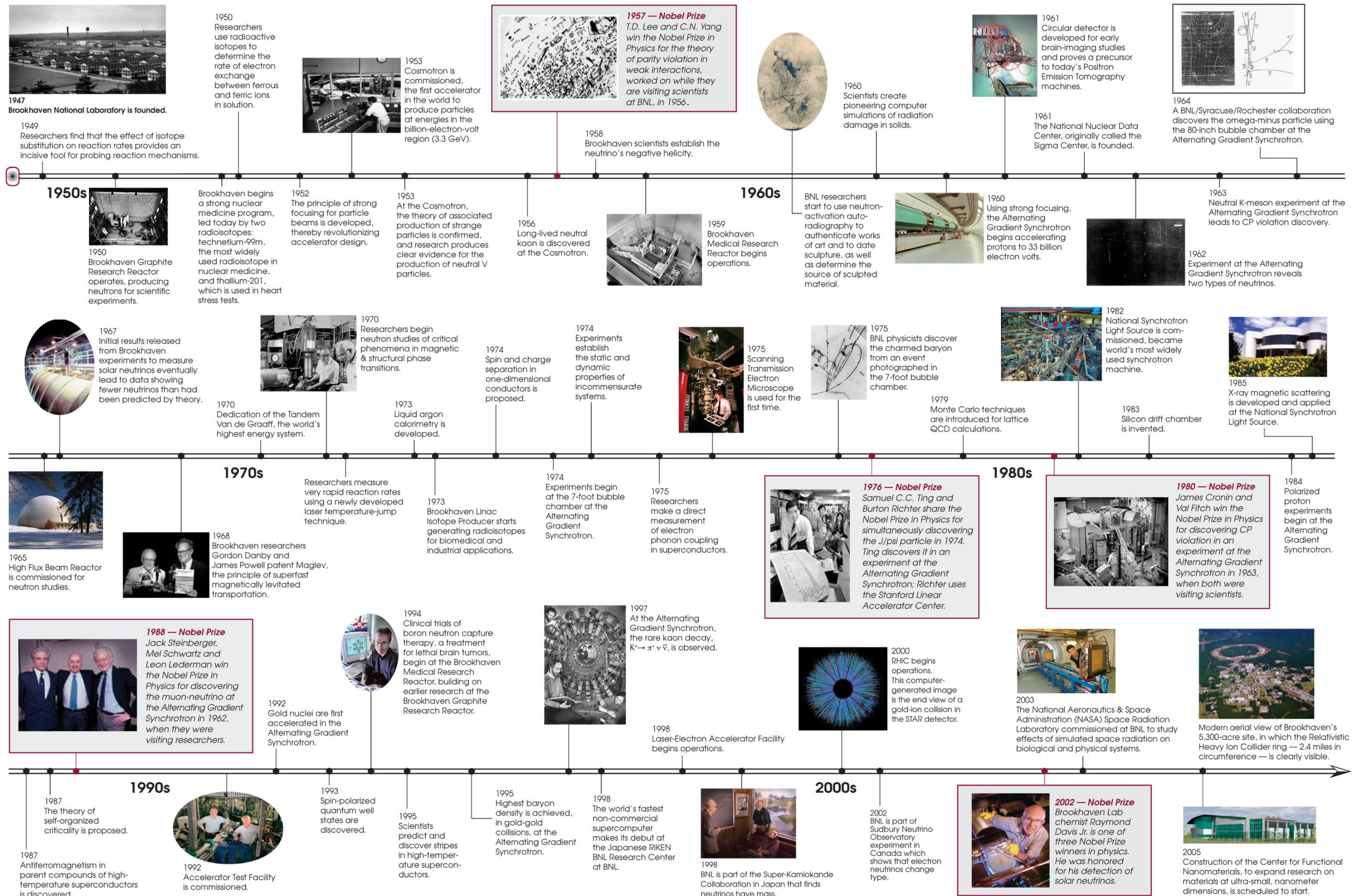
"We are grateful to Maurice for suggesting this research problem and providing continual encouragement along the way," Chrien said. "And we also thank Stephen Howell and Harold Schwarz of the Chemistry Department for their assistance." — Laura Mgrdichian



At the Chemistry Department Van de Graaff are (from left) Richard Sutter, David Alburger, James Wishart, and Robert Chrien.

Roger Stoudenburch D043105

BROOKHAVEN NATIONAL LABORATORY CELEBRATES THE WORLD YEAR OF PHYSICS 2005



The U.S. Department of Energy's Brookhaven National Laboratory joins in the worldwide celebration of the World Year of Physics 2005. The year — formally from October 2004 to February 2006 — marks the 100th anniversary of Albert Einstein's publication of three papers describing ideas that have laid the groundwork for modern physics. Funded primarily by the Department of Energy, which leads the nation in funding physical sciences, Brookhaven has been a world leader in physics, as well as other sciences, since its birth in 1947. Home to five Nobel Prizes in physics, the Laboratory has made significant advances that have influenced many areas of science and paved the way for further discovery. Brookhaven is building on Einstein's foundation. This timeline shows many of the Laboratory's major discoveries.

Calendar

of Laboratory Events

— WEEK OF 1/17 —

Monday, 1/17

Martin Luther King Jr. Day, BNL Closed
No Bulletin on Friday, 1/21.

Tuesday, 1/18

BREA Monthly Business Meeting

Noon-1 p.m., Bldg. 475C, Conference Room 107. All are welcome. Joyce Tichler, tichler@bnl.gov.

Wednesday, 1/19

*400th Brookhaven Lecture

4 p.m. Berkner Hall. Maurice Goldhaber, BNL Distinguished Scientist Emeritus, will speak on "The Role of Empirical Rules in Predicting Directions in Science." See story, page 1.

Friday, 1/21

*Employee Lunchtime Tour, Micro MRI

Noon-1 p.m., Meet at Berkner Hall. See notice at right.

*Rock Concert, 'Hammer of the Gods'

8 p.m., Berkner Hall. See notice at right. Tickets, \$10 each. All welcome.

— WEEK OF 1/24 —

Monday, 1/24

*BSA Distinguished Lecture

4 p.m., Berkner Hall. Sylvester James Gates Jr. to give physics talk on 'Superstring/M-theory: A Lathe for Physics?' All are welcome.

IBEW Meeting

6 p.m., Centereach Knights of Columbus Hall, 41 Horseblock Rd., Centereach. A meeting for shift workers will be held at 3 p.m. in the Union Office. The agenda includes regular business, committee reports, and the president's report.

Tuesday, 1/25

GLOBE Meeting

Noon-1 p.m., Berkner Hall, Room B. BNL's Gay, Lesbian, and Bisexual Club meets to discuss discrimination/harassment issues. Bring lunch. For more information, contact Debbie Bauer, Ext. 5664, bauer@bnl.gov, or Mike Loftus, Ext. 2960, loftu@bnl.gov.

Wednesday, 1/26

Agilent Equipment Demo

11 a.m.-3 p.m., Berkner Hall. Representatives from Agilent Technologies will present BNLers with equipment, including logic analyzers, oscilloscopes, and more. Sandi Cowell, 303-662-2709.

— WEEK OF 1/31 —

Wednesday, 2/2

LeCroy Equipment Demo

11 a.m.-2 p.m., Berkner Hall. As a major supplier of high-performance digital oscilloscopes, LeCroy helps engineers validate the design of electronic products for the data storage, computer, semiconductor, and aerospace and defense industries. Dan Monopoli, 845-323-9072.

— WEEK OF 2/7 —

Tuesday, 2/8

Identity Theft Presentation

Noon-1 p.m., Berkner Hall. Talk by Names Pascarella, Assistant District Attorney in the Economic Crimes Bureau, Suffolk County District Attorney's Identity Theft Unit. Michael Thorn, Ext. 8612, or mthorn@bnl.gov.

— WEEK OF 2/28 —

Saturday, 3/5

Bus Trip to Cradle of Aviation Museum

9 a.m.-5 p.m. \$15/adult, \$13/seniors and children. BERA-sponsored coach to Long Island's Cradle of Aviation Museum in Garden City. Tickets cover bus, museum, IMAX movie, and Mars Virtual Voyage ride, buy at the BERA Store, Berkner Hall.

Note: This calendar is updated continuously and will appear in the Bulletin whenever space permits. Submissions must be received by the preceding Friday at noon to appear in the following week's Bulletin. Enter information for each event in the order listed above (date, event name, description, and cost) and send it to bulletin@bnl.gov. Write "Bulletin Calendar" in the subject line.

Classified Advertisements

LABORATORY RECRUITMENT - Opportunities for Laboratory employees.

NS4118. STAFF SPECIALIST (A-6) – Requires a bachelor's degree in accounting, business administration, or equivalent and at least five years' related experience. Extensive administrative experience should include financial performance and analysis, accounting procedures and policies, coordination of program funding, budget and proposal preparation, and financial reporting. Excellent written and oral communication skills, proficiency in Excel and other MS Office products, and experience with PeopleSoft Budgeting, Personnel Forecasting, Queries and Reports required. Must be able to prioritize work and respond to tight deadlines in a fast-paced environment. Will assist in the overall management of administrative business activities and budget/proposal preparation in support of DOE and Work for Others Programs. Energy, Environment & National Security Directorate/Business Operations Office.

OPEN RECRUITMENT – Opportunities for Laboratory employees and outside candidates.

MK4121. ASSISTANT ATMOSPHERIC SCIENTIST – Requires a Ph.D. in chemistry, chemical engineering or a related field, at least 3 years' experience using perfluorocarbon tracer (PFT) technology, and good written and oral communication skills. Experience in the design of PFT release and sampling strategies for atmospheric dispersion experiments over a range of spatial- and time-scales is highly desirable. Position is in the Tracer Technology Center (TTC) and involves management of existing PFT programs, development of new and complementary applications of PFT technology, and securing new sources of funding for the TTC. Under the direction of P. Daum, Environmental Sciences Department.

MK3639. POSTDOCTORAL RESEARCH ASSOCIATE – Requires a Ph.D., experience in MRI and experience in the development of radio frequency (rf) and gradient coils. Will develop magnetic resonance imaging with ultra-fast EPI readout, using parallel imaging techniques at high magnetic field strength. Will be responsible for the development of coils, pulse sequences, and reconstruction algorithms for ultra-fast MRI techniques on the 4 Tesla MRI scanner. Position is with a large neuroscience group interested in effects of drugs of abuse and diseases on brain function. Imaging facilities include a 4-Tesla MRI scanner for human studies, a 9.4-Tesla MRI scanner for small animal studies, and three PET cameras. Under the direction of D. Tomasi, Medical Department.

NS3510. TECHNOLOGY ARCHITECT (I-9) - Requires a Ph.D. in high energy or nuclear physics, six years' related experience, and a strong background in computing, including substantial experience in the collaborative development of core offline HEP software. Demonstrated ability leading large HEP computing projects, and experience in designing, developing and deploying HEP database systems also required. Expertise in C++ expected; familiarity with grid computing, web services, Python, Java, and mass storage systems preferred. Will participate in the development of the core offline software of the ATLAS experience at the LHC, with a particular focus on the data storage, data management and database challenges presented by the petabyte-scale data volumes of ATLAS. Physics Applications Software Group/Physics Department.

TB3618. STAFF ENGINEER (P-5, term appointment) - Requires a master's degree or equivalent in relevant field such as electrical engineering (electronics background or minor a plus), with at least three years of relevant experience in silicon/CZT (cadmium zinc telluride) or other semi-conductor crystal evaluations and excellent oral and written communication skills with experience in MS Word. Familiarity in testing (CZT) as a detector material for possible use in positron emission tomography (PET) applications, including experience and proficiency in clean-room techniques, and thermal diffusion deposition techniques are desirable. Familiarity with crystal growing techniques and a firm materials science understanding of semi-conductors are also desired. Non-Proliferation & National Security Department.

MK3226. PHYSICS ASSOCIATE II (P-5, term appointment) –Requires a Ph.D. and several years' experience with laser technology. Responsibilities will include conducting work on the Deep Ultra Violet Free Electron Laser (DUV-FEL) Project, involving the operation of the driver laser system, the development of the chirped pulse amplifier (CPA), the synchronization between seed laser and the electron bunch, the improvement of the electron beam, and the commissioning CPA mode of the high gain harmonic generation (GHG) experiment. National Synchrotron Light Source Department.

Motor Vehicles & Supplies

03 HARLEY DAVIDSON SPORTSTER - 1200 Custom; Anniv. Ed., vg cond., must sell. 3500 mi. \$8,500/neg. Ext. 7465 or 828-1768.

02 HONDA CIVIC EX - 5-spd., dark blue, moonroof, rear spoiler, excel. cond. 40K mi. \$11,000. Pat. 821-2171.

01 CHEVROLET LS BLAZER - 4x2, 6-cyl, a/c, 2-dr. m/roof, all pwr, c/c, abs, a/t, vg cond., 88K mi. \$8,500/neg. Ext. 4705 or 929-4978.

BSA Distinguished Lecture, 1/24 Gates Talks on Superstring/M-Theory

Sylvester James Gates Jr., Director of the Center for String & Particle Theory at the University of Maryland at College Park, will give a BSA Distinguished Lecture, "Superstring/M-theory: A Lathe for Physics?" in Berkner Hall on Monday, January 24, at 4 p.m. All are welcome.



Hammer of the Gods in Concert, 1/21



The rock band Hammer of the Gods will appear in concert at BNL on Friday, January 21, at 8 p.m. in Berkner Hall. Sponsored by the BNL Music Club, the concert will feature the music of Led Zeppelin, the rock band that became famous in the 1970s.

Tickets cost \$10 each. Buy them at the door or in advance at the BERA Sales Office in Berkner Hall. The concert series is open to the public. All visitors to the Laboratory age 16 and over must bring a photo ID.

Brookhaven Retired Employees Association News Retiree Health Care Benefits Meeting, 2/15

Health care benefits for BNL retirees will be the subject of a meeting held by the Human Resources & Occupational Medicine Division (HROM) at Berkner Hall on Tuesday, February 15, at 1:30 p.m. (snow date: Thursday, February 17, same place and time). Topics will include: coordination of benefits with CIGNA and Medicare, out of network benefits, deductibles, the mail order drug program, change from PPO to OAP, which is only a change in networks, not in benefits; and dual coverage processing. Copies of the CIGNA OAP provider directories and of the medical benefits summaries and drug claim forms will be provided. Time will be allowed for general questions about retiree benefits.

All are invited to attend. The Brookhaven Retired Employees Association (BREA) will try to coordinate rides if anyone needs to be driven to the meeting. Should you be willing to provide a ride or need a ride, send e-mail to brea-l@lists.bnl.gov or telephone Joyce Tichler at 631-563-0989.

BERA Sponsors Two Swim-Pool Programs

To register for either of these classes, call Sue Dwyer at the pool, Monday-Thursday, 4:30-8:30 p.m., or the Recreation Office, Ext. 2873, weekdays, during business hours.

• Lifeguard Training Classes — Red Cross Certification

Eight weeks beginning Sunday, February 27, at 10 a.m. You must be 15 and over, be able to meet the physical requirements, and attend all eight weeks. Fee: \$300.

• Adult Swim Lessons

An eight-week Wednesday-evening course begins on February 9 at the BNL pool, 5:30-6:30 p.m. Open to all employees, those with visitors/guest appointments, facility users, retirees, and immediate family members over 17. The fee is \$80, payable to BERA.

01 KAWASAKI ZX9R - 900cc sportbike, vg cond. 5900 mi. \$5,400. Lawrence, Ext. 4797.

01 OLDMOBILE BRAVADA - 6-cyl., 4WD, loaded, s/roof, Bose stereo, leather heated seats, Mint. 30K mi. \$14,900/neg. 433-0833.

00 JEEP GRAND CHEROKEE - 6-cyl., 7 yr/70K mi. warr., excel. cond., new tires. 46K mi. \$13,200. 475-7500.

00 NEWMAR KOUNTRY STAR - Class A 34' motorhome; diesel puller, 2 slideouts, Freightliner, 9,500 mi. \$75,000/neg. 929-4753.

98 HONDA CIVIC DX - 5-spd., runs excel, body kit, rims, must go. 87K mi. \$5,500/neg. 727-6714.

97 FORD EXPLORER XLT - a/t, all pwr., 4 dr., pwr. moonroof, white, gd. cond., extras, 85K mi. \$6,300/neg. Angela, 289-4442.

95 FORD BRONCO - Eddie Bauer ed., orig. owner, 5.8V. 183K mi. \$4,250. Mike, Ext. 6090.

94 FORD EXPLORER XLT - 6-cyl., green, a/c, a/t, am/fm/cd, 4wd, p/b, p/l, gd. cond. 125K mi. \$3,100. George, Ext. 2550 or 584-7172.

93 AUDI 100S - 6-cyl, 4dr, a/t, abs, a/c, p/b, p/s, p/w, p/l, c/c, am/fm, cass, sun rf, gd. cond. 120K mi. \$3,400/neg. Paul, 878-1486.

91 VW VANAGON - 4-cyl., water cooled, 4-spd. manual, a/c, am/fm cassette, towing pkg. 128K mi. \$2,500/neg. Bob, Ext. 4326.

90 MERCURY MARQUIS - Always garaged, beaut. car. 87K mi. Marie, Ext. 3783.

90 FORD TAURUS - V6, p/w, p/b, new alt., gd. inter., 2 new tires, body fair, reliable. Call eves. 114K mi. \$650/neg. 929-5876.

90 GRAND AM PONTIAC - New tires, runs v well, excel. 105K mi. \$1,050/neg. 878-6417.

89 MAZDA MX6 - 2dr., runs well. ask \$800 neg. 127K mi. \$800/neg. Mark, Ext. 2238 or 828-6459.

87 NISSAN PICKUP - 4x2, 2dr, standard, high mi., runs well. 0 mi. \$1,000. 926-2613.

Sports, Hobbies & Pets

LIFT TICKETS - 2 mid-week adult lift tickets to Stowe Mountain Resort in Vermont. \$65 value, \$40/ea. Michael, Ext. 7941.

Community Involvement

SAFETY FIRST AID KIT - use in every home, car, basic first-aid kits, \$6, being sold to benefit Cub Scout Pack 589. Ben, 921-9133.

TSUNAMI RELIEF - for Sri Lanka: Checks or money orders made out to New York Buddhist Vihara Foundation (mark them "Disaster Relief") (see www.newyorkbuddhist.org); or to I-FREED (www.I-FREED.ORG), and for India, the M.A. Center, a nonprofit corp., (510) 537-9417 and/or cash collected by Mahendra Kahanda, Ext. 2973, mka.handa@bnl.gov, Jean Petterson, Ext. 4302, both Bldg. 555.

Wanted

JARS OF PEANUT BUTTER - for St. Mark's ministry, making 1,300 sandwiches/month to feed the hungry. Pat, Ext. 2531.

SKIERS - to ski Hunter Mountain, \$56/bus & lift, send pymt. to A. Hoffman, Bldg. 510A.

Farewell Gatherings

BEN AZZARA & JOHN MCNEIL - 1/20, 6 p.m. Rock Hill Golf Club. \$27 incl. buffet, gift. Cash bar. RSVP TODAY. Dan, Ext. 2121.

For Rent

OUTER BANKS, NC - pvt. oceanside home, 5 min. walk to ocean & 2 min. walk to lake, 5 bdrm./3 bath, pool, hot tub, billiard rm., www.family-vacation-homes.com. \$2,695/week. Carrie, 889-5303.

Recital

BSA Noon Recital, 1/26 Pianist Natalia Lavrova

Classical piano soloist Natalia Lavrova will give the BSA Noon Recital on Wednesday, January 26, in Berkner Hall. All are welcome to this free concert.

Born in Moscow, Russia, Lavrova began music studies in 1986 at five years old and won her first international competition in the 1994 Young Pianist competition in New Jersey. She has won honors in Italy, France, Russia, the U.S., and England.



Arrivals & Departures

Arrivals

Deborah Keszenman Pereyra Biology
Hyung Chul Kim Env. Sci.
William Nettles Env. Sci.
Rita Nicolaides Medical

Departures

Andy Lockwood ES
Victoria McLane ES&T

Get to Know Your Lab Tour Micro MRI, Noon, 1/21

On Friday, Jan. 21, the Employee Lunchtime Tour will visit the Medical Department's micro MRI facility, where researchers do non-invasive brain imaging of mice, rats, etc., to learn more about causes of brain disease. All are welcome. Meet at Berkner Hall lobby at 12 noon. The tour ends by 1 p.m. No reservations are necessary.

Retirement Counseling

A TIAA-CREF consultant will visit BNL on Tuesday and Wednesday, January 18 and 19, to answer employees' questions about financial matters. Sample topics include: importance of protecting assets against inflation, finding the right allocation mix, learning about TIAA-CREF retirement income flexibility, comparing lifetime income vs. cash withdrawal options. For an appointment, call Kathy Murphy, (866) 842-2053, Ext. 4625.

Softball Captains Meeting, 1/25

A meeting of Softball Captains will be held on Tuesday, January 25th, noon-1 p.m., in Berkner Hall, Room A, to discuss the 2005 Season. Bring with you a tentative roster for your team. Also required at this meeting is a team fee deposit of \$50. Make checks payable to BERA Softball.

The Bulletin regrets that many ads have had to be omitted due to lack of space. All these ads have been on the internal web homepage of the Bulletin for one week. To have your ad run again, please re-submit it.