QUITE A REMARKABLE SPRING: NOTES FROM THE 2006 NSLS-CFN JOINT USERS' MEETING

May 15-17, 2006

A rosy future was forecast for Brookhaven's user facilities at the first-ever joint meeting of the user communities for the National Synchrotron Light Source (NSLS) and the Center for Functional Nanomaterials (CFN), held May 15-17, 2006.

2006 NSLS UEC Members and SpIG Representatives stand with DOE and BNL management.

At the main meeting on May 16, held in BNL's Berkner Hall, officials from the Laboratory, the Department of Energy's (DOE) Office of Science, and the New York State congressional delegation painted an optimistic picture for an audience of several hundred current and prospective users of Brookhaven's cutting-edge science facilities – those that are currently in operation, planned and under construction, or eagerly anticipated. The Laboratory's interim director, Sam Aronson, welcomed the participants and outlined Brookhaven's "extremely strong science agenda in terms of ongoing research and new facilities that will maintain Brookhaven as a leader in world science." He said meetings like this are important places in which to foster new research collaborations and get updated on the status of work at the Lab. He said that the Laboratory's highest priority is the design and construction of the NSLS-II, which, along with the CFN, will give Brookhaven a powerful combination of cutting-edge research tools.

Sam Aronson

Last fall, the DOE granted "Critical Decision Zero (CD-0) status to National Synchrotron Light Source-II (NSLS-II), the planned world-leading successor to the NSLS. soon, Critical Decision One (CD-1) will yield a construction plan and a site decision will be made.

Robert McGrath

"The NSLS-II will allow our science to continue to flourish and expand, and keep the United States in the forefront of light-source science," Aronson said. Citing Brookhaven's expected contribution to energy research, Aronson said that work here "will be vital to that effort for the U.S. economy and energy security." He said that the DOE's forward-looking investments in user facilities "will eventually change the face of the Laboratory. The completion and operation of the CFN and NSLS-II will profoundly change the balance of research here."

Following Aronson, Stony Brook University provost Bob McGrath gave an update on the search for a new Laboratory director. The search committee has created a list of potential candidates and is contacting key individuals of interest. McGrath said that the committee has a list of 40 people and will begin serious interviews with 10 of those candidates. The committee expects to have a recommendation to Brookhaven Science Associates in September.

The American Competitiveness Initiative

Pat Dehmer, director of DOE's Office of Basic Energy Sciences, outlined the chain of events that led to the Laboratory's bright future outlook, which she termed "a quite remarkable spring." Focusing on the rollout of the American Competitiveness Initiative (ACI) which she called "great news for the physical sciences," Dehmer explained that the ACI doubles funding for DOE's Office Science over the next 10 years. One of the ACI's focus areas is the tools of science, described as "unique, expensive, large-scale tools beyond the means of a single organization."

Pat Dehmer

Dehmer said that she had anticipated that funding for Office of Science programs would be flat or would decline slightly, but that when the ACI was announced during the President's State of the Union speech in January, "a miracle occurred." Projected funding for the Office of Basic Energy Sciences has increased by 25 percent, in large part because the Office's work "aligns almost 100 percent with the ACI goals."

While Dehmer was optimistic about the construction of the NSLS-II, she cautioned that the project would have a long construction life, which will be filled with unanticipated challenges.

"You are embarking on a wonderful journey," she said. "You should be euphoric...and frightened. And you will vacillate between the two."

She concluded her remarks by urging employees and users to contact their congressional representatives to thank them for the support that resulted in this "completely unexpected" funding picture.

"You must realize how difficult it was to make that happen," she said, citing the war, last fall's hurricanes and other budgetary pressures. "Politicians are people, too. They deserve your thanks, and they need to hear from you."


Tim Bishop

Speaking after Dehmer, Congressman Tim Bishop said that he is "so proud of this Lab, the people who work here, and the work that's moving America forward in so many different ways." To see the administration's proposed investments in science is "encouraging indeed," he said. Citing the FY06 budget language stating that it is the "sense of the Congress" that NSLS-II be built at Brookhaven, Bishop pledged to continue pushing for that result.

Bishop said the full funding of the CFN is also a testament to the faith that the Office of Science has in Brookhaven, as well as to the "strenuous advocacy" of the New York congressional delegation.

"We speak with one voice on the importance of this Lab," he said, and urged attendees to stay in touch with their representatives.

"Be forceful in your advocacy," he said. "We value your professional expertise, and these are important issues."

NSLS-II Update

The morning's next speaker, Steve Dierker, BNL Associate Director for Light Sources, is leading the effort to bring the NSLS-II to BNL. Noting that "the CFN will be producing materials that will be crying out to be characterized," he said that development of nanoscale materials will be critical for the development of future energy technologies.

"NSLS-II will be brighter than any existing light source. None of today's light sources were designed to probe materials with one-nanometer spatial resolution and 0.1 meV energy resolution," he said. "The changes that NSLS-II brings will be transformative."


Steve Dierker

Dierker briefly described plans for the Joint Photon Sciences Institute (JPSI), intended to foster development of new techniques and capabilities. He thanked Stony Brook's Bob McGrath for helping to secure a $30 million commitment from New York State for a building to house the proposed institute.

"JPSI will serve as an intellectual center for development and application of the photon sciences and as a gateway for NSLS-II users," he said.

Dierker showed new drawings depicting the proposed facilities, and noted that there have been some changes in the design, in particular, the substitution of a full-energy booster for a full-energy linac injector. He said that 99 people are currently working on NSLS-II, and predicted that the programs would overlap for less than one year before both will be fully and independently staffed.

"The NSLS-II will be essential for energy security, and important for U.S. industry, "he concluded. "It will enable 'grand challenge' science in many diverse fields."

The Center for Functional Nanomaterials

Doon Gibbs, Associate Laboratory Director for Basic Energy Sciences and Interim Director of the CFN, said that an active search is underway for a permanent CFN director, and he urged attendees to bring promising candidates to the attention of the search committee. He said a broader search effort will begin this fall, with an eye to have a permanent director on board by October 2007. Gibbs observed that the CFN building's structural shell is complete, and that more than half of the Center's equipment will be ordered by the end of May.


Doon Gibbs

The CFN, whose focus will be energy security, has added nine new scientific and technical staff members, bringing the total fulltime staff total to over 20. He added that the staff is becoming more collaborative and using bigger teams.

Gibbs said that along with NSLS-II, the CFN will "enable the nanoscience revolution," and he said that the joint user meetings should take place every year or two.

"It is very significant and gratifying that so many users have come here from all over," he said. "We should continue to have such joint workshops because they perform a valuable service and bring us together."

"It really has been fun being interim director," he said. "It's an exciting time to lead this project."

NSLS Update

An update on the work of the NSLS was given by Chi-Chang Kao, Interim NSLS Chairman. He said that FY06 was a "tough year," but observed that no layoffs were necessary, and he said that funding prospects for FY07 remain very good.

Chi-Chang Kao

Kao said the NSLS continues to serve some 2,300 users per year, and announced plans for a BNL User Center to give users "one-stop shopping," for functions including check-in, badging, and housing. The user center will also have extended hours on nights and weekends. He said the NSLS hopes to continue to add more staff on the floor, which he termed important for both science and safety.

"More staff, then more beamlines," he said.

Kao addressed the issue of orbit stability at the facility, noting that the staff running the 65 operating beamlines is not the same staff that built them.

"There has been some lack of understanding of the sensitivity of beamline optics to electron beam motion," he said. "The beamlines need regular alignment and performance calibration."

Along with its usual complement of materials science users, Kao noted an "up tick" in the number of biomedical imaging users. A technique called Diffraction Enhanced Imaging or DEI has been developed to image soft tissue samples and delivers 8 to 33 times greater contrast than digital mammograms.

"This could eventually have a very wide impact in the health industry," he said.

In conclusion, Kao promised both an aggressive upgrade plan for the facility and close NSLS-CFN coordination.

Building Safe Nanomaterials

As science ventures into the nanoworld, concerns will arise over the potential risks involved in producing and working with materials with properties that may not have previously been observed. Vicki Colvin, a chemistry professor from Rice University, spoke about developing nanomaterials with low environmental impacts.

The future of nanotechnology promises answers to key questions in science, she said. Of particular interest to Long Islanders and others in the northeast United States is a technology to remove arsenic from water efficiently and in large quantities. But in considering such advances in technology, scientists must deal with what Colvin termed the "Wow to Yuck Trajectory," in which the environmental impacts of new technology are only revealed after the technology is in wide use. Examples include DDT, which cured malaria but endangered birds, and refrigerants, which cooled our houses but led to a hole in the ozone layer.

"Early examination of nanomaterials' effects will create a responsible technology," Colvin said. "Scientific data and analysis should take the debate about the risks of nanotechnology to the highest possible technical level."

Colvin illustrated some of the challenges inherent in attempting to answer questions of risk by considering the question: Are single-walled carbon nanotubes (SWNTs) toxic? She pointed out that there are 20 major types of SWNTs, and four manufacturing types. All of these types have different lengths, different purification methods, and 10 possible surface coatings, for a possible 50,000 SWNT samples.

"It will be necessary to map out basic structure-function relationships for nanomaterials and biological impacts," she said. "Fundamental nanostructure will include both chemical and physical properties."

NSLS User Science Talks

Following a lunch break, users heard from several scientists who have conducted research at the NSLS.

Henry Chapman, a staff scientist at Lawrence Livermore National Laboratory, spoke on "Ultrafast Coherent Diffraction Imaging with a Soft X-Ray Free-Electron Laser." This vacuum ultra-violet free-electron laser is located at the Deutsches Elektronen-Synchrotron (DESY) in Hamburg, Germany. It generates pulses just 25 femtoseconds in duration with more than a trillion photons per pulse, and is the first free-electron laser to produce soft x-rays. It is ideal for high-resolution holography and imaging, Chapman said, and he showed this by displaying diffraction images and measurements.

Next, a talk on the “Engineering of Carbon Nanotube Structures” was presented by Pulickel M. Ajayan from the Department of Materials Science and Engineering at Rensselaer Polytechnic Institute. His talk focused on recent developments in his laboratory to fabricate carbon-nanotube-based structures that are tailored for various applications. Specifically, he discussed how he and his group create branched nanotube and nanotube-hybrid structures for applications such as sensors, electrical interconnects, and filters.

Before the afternoon break, Lawrence Shapiro, an associate professor at Columbia University, spoke on “Decoding Cell Adhesion with Protein Crystallography.” Cell adhesion – connections that allow cells to stick together – is critical to the formation of tissues and complex cellular networks, such as those that make up the nervous system. These connections are made possible by a few cell-surface protein families. Shapiro discussed how, at the NSLS and other synchrotrons, high-resolution protein-crystal structures are beginning to reveal the atomic-level mechanisms of cell adhesion.

Other Notables
Each year, the NSLS Users’ Executive Committee (UEC) presents one user with the UEC Community Service Award, which honors hard work and dedication toward bettering the experience of users and the user community. At the main meeting, UEC Chair Peter Stephens presented this year’s award to Bob Sweet (BNL-Biology). More details on this year’s award can be found in the following article.

At the conclusion of the main meeting, participants attended the annual poster session and vendor exhibition. Hors d'oeuvres were served as attendees mingled and talked, making for a lively, enjoyable event. Awards were presented to the top student and postdoc posters, which were on display in the NSLS lobby during the month of June. The winners were: Elena Loginova (Rutgers University), Seo-Young Kwak (BNL-NSLS), Shuguo Ma (BNL-Chemistry), Minhua Shao (Stony Brook University), Jae-Hyuk Her (Stony Brook University), and Ariane Kretlow (Robert Koch Institute, Germany). Each winner received a BNL certificate and a $50 American Express gift certificate. Additionally, the Synchrotron Catalysis Consortium gave out two poster prizes of its own. First prize went to Shao, and second prize was awarded to Wen Wen (BNL-Chemistry).

During the two days after the main meeting, workshops were held at locations across the Laboratory. They were *"Synchrotron Catalysis Consortium: New Opportunities for in-situ XAFS Studies of Nanocatalysis,"* organized by Simon Bare (UOP) and Anatoly Frenkel (Yeshiva University); *"Soft Matter and Biomolecular Materials: X-ray Scattering Enabled by High Brightness Beamlines,"* organized by Ben Hsiao (Stony Brook University), Lin Yang (BNL-NSLS), Elaine DiMasi (BNL-NSLS), and Ron Pindak (BNL-NSLS); *"Nanoscale Correlations Heterostructures,"* organized by Jim Misewich (BNL-Material Sciences) and Tony Heinz (Columbia University); *“Chemical and Biological Applications of X-ray Emission Spectroscopy,"* organized by James Penner-Hahn (University of Michigan) and Trevor Tyson (New Jersey Institute of Technology); *"Platforms for the Integration of Biological Systems into Nanomaterials and Interfaces,"* organized by Oleg Gang (BNL-CFN), Daniel Van Der Lelie (BNL-Biology), and Molly Frame (Stony Brook University); and *"VUV Radiometry,"* organized by Jeff Keister (SFA, Inc).

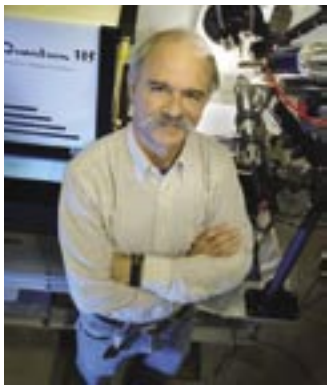
Poster winners (from left) Shuguo Ma, Minhua Shao, Ariane Kretlow, Elena Loginova, Seo-Young Kwak, and Jae-Hyuk Her.

— Kay Cordtz and Laura Mgrdichian

BOB SWEET, THE 2006 UEC COMMUNITY SERVICE AWARD RECIPIENT

May 16, 2006

For his extraordinary service, the NSLS Users' Executive Committee chose Robert M. Sweet for the UEC Community Service Award.



Bob Sweet

Biological crystallography has emerged as an extremely high-profile research area with synchrotron radiation, and Bob has made numerous contributions to create and sustain a vibrant community of users at the NSLS. Bob is the Principal Investigator of the Macro-

molecular Crystallography Research Resource (PXRR), which provides facilities and support at the NSLS for the benefit of outside and in-house investigators. The PXRR is supported by the NIH's National Center for Research Resources and the DOE Office of Biological and Environmental Research in its mission to create optimal facilities and environments for macromolecular structure determination by synchrotron x-ray diffraction. With a staff of about 24, the PXRR innovates new access modes such as FedEx crystallography, builds new facilities, develops remote participation software, collaborates with outside groups, teaches novice users, and supports visiting investigators with seven-day, 20-hour staff coverage.

The PXRR includes six beamlines at X8C, X12B, X12C, X25, X26C, and X29. Bob's work on developing macromolecular crystallography at the NSLS helped in a continual push toward improved performance for NSLS beamlines. The X25 wiggler provided an early demonstration of the potential for insertion devices at NSLS, and the mini-gap undulator at X29 has added to that innovation, and inspired upgrades to mini-gap undulators for other beamlines, notably X25.

Bob's efforts have led to the development of sample-loading automation techniques at the NSLS, software that enables easy user experimental interaction, and the scope of the PXRR has established standardization across many NSLS beamlines, enabling users to move easily from one beamline to the next.

Bob is warm, easy to talk to, and accessible to regular users in the community. Through all his efforts, Bob has likely been the single most important factor in keeping the NSLS on the cutting edge of macromolecular synchrotron crystallography.

It is thus with great pleasure that Bob Sweet was given the NSLS Community Service Award for 2006.

ENERGY SECRETARY, UNDER SECRETARY FOR ENERGY TOUR NSLS

June 2, 2006

On June 2, BNL welcomed Energy Secretary Samuel Bodman and Raymond Orbach, newly named Under Secretary for Science at the Energy Department.

During a whirlwind visit, the Secretary and Under Secretary met researchers at the NSLS, where they talked about current and future research. While discussing applications of synchrotron soft x-rays, NIST physicist, Dan Fischer, gave Bodman and Orbach a tour of beamline U7A. NSLS biophysical chemist, Lisa Miller, showed the Secretary and Under Secretary infrared beamline U10B and described her group's work on skin melanoma while Steve Dierker, Associate Laboratory Director for Light Sources, highlighted the prospects for NSLS-II.

ALD for Light Sources Steve Dierker shows Energy Secretary Samuel Bodman and Under Secretary Raymond Orbach posters in the NSLS lobby.

Bodman and Orbach also met researchers at the Relativistic Heavy Ion Collider's (RHIC) PHENIX and STAR detectors and the molecular beam epitaxy system laboratory, where they heard about the Lab's nanoscience efforts.

Later, the Secretary gave a standing-room-only talk in Berkner Hall to an audience of employees and other guests, including Shirley Strum Kenny, President of Stony Brook University and Chair of the Brookhaven Science Associates (BSA) Board; Carl Kohrt, Battelle President, CEO, and BSA Vice-Chair; and other members of the Board. His purpose in coming to the Lab, the Secretary said, was to support the same level of quality in BNL's future work as that of the greatness of its past — ensuring that "from RHIC to the new Center for Functional Nanomaterials to the preferred siting for the NSLS-II, history will be repeated at the Lab."

DOE/BNL Partnership Requires Safety and Science

In committing to maintaining that tradition, DOE "requires a partnership between you and us," Bodman said. "We look to this laboratory for excellence in management as well as science."

"The most important asset the Department has here . . . is all of you," he continued. "The personal safety of all departmental employees and contractors is a top priority for me." The Secretary emphasized that Brookhaven can be proud of its

Energy Secretary Samuel Bodman (front, middle) stands at beamline U7A with (from left) NIST physicist Dan Fischer, Under Secretary Raymond Orbach, Battelle President and CEO Carl Kohrt, Associate Laboratory Director for Light Sources Steve Dierker, BNL Interim Director Sam Aronson, and scientists Faisal Alamgir and Sharadha Sambasivan.

history of scientific achievement and contributions in many fields, "But, in my judgment, your safety record requires improvement," he said. "We ask you to take care of each other and think of yourselves. Small accidents are the precursors to serious accidents."

Investing in Science

The President understands that we must make investments to ensure that America retains its world pre-eminence in science, Bodman said. "That is why he has proposed the American Competitiveness Initiative (ACI), the Alternative Energy Initiative, and the Global Nuclear Energy Partnership (GNEP). The Energy Department has a major role in all three programs."

Through the ACI, the Office of Science budget is expected to increase by 14 percent in 2007, to $4.1 billion. This initiative is especially important to the NSLS, as the Office of Science will direct additional funds to sectors promising breakthroughs, including supercomputers, nanotechnology, energy from biomass, nuclear fusion, and high-intensity light sources like the NSLS.

Another reflection of Washington's growing awareness of the importance of science, the Secretary pointed out, is Congress' recent confirmation of Ray Orbach as "the first Under Secretary for Science in the history of our Department. The symbolism involved expresses a role for science in our country's government that it has never had before, and we will take maximum advantage of it." Over the next 10 years, even more funding will come from the ACI — $136-plus billion — to invest in research and development, improved math and science education, and incentives to encourage entrepreneurship and innovation, Bodman said.

NSLS scientist Lisa Miller shows Energy Secretary Samuel Bodman infrared beamline U10B.

GNEP, meanwhile, is a collaboration among several countries, Bodman said. The aim is to develop new technologies to recycle spent nuclear fuel in a way that cuts proliferation risks while reducing the volume of waste for disposal. Nine DOE labs, including Brookhaven, are playing a role in this program.

The Alternative Energy Program is also focused on developing new technology. With a 22 percent increase for FY07, this will translate into more support for work on cellulosic ethanol, lithium ion batteries for hybrid vehicles, and hydrogen fuel cells.

All this effort depends on people, Bodman said, and pointed to the ACI call for $380 million to improve mathematics, science, and technical education in U.S. elementary and high schools. He cited the work being done by BNL's Office of Educational Programs as an example of the type of program needed to "assure that future generations of scientists and engineers will step forward to carry on the work that all of you are doing so ably here today." In conclusion, the Secretary reiterated the "tremendous respect" he had for BNL's achievements and what he expected the Lab to achieve in the future. He ended his formal comments by urging Lab employees to e-mail him with their concerns at any time.

— Liz Seubert with Peter Genzer and Kendra Snyder

CRYSTAL GROWTH WORKSHOP HAS CRYSTALLIZING RESULTS

June 12-15, 2006

Hailing from as far as Australia, 40 researchers shared the complexity of the protein crystal growth process with leaders in the field at the "Crystallization: Focus on Optimization and High Throughput Techniques" workshop. The fourth annual course took place at the NSLS from June 12-15, 2006. Organized by Vivian Stojanoff (NSLS) and Naomi Chayen (Imperial College London), with help from

scientists Fabiano Yokaichiya (NSLS) and Jean Jakoncic (NSLS), East Coast NIGMS Structural Biology Research Facility, and Stony Brook intern Matthew Worth, the workshop included a record-number of 11 hands-on tutorials for participants to choose from.

The purpose of the three-day course was to help researchers obtain high-quality protein crystals through both conventional and non-conventional methods including the use of oils, novel nucleating agents, detergents, crystallization in lipid cubic phase, crystallization with gels and high throughput techniques. Participants were divided into groups of three or four, according to their main interests, and followed practical sessions during the course. Researchers chose seven of the 11 sessions to attend, whereas last year's course offered eight sessions.

The participants of the 2006 Crystallization workshop

"What's unique about this course is that it is a real hands-on experience," Stojanoff said. "You really get to try these things out yourself." This unique aspect inspired about a third of the participants to bring their own proteins on which they tried different methods. A few participants actually produced crystals from the proteins they brought, which were screened on beamline X6A on the last day of the workshop.

Experts in the academic and industrial crystallization field gave a series of talks and tutorials. Neer Asherie (Yeshiva University) discussed "Understanding Protein Phase Behavior," Marie-Claude Marchand (Qiagen Inc.) discussed "The Vapor Diffusion Method and Optimization," Gwen Nneji (Imperial College of London) discussed "Non-standard Crystallization Techniques," Pat Loll (Drexel University) discussed "Membrane Proteins and Detergents," Peter Nollert (Emerald BioSystems) discussed "Micro Crystallization using the Lipidic Cubic Phase Methodology," Ingo Grotjohann (Arizona State University) discussed "The Role of the Phase Diagram in the Crystallization of PSI and PSII," and Abel Moreno (Universidad Nacional Autonoma de Mexico) discussed "Gels and Fields: What Can They Say About the Phase Diagram?"

Practical sessions also included talks by Troy Burke (GE Healthcare), Marcia Armstrong (Qiagen Inc.), Trevor Harvard (Precision Detectors), Craig Sterling (Emerald BioSystems), Chris Gawronski (Fluidigm), and NSLS Interim Chairman Chi-Chang Kao, who gave participants an introduction to the light source facility.

In addition, by request of last year's participants, a special session on cryogenic protection and quality assessment of crystals was conducted at beamline X6A on the last day of the workshop. Seetharaman Jayaraman (Columbia Universtiy) introduced the topic and conducted demonstrations in the New York Structural Biology Center Laboratory.

The course attracted researchers with all levels of crystallization experience, including current NSLS users who have previously encountered problems with their crystals. "The course brings new people and awareness to companies about the NSLS and mutual benefits we can have," Stojanoff said.

One participant commented on the course survey: "It is better than a conference. In a conference, people present results, but in this workshop, we are shown how to get results."

Stojanoff stressed her appreciation to the following groups that allowed the use of their labs and time: New York Structural Biology Center, Case Center for Proteomics, the X19C PRT, X17 PRT, X19A PRT, NSLS staff, NSLS User Administration, and the NSLS Outreach Office. Major sponsors included GE HealthCare, Qiagen, Precision Detectors, Emerald Biosystems, and Fluidigm. Additional support was provided by Hampton Research, Douglas Instruments, Anatrace, Millipore, Eppendorf, and New York New Jersey Scientific.

— Kendra Snyder

FUTURE 'POETS,' STUDENTS LEARN ABOUT NANOSCIENCE AT BNL

June 19, 2006

Whether they want to be speech therapists or chemists, all students can benefit from learning about nanoscience. That's the mantra of National Synchrotron Light Source user Anatoly Frenkel, who taught two courses on the subject this summer leading up to a week of hands-on research at BNL for eight students and eight research assistants from Yeshiva University.

The six-week courses, "Discover Nanoscience" and "Nanoscience for Poets" attracted students

with majors ranging from history to computer science. “We want them to become aware of the most important problems in modern science,” said Frenkel, who taught the courses along with fellow Yeshiva professors Gabriel Cwilich and Fredy Zypman.

Participants in the Yeshiva University nanoscience courses at the NSLS

The students worked in teams on the design, synthesis, manipulation, and characterization of nanoparticle catalysts, which are key components of hydrogen fuel cells. “We designed the course around some activities that students could do from beginning to end,” Frenkel said.

The courses began in late May with introductory lectures and labs at the Yeshiva campus, in New York City, in order to get participants up to speed with the concepts of nanoscience and nanotechnology. Students then prepared thiol-stabilized Pd nanoparticles for their research.

The focal point of both courses was a weeklong stay at Brookhaven, which started on June 19. On NSLS beamline X11A, students analyzed their samples using x-ray absorption fine structure (XAFS) spectroscopy. Short trips also were made to Stony Brook University, where students characterized their nanoparticles with electron microscopy and atomic force microscopy.

The efficiency of hydrogen fuel cells correlates with the ability of their catalysts to absorb and/or adsorb hydrogen. The students studied the effect of hydrogenation of fuel cell performance by changing the size of their Pd samples. One of the most exciting parts of the courses is that actual data was collected, Frenkel said. A mini conference with presentations served as the final exam for the students, and their results will be presented in Boston this November at the annual meeting of the Materials Research Society.

Frenkel held a similar course in 2003 on experiments in modern physics and plans to expand the nanotechnology courses in future years.

“Some students go into sciences without knowing too much what the day-to-day research is like because they didn’t have any opportunity to learn how serious research is different from undergraduate work. And then they’re disappointed and find out later in their lives that research is not what they wanted to do,” Frenkel said. “We can help show them what it’s like and help them make a decision, no matter what that decision is.”

— Kendra Snyder

IN MEMORIAM: DAVID MURRAY ZEHNER

June 19, 2006

David Murray Zehner, who helped develop beamline U12B at the NSLS, died on June 19, 2006. He was 62.

David Zehner

A native of Philadelphia, Zehner received his B.A. at Drexel University and his Ph.D. in physics from Brown University. Zehner was a research scientist for more than 30 years in the Solid State and Condensed Matter Physics Divisions at Oak Ridge National Laboratory, where he served as group leader and section head for many years.

He completed his thesis at Brown under famed physicist Harrison E. Farnsworth, one of the first to use low-energy electron diffraction to study metal crystal surfaces. Described by colleagues as an “old-school physicist,” Zehner was greatly influenced by his mentor and focused most of his research on elemental and alloy metal surfaces.

Doon Gibbs, BNL’s Associate Laboratory Director for Basic Energy Sciences, first worked with Zehner in the late 70s and early 80s on experiments focused on the structure and phase behavior of gold surfaces. Prior to completion of the NSLS, Gibbs’ group used a rotating anode source in the Physics Department and the Cornell High Energy Synchrotron Source (CHESS) to carry out the experiments. After the start-up of the NSLS, they transferred their studies to beamline X22C and added platinum and iridium surfaces to their research. Zehner also conducted research at beamline X20.

"David was brutally honest and he liked to do things right," Gibbs said. "He was very precise about the little details, from doing the experiment to writing the papers. But he also was a lot of fun and cared a lot about what people thought and how they were doing."

Zehner helped develop beamline U12B at the NSLS in the early 80s along with Ward Plummer, now a Distinguished Scientist at Oak Ridge and a Distinguished Professor of physics at the University of Tennessee. As a collaboration between Oak Ridge and the University of Pennsylvania, beamline U12B researchers used electron scattering to determine and understand the structure and chemistry of surfaces. "He was emphatic that he had to do it right and he would do it over and over again until it was," said Plummer, who published some 15 papers with Zehner during their time together at the beamline. "That led to a lot of late nights at Brookhaven."

Colleagues say Zehner's compassion was evident by the way he mentored the graduate students and postdoctoral researchers who worked on his experiments. "He followed their career with every step they made," Plummer said. "He really cared about people. He joked that with his affinity for people, he probably missed his calling and should have become a real doctor."

One of those young researchers who Zehner took under his wing was Art Baddorf, now a senior research staff member at Oak Ridge who worked with Zehner and Gibbs at Brookhaven in the 1990s. "I learned a lot from him," Baddorf said. "He was a lot of fun to be around and he was interested in what everyone else was doing and how they were doing it."

Zehner enjoyed windsurfing, sports, and music, and was a member of the American Vacuum Society and the American Physical Society. A resident of Lenoir City, TN, Zehner is survived by close friend, Donna Watson; and former wife, Theodora Zehner.

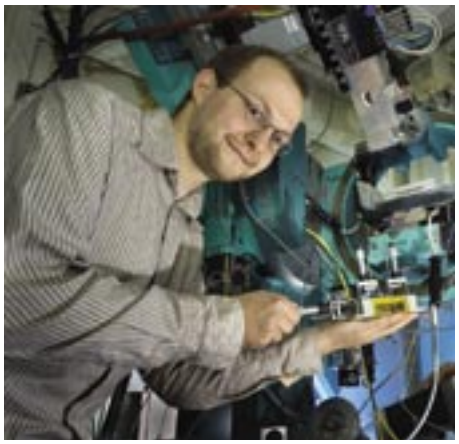
— Kendra Snyder

IN MEMORIAM: JULIAN DAVID BAUMERT

June 24, 2006

Julian David Baumert, a Brookhaven physicist working on the cutting edge of research on liquid surfaces and thin organic films, died of melanoma on June 24, 2006. He was 31.

Described as dedicated, bright and caring,



Julian Baumert

Baumert was a relatively new research associate in the Soft Matter and X-ray groups in the Condensed Matter Physics and Materials Science Department at BNL. "Julian was an exceptionally talented, hard-working young researcher, who loved his work," said colleague John Hill. "He understood his research at a deep level and it was always a pleasure to ask him what he was working on and hear his clear, precise, and enthusiastic explanations of his latest results and what they meant. It is such a tragedy to lose him so early in his life and in his career. We will all miss him immensely."

A native of Molfsee, Germany, Baumert was educated at the Institute of Experimental and Applied Physics (IEAP) at the University of Kiel and the Institute Laue-Langevin (ILL) in Grenoble, France, where he studied a compound known as methane hydrate, which is found naturally on the sea floor and is a major worldwide energy resource. His thesis focused on the structure and dynamics of this compound using neutron and x-ray scattering techniques and numerical simulations. Baumert obtained his Ph.D. from the University of Kiel in February 2004, receiving the prestigious "Familie-Schindler Foerderungs-Preis" of the Faculty of Science in Kiel.

"He was a very cheerful person," said colleague Oleg Gang. "We deal with so many difficult and complicated things here, but he created this atmosphere around him where everything was positive."

Baumert came to BNL in July 2004 and conducted his research at beamline X22 of the National Synchrotron Light Source, where he was part of a team of scientists learning to make smaller and more powerful molecular-scale circuit components that could someday make electronic devices more efficient. He was the principal investigator on a paper published in February 2006 in the Proceedings of the National Academy of Sciences that

described the first measurements of the structure of a molecular junction at buried interfaces. He was working to elucidate how the structural and electrical properties of these molecular junctions depend on the molecular coverage.

"He had such great promise to be an extremely successful scientist," said Ben Ocko, who hired Baumert into his research group. "He was easy-going and friendly, and exhibited a high level of creativity, great skills as an experimentalist, and the ability to explain complex phenomena in simple and elegant terms. He had such a bright future ahead of him."

In the past year, Baumert was diagnosed as having skin cancer and underwent extensive treatment. That didn't stop him from continuing his research at Brookhaven. "Even when his health deteriorated, he continued to come to the Lab daily to work on experiments and to discuss science with his colleagues," Ocko said. After an operation last summer, Baumert continued his scientific research including travel to the Advanced Photon Source last December to investigate how "surface freezing" modifies the capillary wave spectrum at the surface of long-chain alkane molecules using a technique called x-ray photon correlation spectroscopy.

"It was really amazing how he dealt with it," said Baumert's office mate and colleague Masa Fukuto. "He must have known the odds were against him, but he was courageous to the very last minute. He never lost hope."

A resident of Sound Beach, Julian Baumert is survived by his wife, Maren; his parents, Ingrid and Jürgen; and his sisters, Anna and Sophia.

— Kendra Snyder

IN MEMORIAM: ELIZABETH A. HICKS

July 12, 2006

Elizabeth "Liz" A. Hicks, a Brookhaven systems analyst for more than 14 years, died on July 12, 2006. She was 41.

A native of Syosset, Hicks received a B.S. in computer science from Stony Brook University. She joined BNL in May 1990 as a Database Administrator at the National Synchrotron Light Source and later became an applications engineer. Hicks maintained and developed numerous employee databases, assisted the NSLS User Administration Office, helped develop the NSLS stockroom database, and provided general support for sections throughout the department.

Liz Hicks with sons Christopher and Adam

"She was very competent and very good at what she did," said NSLS Business Operations Manager Frank Terrano. "She loved her work, she loved to work, and she never shied away from putting in extra hours. She had a huge effect across the entire department."

When last-minute jobs came in, Hicks was ready to work, said colleague Mary Anne Corwin. "She was always there and always helpful," Corwin said. "She was so friendly and really focused on doing things the right way."

Hicks battled multiple illnesses during her time at Brookhaven, but she didn't let that affect her spirits. "She was so strong-willed and optimistic," said colleague Donna Buckley, who worked with Liz to develop the NSLS stock room database. "She was such a happy person. I don't think I ever saw her angry in all of the days I worked with her."

Described as daring, humorous, and without a "mean bone in her body," Hicks enjoyed skiing, sailing and the annual Mattituck Strawberry Festival, which she attended for the last time with her two sons in June. Hicks left the lab on long-term disability in July 2004, partly to spend as much time as possible with her children, friends said. "She knew she wasn't going to make it to a ripe old age," said colleague Wendy Morrin. "She lived for her boys. She was a really good mom."

Hicks also loved to sing, dance and play the piano. The clanking sound of tap shoes ringing down the NSLS hallways could be pinpointed to Hicks' office, where she and Morrin practiced routines during lunchtime for their dance classes.

"It was always great to see Liz," Morrin said. "She was always cheerful and smiling. She had so much against her health-wise, but she never let it show. She lived every day to its fullest. She was just a truly beautiful person."

A resident of Mattituck, Hicks is survived by her husband, Eugene; her sons, Christopher and Adam; her parents, Holmes and Lucy; her brothers, Gary and Kenneth; and her sister, Lee.

— Kendra Snyder

JEAN JAKONCIC WINS ESTEEMED STUDENT LECTURER AWARD

July 22-27, 2006

National Synchrotron Light Source student researcher Jean Jakoncic won the prestigious Margaret C. Etter Student Lecturer Award for researching the use of high-energy x-rays to prevent crystal damage in diffraction studies.

Jean Jakoncic

He received the award at the American Crystallographic Association national meeting, held in Honolulu, Hawaii, on July 22-27, where he also gave a talk on the subject. The Etter award, given out just once a year, recognizes achievement and future potential for scientists at an early stage in their independent careers.

Jakoncic, a graduate student from Joseph Fourier University working toward his Ph.D. in structural biology, came to the NSLS four years ago. Conducting research primarily at NSLS beamline X6A (under the supervision of Vivian Stojanoff), in addition to X17B1 and the European Synchrotron Radiation Facility (ESRF) beamline ID15B, Jakoncic helped to show that high-energy x-rays could be an option for the structural determination of radiation-sensitive proteins. In addition to Stojanoff, he worked with NSLS scientist Zhong Zhong and ESRF scientists Marco Di Michiel and Veijo Honkimaki.

“Traditionally, people use medium- and low-energy x-rays for diffraction studies of protein samples,” Jakoncic said. “At these energies, there is a significant amount of energy deposited in the crystal and substantially there is radiation damage. We propose to use higher energies, where the energy deposition is about 10 to 15 times less than at lower-energy x-rays.”

To visualize radiation damage, the group exposed lyzozyme crystals, which are standard test protein crystals, to high-energy and low-energy x-rays and compared the results. “With the same resolution limit, we didn’t see any radiation damage at 55 keV, the high-energy data, while we observed radiation damage at 12 keV,” Jakoncic said, adding that plans for additional testing with crystals from different proteins are underway. “This is the first step,” he said.

Jakoncic describes his efforts associated with the high-energy x-ray research as a “satellite project” in relation to his other scientific interests. His core research at the NSLS focuses on enzymes involved in the degradation of toxic compounds, in particular polycyclic aromatic hydrocarbons (PAH).

— Kendra Snyder

NSLS SUMMER SUNDAY DRAWS 650 VISITORS TO FACILITY

July 30, 2006

Using gumdrops and toothpicks to illustrate molecular crystals and Marshmallow Peeps to demonstrate the power of a vacuum, about 650 community members had a sweet time at the NSLS Summer Sunday on July 30, 2006.

For eight consecutive Sundays each summer, the Brookhaven National Laboratory Summer Sunday program invites the public to see the popular Whiz-Bang Science Show and showcases a different BNL facility every week.

Visitors who came to the event began their tours in Berkner Hall, where Marc Allaire, Lisa Miller,

A steady stream of visitors filled the NSLS Lobby

Visitors gather around the liquid nitrogen display outside the NSLS

Steve Hulbert, Tony Lanzirotti, and Andrew Ackerman explained the concept of a light source and gave more detailed information about the facility and its research goals. Before boarding a bus for the quick drive to the NSLS, visitors learned more about nanoscience research at a display set up by the Center for Functional Nanomaterials, and roamed among several other hands-on exhibits.

Once at the NSLS, visitors crowded the lobby, seminar room, and front patio, where 14 hands-on displays were set up to demonstrate how the light source works and teach visitors about the science performed there. Learning about science topics ranging from diffraction to liquid nitrogen, the NSLS guests floated from display to display, asking questions and collecting some goodies along the way.

At the "Crystals: Unlocking the Secrets of Life" display, many kids, and some adults, assembled "crystals" from toothpicks and gumdrops. Another popular display was "Sounds of Silence," where guests watched how a vacuum pump caused a balloon to expand and the sound of a ringing bell to considerably fade. Display volunteers also exposed Marshmallow Peeps to the vacuum, which expanded the Peeps when turned on and shriveled them down to a smaller size when turned off. Visitors then performed a science experiment of their own by popping the de-puffed Peeps in their mouths. Their findings: The vacuum didn't make the candies any less tasty.

At "See the Light," visitors could observe actual synchrotron light, guided to the lobby from the experimental floor by a fiber-optic. And by using a Skee Ball-type backboard and rubber bouncy balls, the "Electron Catapult" display showed visitors how different amounts of energy are required to propel an electron from an atom's "ground state" level to higher levels.

Standing at the lobby and second-floor viewing windows overlooking the experimental floor were scientists Steve Bennett, John Dabrowski, Susila Ramamoorthy, Gary Weiner, and Ray Raynis. The volunteers pointed out various components of the light source to visitors, using large neon numbers as reference points.

The excitement also carried over to the outside, where every half hour visitors gathered around the building's front windows or on the patio to watch a special water rocket launch in the parking lot across the street by Matt Engel, John Kuczewski, and Steve Ehrlich.

Upon entering the building, each guest received a quiz with questions that could be answered by visiting each display. Every finished quiz was handed in and redeemed for an NSLS orange frisbee, to match the volunteers' orange shirts. In addition, one person was selected raffle-style every half hour by the enthusiastic MC Gerry Van Derlaske to receive one of two prizes – a BNL T-shirt or a tour of the experimental floor. This is the first year that floor tours were offered during the event, and visitors were excited to see the actual piping, foil and wires of the NSLS up close.

Summer Sunday visitors look at displays in the seminar room

The rest of the more than 40 NSLS volunteers that made the event possible included: Kimone Antoine, Al Borrelli, Jonathan Cheung, Mary Anne Corwin, Angelo Dragone, Steve Giordano, Sarah Heins, Madeline Hughes, Steve Hulbert, Syed Khalid, Steve Kramer, Ariane Kretlow, Tony Kuczewski, Brian Kushner, Andreana Leskovjan, Sean McCorkle, Corinne Messana, Eileen Morello, Payman Mortazavi, Shirin Mortazavi, Kathy Nasta, Kumi Pandya, Meghan Ruppel, Cecilia Sanchez Hanke, Lenny Santangelo, Yusuf Siddiqui, Randy Smith, Kendra Snyder, Marie Van Buren, Adele Wang, Matt Worth, Nancye Wright, and numerous NSLS family members.

— Kendra Snyder