1,000 INJURY-FREE DAYS... AND COUNTING

August 14, 2006

NSLS users and staff have worked more than 1,000 days without a lost-time injury. This significant safety milestone was reached on Monday, August 14, 2006 as the tally in the NSLS lobby jumped into the quadruple digits. The number means that almost three years has passed without a person working at the NSLS losing work time or incurring restricted duties as the result of an injury or exposure on the job.

The milestone is a major accomplishment for the NSLS, considering the complicated work environment and the hundreds of people working within the building 24 hours a day, said Bob Casey, the NSLS Associate Chair for Environment, Safety, Health, and Quality. “This success is the result of many people taking care to plan their work and making sure that hazards are identified and controlled,” Casey said. “A safe work environment is good for each of us personally, and it is good for the NSLS. I tip my hat to everyone for their efforts to keep our workplace safe.”

— Kendra Snyder

HATS OFF TO THE 2006 NSLS SUMMER STUDENTS

September 1, 2006

Eighteen high school and college students performed summer research projects at the NSLS this year, working with scientists and engineers from the department in research fields ranging from medical sciences to electrical and mechanical engineering. In addition to their research projects, students had the opportunity to attend scientific lectures, tour BNL research facilities, and participate in numerous social activities.


Kimone Antoine

Interested students apply to these programs in the spring and the programs range from six to 10 weeks long. Here’s an idea of what they did during the summer:

Kimone Antoine worked with Lisa Miller to analyze differences in the chemical composition between children’s and adults’ fingerprints using infrared microspectroscopy. Her objective was to reveal why children’s fingerprints disappear faster than those of adults. Antoine received her Associate’s degree in mathematics and natural science from Lehigh Carbon Community College in Pennsylvania and attends classes at Hiram College.


Kobbina Awuah

Kobbina Awuah worked with John Skaritka as part of the Science Undergraduate Laboratory Internship (SULI) program at BNL. They designed a 2-in-1 cryogenic permanent magnetic undulator (CPMU) and a superconducting undulator (SCU). The design will help reduce project costs associated with switching from one kind of undulator to the other (i.e. CPMU to SCU and vice versa). Awuah is a junior at Cornell University.


Jonathan Cheung

Jonathan Cheung worked at the NSLS with Syed Khalid and Vivian Stojanoff on a project related to the origin of color from natural pigments. Cheung collected different materials that were dyed using pigments from vegetables, tree bark, and flowers. This dying process involves some natural mordants (fixers) such as iron, copper, and aluminum. Using spectroscopy, he found the color of the finished sample to be dependent on the type of material and mordant used. Cheung is a senior at Syosset High School.

Sarah Heins spent most of her time observing administrative staff and scientists while they worked on everything from completing travel authorization forms to determining the structure and magnetism of certain elements. She worked with Stony Brook University graduate student Kathryn Krycka to learn how much time and effort is needed in order to conduct experiments, write a thesis and earn a


Sarah Heins

high-level degree in the physics field. She also spent a small portion of her time researching physical concepts and past experiments done at the NSLS. In her spare time, Heins helped the secretarial staff to learn about the administrative aspects of scientific research. Heins is a freshman at Syracuse University.


John Kuczewski

John Kuczewski worked with Peter Siddons at the NSLS as part of the High School Summer Research Program. He developed a graphical user interface for the Thorlabs OPTODC Servo Motor System under the GNU/Linux platform. Modeled from Siddon's driver and kernel patch, Kuczewski's software package for this motor system was programmed using the C programming language and the GTK+2.0 libraries for the Debian GNU/Linux operating system. GNU/Linux based systems are used at the light source for beamline controls and this new software package will integrate seamlessly into the present control systems. Kuczewski is a sophomore at Shoreham-Wading River High School.


Elhag Shaban, Marcus Mason and Eric Huey

Marcus Mason and Eric Huey worked with Peter Siddons and Elhag Shaban at the NSLS as part of the Faculty and Student Team (FaST) program. Mason and Huey studied the processes involved in the development of a Bulk MicroMegas Detector. They characterized the detector using extended x-ray absorption fine structure (EXAFS) methodology at beamline X12A They also attempted to reproduce stable gains and excellent resolutions as studied in previous detectors. They both are juniors at Southern University at Baton Rouge.


Shirin Mortazavi

Shirin Mortazavi participated in BNL's High School Research Program. Under the guidance of Lisa Miller, Mortazavi studied the chemical composition of children's and adults' fingerprints using infrared microspectroscopy at beamline U10B. The difference between the chemical make-ups should explain why the fingerprints of children disappear before those of adults. Mortazavi is a junior at Bellport High School.

Saka Okyere-Asiedu and Christopher Dixon worked under the mentorship of Delaware Materials Science Professor Robert Opila and NSLS staff scientist Steve Hulbert at the NSLS as part of the Faculty and Student Team (FaST) program. They used ultraviolet photoelectron spectroscopy at beamline U4A to determine how the chemical bonding of materials affects the electrical performance of materials. They investigated how the valence bands of silicon determine the conductivity of photovoltaics. The team also used the system to test for electrical properties of material with a high dielectric constant for application in Si circuits. Their results will help maximize the efficiency of solar cells and help determine which metal and dielectric are used in the future generation of very highly integrated circuits. Okyere-Asiedu and Dixon are undergraduate students at the University of Delaware.


Saka Okyere-Asiedu, Christopher Dixon and Robert Opila

Dylan Roden participated in the Science Undergraduate Laboratory Internship (SULI) program at the NSLS under Lisa Miller. Dylan worked with photodynamic therapy treatment of human melanoma cells in an effort to discover an effective treatment for the disease. He also uses Fourier Transform Infrared (FTIR) analysis to assess chemical changes within the melanoma cells as a function of treatment method. Roden is an undergraduate student at the Massachusetts Institute of Technology pursuing a bachelor's degree in biological engineering with hopes to continue his education in medical school.


Dylan Roden

Yusuf Siddiqui worked with Syed Khalid and Vivian Stojanoff as part of the Community Summer Science Pro-

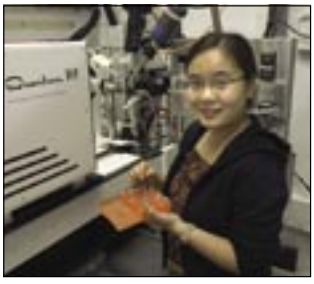

Yusuf Siddiqui

gram at the NSLS. Siddiqui searched for the chemical composition of the active site of ferritin – a protein used in anemia prevention and early haemochromatosis detection. Ferritin contains a hollow shell that can contain a significant amount of iron and is therefore of great use to doctors treating iron deficiency disorders. Small amounts of cadmium, a toxic transition metal found to be in ferritin, could shed light on the plausibility of ferritin usage as a medical treatment, therefore contributing to further research into new treatments for iron deficiency disorders. For these experiments Siddiqui used extended x-ray absorption fine structure spectroscopy (EXAFS). Siddiqui said he hopes that the work done during his internship will contribute to expand general scientific knowledge. He is a junior at Boston University Academy.


Rodney Snow

Rodney Snow worked with Peter Siddons at the NSLS as a GEM National Consortium intern. Snow was engaged with many assignments simultaneously, but his main project was assembling, testing, and characterizing a spin polarization detection chamber. This chamber will be used to detect the ballistic transport of low-energy electrons through ultra-thin films with a thickness on the order of 20 to 100 nm. This study can ultimately realize a new generation of electronics called spin-based electronics. Snow is a second-year graduate student at Michigan Technological University.

Weisha Zhu worked with Babu Manjasetty of the Case Center for Synchrotron Biosciences as a Science Undergraduate Laboratory Intern. Their project studied the complex structures of Escherichia coli L-Arabinose isomerse, an enzyme with potential use for tagatose (low-calorie natural sugar) production. By co-crystallizing the enzyme in complex with co-factor metal ions and candidate substrates/inhibitors, they were able to understand structure-function interactions important for the enzyme's biological mechanism. Crystals of different complexes were grown and several diffraction datasets were collected at NSLS-X4C and X6A beamlines. Comparison studies between the native and complex forms of crystal structures will provide valuable biological information in designing new pathways to increase tagatose production. Zhu is an undergraduate student at Cornell University.


Weisha Zhu

— Kendra Snyder

NSLS, NSLS-II STAFF CELEBRATE AT PICNIC AND SERVICE AWARDS

September 21, 2006

Pushed back a week because of rain, the 2006 Light Source Directorate Picnic took place on September 21 with beautiful weather. For the first time, the annual end-of-year celebration was held for both NSLS and NSLS-II employees, hosted by NSLS Chair Chi-Chang Kao and Steve Dierker, Associate Laboratory Director for Light Sources. In addition to the vast amounts of meat, cheese, pasta salads and candy, Kao presented a cake to celebrate 1,000 injury-free days at the NSLS. The cake was cut – carefully – by Jim Tarpinian, Assistant Laboratory Director for Environment, Safety, Health and Quality, after he congratulated employees on the significant safety milestone.

Service Awards

Michael Caruso, Richard Freudenberg, Richard Heese and Pooran (Boyzie) Singh were honored for 25 years of service at Brookhaven Lab, and 20-year awards went to Scott Buda, Shuchen Kate Feng, and Michael Fulkerson. In the 10-year category were G. Lawrence Carr, Elaine DiMasi, Joan Marshall, Cheo Teng, and John Vaughn III. And although it isn't an officially recognized BNL milestone, John Dabrowski was acknowledged for an impressive 45 years of service at the Lab.


NSLS and NSLS-II staff enjoy the food at the annual picnic.

Spotlight Awards
The Spotlight awards are tributes to NSLS staff members who have shown exceptional dedication to their jobs during the year. This year, the winners were:


NSLS Chair Chi-Chang Kao

Walter DeBoer: The vendor contracted to build the X25 undulator could not deliver the completed device on schedule, so the burden of completing and testing the device fell onto the NSLS technical staff. From August 2005 through February 2006, DeBoer took on a great amount of that responsibility, traveling twice to Lansing, NY, to assemble, bake, and vacuum-test the undulator. Working unpaid hours on long days and weekends both in Lansing and at BNL, DeBoer is a big reason why the undulator was installed successfully during the winter shutdown.

David Harder: The original schedule for X25 undulator development included at least one and a half months for magnetic measurement and shimming of the device. However, the delivery was delayed because of the vendor, and as a result, less than two weeks were left to spend on these steps. Harder, whose careful examination of the Hall probe scanning system enabled a precise characterization of the undulator's magnetic field, spent seven days a week for two months on the project to compensate for the lost time.


ALD for Light Sources Steve Dierker

Mike Lehecka: Lehecka also worked seven days a week for two months to make up for lost time on the magnetic measurement and shimming aspect of the X25 undulator installation. Lehecka, who runs the pulsed wire bench for the NSLS magnetic measurement laboratory, does both mechanical and intricate vacuum-related work. He is an expert in setting up pulsed wire measurement systems, which vendors don't have the capability to do. Without his effort, the X-25 undulator measurements couldn't have been finished in such a short amount of time.

Ed Losee: In the effort to produce superconducting undulators for the NSLS and NSLS-II, Losee undertook the responsibility for prototype undulator magnet fabrication and assembly. The process requires special skills and equipment, and such devices had never been built in the United States. With minimal direction, Losee taught himself how to use a complex turntable device to fabricate the magnet, and using it, he then produced several prototypes. The NSLS can now produce and test superconducting magnets and other complex components in-house with Losee's assistance and skills. Losee also provided significant support on the X17 superconducting wiggler during the winter 2005-06 shutdown.

Philip Marino and Tom McDonald: Marino and McDonald won this shared Spotlight Award for upgrading the NSLS beamline safety checklists, which were old, difficult to use, and didn't have a system in place to assure periodic review and update. Beginning in 2003, Marino and McDonald approached each beamline to identify the critical components, meeting with the local contacts to assure minimal interruption to operation. They then made and connected all the needed labels and photos and assembled the new checklists in a standard format. The NSLS relies on this system for radiological safety, and Marino and McDonald spent considerable effort and time completing the upgrade.

Paul Montanez: Montanez served as an engineer, supervisor and coordinator during the relocation of beamlines X9A and X9B to X3. The series of moves was planned and coordinated in a way that needed no additional shutdown time for the machine and minimized the total disruption to the X9 program. The originally proposed spring shutdown schedule was cut in half because Montanez figured out ways to do more preparation and minimize work. He put in extra hours to ensure this relocation was successful while still completing projects with beamline X25 and NSLS-II.

Charlie Nielson and Wayne Rambo: The NSLS Controls and Diagnostics groups were tasked with integrating the X25 MGU control system, designed by an outside contractor, into the NSLS Controls System. At the end of 2005 and early part of 2006, Rambo and Nielson both put in overtime hours and extraordinary effort to accomplish the system pretesting, installation and commissioning within the tight schedule. Both men made trips to Advanced Design Consulting in Lansing, NY, to check on the project's progress and work around problems as they came up during testing and commissioning.

Mihai Radulescu: The bellows on the VUV-IR injection shutter failed during operations in July

2006. A previous failure of this same assembly required complete removal and rebuilding of the shutter, and fortunately, the about two-week repair process happened near a major maintenance time. This recent instance, however, would have resulted in major downtime if it weren't thanks to Radulescu. He developed a method for removing the actuator while leaving the shutter block in place. This whole process was completed in less than 60 hours from the time it was discovered.

— Kendra Snyder

CHI-CHANG KAO NAMED CHAIR OF THE NSLS

October 1, 2006

Chi-Chang Kao, a physicist and leader in synchrotron light research, was named Chair of the NSLS Department, effective October 1. Kao served as interim NSLS Chair since mid-January 2006, after Steve Dierker stepped down to lead the development of the NSLS-II.

Chi-Chang Kao

"Chi-Chang is an internationally recognized scientist with a remarkable talent for bringing people together and growing scientific programs," said Dierker, who is the current Associate Laboratory Director for Light Sources. "I can think of no better choice than Chi-Chang to lead the NSLS forward."

As Interim Chair, Kao produced a five-year plan for the future development of the NSLS. With input from the user community, NSLS staff, and Brookhaven researchers, the plan identifies a number of exciting scientific opportunities, improvements needed for better accelerator operation, and upgrades for beamlines, detectors, and infrastructure. As the new NSLS Chair, Kao wants to ensure that these initiatives are implemented.

"The next five years will be a very important time for the NSLS, because if NSLS-II gets approval, we will transition into the new light source at the end of that period," Kao said. "We have developed a very aggressive strategic plan that will help keep scientific productivity up and also grow new scientific communities at the NSLS. In particular, we want to grow in a way that will allow us to smoothly transition the user scientific program to the NSLS-II."

Additionally, Kao wants to encourage closer interaction between the NSLS, Brookhaven's research departments, industry, and universities, as well as emphasize research related to nanoscience and energy. "There are many ways that synchrotron research can make significant contributions to solve the energy problems the world is facing today," Kao said. "Using light, we can study and make advances in the fields of catalysis, energy storage, fuel cells, and solar energy."

Kao earned a B.S. degree in chemical engineering in 1980 from National Taiwan University and a Ph.D in chemical engineering from Cornell University in 1988. Shortly after, he joined BNL as a postdoctoral research assistant at the NSLS. His research focuses on the development of new experimental techniques using synchrotron radiation, and their applications to condensed matter physics and material sciences.

He received tenure as a Brookhaven physicist in 1997 and served as the NSLS high-energy program coordinator from 1998 to 2001. He was promoted to senior physicist in 2001 and was named NSLS Deputy Chairman in 2005. Kao also is the Associate Chairman for User Science and an adjunct professor in the Department of Physics and Astronomy at Stony Brook University. He is a member of the American Physical Society and the American Association for the Advancement of Science.

— Kendra Snyder

UPDATE ON THE X27A MICRO-SPECTROSCOPY FACILITY BEAMLINE

October 1, 2006

In 2006, NSLS hard x-ray micro-spectroscopy facility beamline X27A became fully operational. A smooth transition from commissioning to operations during the fall of 2005 provided immediate implementation of a wide and diverse research program involving an extensive range of institutions: Stony Brook University, Rutgers University, BNL Environmental Sciences Department, Miami University, Institute of Nuclear Physics (PAN) Poland, University of Western Ontario, Natural Resources Canada and IMEC of Belgium. Ongoing research areas include the study of manganese and arsenic speciation/distribution in a range of environmental sensitive samples; the nature of

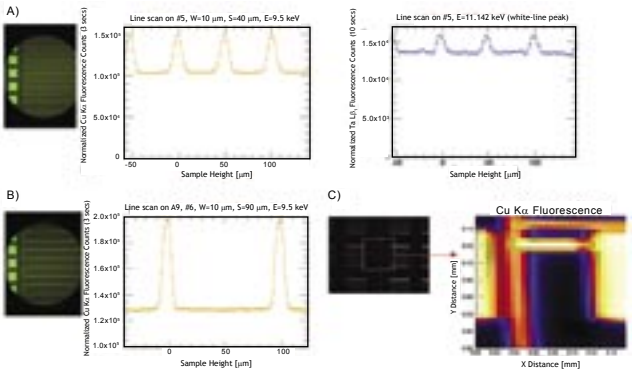


Figure 1. X-ray fluorescence line scans across 10 um-wide copper interconnects spaced at (A) 40 um and (B) 90 um. (C) Cu Kd fluorescence image of a pad structure.

titanium incorporation through applied creams into human skin layers; plutonium and uranium distribution/speciation in contaminated soils; polarization dependent thorium EXAFS measurements on small apatite single-crystals; understanding strontium incorporation in osteoporotic bone; and determining trace-metal distribution in diseased brain tissue. The success of implementing these research areas, and the high-quality data being collected at this facility, is largely due to the good stability of the NSLS x-ray ring, which is especially important for microprobe beamlines.

An example of an area of research initiated at X27A is the investigation of tantalum and tungsten thin-film diffusion barriers that are used in copper interconnect technology. Using the x-ray microbeam, buried thin-film layers beneath copper are investigated using fluorescence x-ray absorption spectroscopy. The ability to characterize these films, which are often amorphous and cannot be studied using x-ray micro-diffraction, is an important area of applied research within the semiconductor industry. Currently, preliminary experiments on thin-film interconnect test structures have been conducted and analyzed, and these encouraging results have initialized the fabrication of 'real' systems for future in-situ measurements. Preliminary measurements on passivated 10 μm wide, 120 nm thick Cu interconnects, separated by 40 μm and 90 μm 'field' regions, and with a 4 nm thin ALD Ta_3N_4 barrier layer have been performed. Cu Kα fluorescence recorded at an incident x-ray energy of 9.5 keV, and Ta $L\beta_1$ fluorescence recorded at the peak of the Ta white-line at ~11.142 keV, are shown in **Figure 1**. The Ta L_2 XANES on a PVD Ta_2N (5 nm)/Ta (20 nm) blanket film and a 4nm ALD Ta_3N_4 barrier used in a copper interconnect test structure are shown in **Figure 2**. As can be seen, the nitrogen content within the Ta_2N barriers is clearly evidenced by the spectral signature of the near-edge region and the shift in the absorption edge towards higher x-ray energies, compared to the Ta_2N (5 nm)/Ta(20 nm) blanket film, which is of predominantly Ta character.

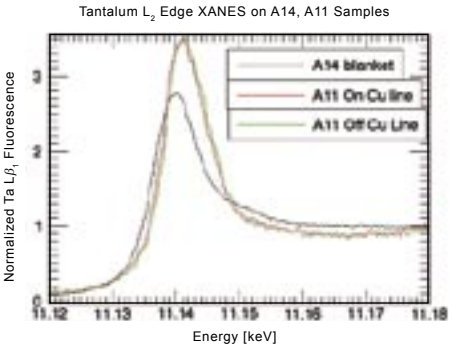


Figure 2. Ta L_2 absorption-edge XANES on Ta_2N (5 nm)/Ta (20 nm) blanket film and the Ta_2N barrier on a Cu interconnect patterned sample, both on and off the interconnect lines.

— James M. Ablett

RICHARD BISCARDI WINS SITEWIDE SAFETY STEWARD AWARD

October 16, 2006

NSLS chief electrical engineer Richard Biscardi was one of four BNL employees to win a Sitewide Safety Steward (S3) Award as part of a new employee recognition program for safety awareness.

The S3 program recognizes outstanding awareness and implementation of health and safety improvements and corrective actions. Biscardi was nominated for the award based on his initiative in reducing electrical hazards, an important area of risk for the NSLS.

Erik Johnson, Biscardi's supervisor, noted that his job requires him to be more attuned to electrical hazards than most staff members, but he has built upon his heightened awareness and shared his expertise broadly throughout BNL, primarily as a member of the Lab's electrical safety committee.

"His work has led to the identification of hazards and non-compliances as well as possible methodologies for their mitigation that are now being employed across the Laboratory," Johnson said. "He has truly adopted a stewardship role in promoting electrical safety for the NSLS and BNL."

Of particular note is his effort in providing pathways to compliance with the requirements of two safety codes: National Fire Protection Association (NFPA) 70E, which describes standards for electrical safety in the workplace; and 10CFR851, a worker health and safety program.

At the presentation of the Sitewide Safety Stewardship (S3) Award, the winners were: (from left) Richard Biscardi, National Synchrotron Light Source Department; Cheryl Conrad, Energy Sciences & Technology Department; and (right) Richard Scheidet, Plant Engineering Division. The fourth award winner, Jeff Gillow, Environmental Sciences Department, was not present. A team award was also presented to: (third from left) Adele Billups, Laura Thompson, and Peter Guida, all of the Medical Department.

On very short notice, Biscardi worked with staff across the department to develop a protocol for the NSLS to come into compliance with the personal protection equipment requirements of 70E. He also established an equipment inspection program to assure the electrical equipment used by staff, vendors, and visitors either meets Nationally Recognized Testing Laboratory (NRTL) requirements or has been properly inspected and tagged. This program is being emulated across the Laboratory.

Biscardi also formed a team to investigate equipment compliance with the requirements of 10CFR851. This working group's findings and recommendations are at the heart of the NSLS program to come into compliance with 10CFR851.

Biscardi, along with the other S3 award winners, runner-ups, and nominees, was recognized in a BNL ceremony on October 16.

— Kendra Snyder

418TH BROOKHAVEN LECTURE 'BRIGHT PHOTON BEAMS: DEVELOPING NEW LIGHT SOURCES'

October 18, 2006

A world-leading brightness of intense x-ray light is needed for scientists to make the next generation of discoveries in a wide range of disciplines, from structural biology to nanoscience, from the structure and dynamics of disordered materials to properties of materials under extreme conditions — and more.

To provide this bright light, BNL proposed and the DOE approved the National Synchrotron Light Source II (NSLS-II), a state-of-the-art medium energy machine designed to produce x-rays more than 10,000 times brighter than those produced at the current NSLS. These powerful beams and the advanced instrumentation at NSLS-II will be able to probe samples of materials in a wide range of sizes and conditions, giving information that could lead to advances, for example, in clean and affordable energy, molecular electronics, and the self-assembly of nanomaterials into useful devices.

Developing the machine and its instrumentation is not easy, however. Achieving and maintaining the needed level of intensity will involve tightly focusing the electron beam, providing the optimally matched insertion devices, and achieving and maintaining a high electron current. At BNL, research and development are ongoing on these and other challenges.

Timur Shaftan

Timur Shaftan, a scientist in the NSLS Department, gave the 418th Brookhaven Lecture on this work on October 18, 2006 during his talk "Bright Photon Beams: Developing New Light Sources."

In his talk, Shaftan discussed various sub-systems of NSLS-II and the requirements and key elements of their design. He also explained how scientists at the NSLS developed a prototype of a light source of a different kind — a short-wavelength free electron laser — and reviewed the development of new concepts in the physics of bright electron beams in this facility.

Timur Shaftan, who earned his Ph.D. in physics at the Budker Institute of Nuclear Physics, Russia, in 1997, joined BNL in February 2000. Since 2003, he has been involved in many areas of the NSLS-II project, including lattice design, insertion devices, and the design of the injection system. He currently leads the group working on Conceptual Design of the NSLS-II injection system. Involved in collaborations with a few accelerator facilities worldwide, he also serves as a reviewer in Nuclear Instruments and Methods in Physics Research journal.

— Liz Seubert and Kendra Snyder

BNL WINS R&D 100 AWARD FOR X-RAY FOCUSING DEVICE

October 19, 2006

Brookhaven National Laboratory has won a 2006 R&D 100 award for developing the first device able to focus a large spread of high-energy x-rays. The device, called a Sagittal Focusing Laue Monochromator, could be used in about 100 beamline facilities around the world to conduct scientific research in physics, biology, nanotechnology, and numerous other fields.

R&D 100 Awards are given annually by R&D Magazine to the top 100 technological achievements of the year. Typically, these are innovations that transform basic science into useful products. The awards were presented in Chicago on October 19.

NSLS physicist Zhong Zhong led the development of the focusing device with help from BNL scientists Chi-Chang Kao, Peter Siddons, Hui Zhong, Jonathan Hanson, Steven Hulbert, Dean Connor and Christopher Parham; BNL technicians Anthony Lenhard, Shu Cheung, and Richard Greene; and former BNL scientist Jerome Hastings, who is now working at the Stanford Linear Accelerator Center.

"I congratulate the researchers who have won this award, which highlights the power and promise of DOE's investments in science and technology," Secretary of Energy Samuel W. Bodman said about the BNL team. "Through the efforts of dedicated and innovative scientists and engineers at our national laboratories, DOE is helping to enhance our nation's energy, economic and national security."

As x-rays are produced at light sources, they spread out, or diverge. X-rays produced by a beamline with a 5 milliradian divergence, for example, will spread to 5 millimeters (mm) by the time they are 1 meter away from their source, and to 50 mm when 10 meters away. This is a problem for light source scientists, who want the highest possible x-ray flux on a small spot, which requires a well-focused beam.

On the left, from front to back: Jonathan Hanson, Steven Hulbert, Shu Cheung, Anthony Lenhard, and Zhong Zhong. On the right, from front to back: Peter Siddons, Hui Zhong, Chi-Chang Kao, Dean Connor, Christopher Parham, and Richard Greene. Not pictured: Jerome Hastings.

Previous x-ray focusing technologies relied on mirror-like surface reflections, but this required large surfaces and caused technical difficulties in error control and limitations on the energy of the x-rays that could be focused. The device developed by Zhong's team, however, doesn't rely on a crystal surface to reflect the beam. Instead, it sends the x-rays directly through a set of silicon Laue crystals, named for German physicist Max von Laue. The result is a 1,000-fold increase in beam intensity, as well as high-energy resolution, reduced costs and ease of operation, Zhong said.

The device consists of two thin bent crystals mounted on a slide, with the first one diffracting upward and the second one diffracting downward to focus the beam horizontally. It is the first device that can focus a large divergence of high-energy x-rays, handling a beamline with a divergence as great as 20 milliradian.

"This is a very elegant solution to an existing problem," said Zhong, who started working on the project in 2001. The first version of the device is installed at the NSLS beamline X17B1 and is gaining interest from members of other Brookhaven beamlines and scientists at light sources around the world. Development of the award-winning device was supported by the Office of Basic Energy Sciences within the U.S. Department of Energy's Office of Science.

— Kendra Snyder

SHORT COURSE: XAFS STUDIES OF NANOCATALYSIS AND CHEMICAL TRANSFORMATIONS

October 19-21, 2006

The short course in x-ray absorption fine-structure (XAFS) analysis, emphasizing problem-solving methods in typical catalysis applications, was offered on October 19-21 at the NSLS. It continued the annual NSLS tradition of gathering a group of scientists, active in the field, who share their expertise with those interested in learning about the possible use of XAFS in their research as well as with those who are relatively advanced. The latest two courses were organized and co-sponsored by the U.S. Department of Energy's Synchrotron Catalysis Consortium (SCC) and the NSLS. The theme of the latest course was tailored to users

Participants in the XAFS Studies of Nanocatalysis and Chemical Transformations Short Course

of the SCC who have recently collected data in systems of relevance for catalysis applications: nanoparticles- mono- and bimetallic (including core-shell), supported on different surfaces, studied ex situ or in situ. The latter included real-time reactions studied at the SCC facilities by XAFS.

The course was organized by Anatoly Frenkel (Yeshiva University), Syed Khalid (NSLS), and Faisal Alamgir (NIST). The format of the course consisted of lectures in the morning and data analysis sessions in the afternoon. Most lectures were designed as tutorials on different aspects of XAFS analysis, such as the "Theory of XANES" and "Theory of EXAFS" (Josh Kas, University of Washington), advanced data analysis methods (Principal Component Analysis, by Stephen Wasserman, SGX Pharmaceuticals), and the basics of EXAFS data processing and fitting (Scott Calvin, Sarah Lawrence College). In addition, lecture topics included the "Concepts of advanced EXAFS data modeling" (Anatoly Frenkel), "In situ XAFS studies of fuel cell catalysts" (Carlo Segre, IIT), "XAFS studies of battery materials" (Faisal Alamgir), and "New opportunities with Quick XAFS at the NSLS" (Syed Khalid).

There were 26 registered participants from academia, industry, and national laboratories, as well as 5-10 graduate students from Stony Brook University and Yeshiva University who audited the course. The lecturers were also the data analysis session instructors. During the data analysis session, participants were trained in using the XAFS analysis packages IFEFFIT (authors: M. Newville and B. Ravel), FEFF8 (authors: J. Rehr, et al) and PCA software (author: S. Wasserman).

Most of the course participants brought their own data they recently collected at the NSLS or other synchrotrons. The analysis sessions were organized by matching instructors to the problems. Instructors rotated between sessions, thus sharing their expertise with more than one group of participants. For example, all groups benefited from Steve Wasserman's tutorials on the use of his Principal Component Analysis program and Josh Kas' tutorials of modeling in-situ XANES data in nanoparticles with FEFF8. Scott Calvin, Faisal Alamgir, and Carlo Segre advised all those interested in adaptation of IFEFFIT programs to advanced modeling methods. Anatoly Frenkel helped those studying monometallic and bimetallic, including core/shell, nanoparticles.

All course members thoroughly enjoyed friendly and professional logistical support by the NSLS Users Administration Office: Gretchen Cisco, Liz Flynn, Kathy Nasta, and Mercy Baez.

— Anatoly Frenkel

NSLS USERS RECOGNIZED

October 25, 2006

Each year, a number of NSLS users win prestigious awards in their field of scientific research. The following represent a collection of some of the 2006 awards:

2006 Alvin Van Valkenburg award

Li Li

NSLS user Li Li was the 2006 recipient of the Alvin Van Valkenburg award. This international award is given every second year in the name of physicist Alvin Van Valkenburg, co-inventor of the diamond anvil cell, to honor a young scientist whose research involves high pressure.

Li received her Ph.D. in geophysics from Stony Brook University in 2003 and is an adjunct research assistant professor at the Stony Brook Mineral Physics Institute. She started using beamline X17B2 as a graduate student in 1998 to study the rheology of minerals at high pressures and temperatures.

Rheological properties of materials at high pressure are valuable in many scientific fields, including geoscience, which is Li's concentration. Geoscientists obtain insight about the dynamics of the earth by deforming minerals at mantle conditions. Li probes these properties in-situ using synchrotron x-rays. She also performs theoretical calculations in collaboration with the University College London.

The Van Valkenburg award was presented at the 2006 High Pressure Gordon Conference in Biddeford, Maine, on June 29, 2006.

2005 Hans-Jürgen Engell Prize

Dev Chidambaram

The International Society of Electrochemistry (ISE) awarded the 2005 Hans-Jürgen Engell Prize to NSLS user Dev Chidambaram in recognition of his scientific work and publications in the field of electrochemistry.

The ISE is a professional organization for electrochemists, with 1,400 members from more than 60 countries. Chidambaram received his prize, consisting of a plaque and 500 euros, at the organization's 2006 annual meeting, held in Edinburgh, Scotland. Chidambaram delivered a keynote lecture on September 1, 2006.

Chidambaram joined Brookhaven Lab in 2004 as a Goldhaber Distinguished Fellow. His research focuses on protecting metals from corrosion and remediating toxic metals and radionuclides in the environment. In a project funded by the U.S. Air Force, Chidambaram found that molybdenum may be a viable replacement for chromate coatings, which are used to coat metals to prevent corrosion but are carcinogenic. Later, this result was used as a starting point for a program funded by the U.S. Army. Working with a team from Stony Brook University, Chidambaram has developed a new molybdate-based coating to prevent the deterioration of depleted uranium. Both programs extensively used the analytical techniques at the NSLS to study the materials.

Best Paper Award at 2006 EPCOS

Simone Raoux

Jean Jordan-Sweet

NSLS users Simone Raoux and Jean Jordan-Sweet won one of three "best paper" awards given annually at the European Symposium on Phase Change and Ovonic Science (EPCOS) for work done in part at NSLS beamline X20C.

The award was presented in May at the 2006 EPCOS in Grenoble, France, for the paper "Scaling properties of phase change nanostructures and thin films."

Using time-resolved x-ray diffraction (XRD), the researchers studied the thickness and size-dependent behavior of ultra-thin films and nanostructures, which are important for their applications in solid-state memory devices that could one day replace digital camera flash cards. The goal, Raoux said, is to find a small-scale phase change material that would allow for faster and cheaper technology.

Raoux, from the IBM Almaden Research Center, and Jordan-Sweet, from the IBM T.J. Watson Research Center, started working on the project at the NSLS more than two years ago. Other companies involved in the research included Infineon Technologies and Macronix International Co.

2006 Gregori Aminoff prize

Stephen Harrison

Stephen Harrison, a former NSLS user, was awarded the 2006 Gregori Aminoff Prize in Crystallography by the Royal Swedish Academy of Sciences. Harrison received the prestigious award along with Oxford University professor David Stuart, "for their remarkable contributions in virus crystallography."

The Aminoff prize is given out annually to scientists or research groups who have made a major contribution to the field of crystallography. It consists of a gold medal, a diploma, and a cash award, and is named after Swedish crystallographer Gregori Aminoff, the first scientist to introduce crystallography to Sweden.

Harrison was a regular NSLS user from the mid 80s through the end of the 90s. He worked mainly on beamline X25, studying the structure of DNA protein complexes, in particular, those that control the process of transcription. He also served on the NSLS Science Advisory Committee, which advises the NSLS Chair and the Associate Laboratory Director for Light Sources on scientific, technical, and policy issues related to the optimization of the scientific productivity of the NSLS. Harrison, a Harvard Medical School professor, used the Cornell High Energy Synchrotron Source (CHESS) to conduct most of his research in virus crystallography.

The prize was presented at the Royal Swedish Academy of Sciences in Stockholm on June 7, 2006. A two-day symposium illuminating the latest developments and results in the field of structural work on viruses was organized to honor the prize-winners.

— Kendra Snyder

NANOSCIENCE SAFETY HIGHLIGHTED

December 1, 2006

Nanoscience safety requirements at the NSLS tightened in 2006, in an effort to ensure that there are no harmful health effects from the study and handling of nanomaterials.

The properties of nanoscale materials are known to differ from those observed for the same materials in bulk or even microscale configuration, and those differences result in uncertainty about the potential health effects and environmental concerns these materials could present.

Studies are showing that nanoscale particulates can pass through intact skin, are more likely to reach the air exchange portion of the lungs when inhaled, and can migrate in the body through compartments, along nerve pathways, and through epithelial barriers. The acute and chronic effects of exposure are not yet defined and, until researchers are able to develop a technical basis for exposure standards and for assessment of the risks presented, nanomaterial work conducted at Brookhaven National Laboratory must include conservative controls.

The U.S. Department of Energy (DOE) and BNL policy is to use these materials with care and to minimize personnel exposures and environmental releases. Environmental, Safety and Health (ESH) staff working at each of the five DOE nanocenters developed a set of nanoscience safe work practices that is posted on the BNL Standards Based Management System (SBMS) website: *https://sbms.bnl.gov/sbmsearch/subjarea/105/3836d011.pdf***.** Everyone working with these materials is expected to know and meet the requirements outlined in that document.

The work practices apply to all nanomaterial handling, but focus on control of "free" nano-particulate work as that presents greater risk of exposure or release. Included are requirements for working in hoods, encapsulating samples, scrubbing gasses that flow over particulates, labeling, transport packaging, and waste handling.

— Andrew Ackerman

CHI-CHANG KAO AMONG FIVE NAMED APS FELLOWS

December 28, 2006

Five scientists at BNL – Tim Hallman, Chi-Chang Kao, Dmitri Kharzeev, William Morse, and Yimei Zhu – were named Fellows of the American Physical Society (APS), a professional organization with more than 45,000 members. Election to APS Fellowship is limited to no more than one half of one percent of its membership in a given year, and election for this honor indicates recognition by scientific peers for outstanding contributions to physics. The Brookhaven scientists were among 212 Fellows elected in 2006.

Clockwise from left, Dmitri Kharzeev, Tim Hallman, William Morse, Yimei Zhu, and Chi-Chang Kao

Kao, Chair of the NSLS, was recognized “For his many contributions to resonant elastic and inelastic x-ray scattering techniques and their application to materials physics.” During his research at the NSLS, Kao has developed new x-ray scattering techniques to study the electronic and magnetic properties of magnetic and strongly correlated materials. These techniques have led to better understanding of the Earth’s interior and materials properties under extreme conditions.

Kao earned his Ph.D. in chemical engineering from Cornell University in 1988. Shortly after, he joined BNL as a postdoctoral research assistant at the NSLS. He was promoted to senior physicist in 2001. Kao is also an adjunct professor in the Department of Physics and Astronomy at Stony Brook University.

— Kendra Snyder