BROOKHAVEN NATIONAL LABORATORY

NEWSLETTER

national synchrotron light source

December 2002

Scientists at NSLS Gain Insight into how Papillomavirus 'Unzips' its DNA

Patrice Pages, NSLS Science Writer

Infection with the human papillomavirus (HPV) is the most common sexually transmitted disease in the United States. According to the Centers for Disease Control and Prevention in Atlanta, an estimated 20 million Americans are currently infected - but the vast majority do not know it.

Though HPV sometimes causes genital warts, in most cases, it infects people without causing visible symptoms. Women with persistent infections from certain types of HPV are at risk for cervical cancer, as 99 percent of cervical cancers around the world are associated with HPV infection.

Preventing papillomavirus from multiplying is one way of stopping the infection. Toward that goal, a team of scientists from Cold Spring Harbor Laboratory (CSHL) in New York, working at the National Synchrotron Light Source (NSLS), have gained new insight into how papillomavirus - in this case, cow, or bovine papillomavirus, commonly used as a model system - starts to multiply, causing infection. This new understanding could be used to design drugs to stop HPV infection, which is of particular significance since no cure or vaccine are currently available, although vaccine development is underway.

"We know very little about how papillomavirus replicates," says biologist Leemor Joshua-Tor, the Cold Spring Harbor team leader. "So we decided to look at the molecular details of how the replication mechanism is initiated, with the aim of helping to design drugs that act like monkey wrenches in the replication process."

Like all viruses, a papillomavirus is an infectious agent that uses the cells it infects to reproduce itself. Replication of HPV does not kill the host cells, but can make them cancerous.

The infection process starts as follows: The papillomavirus first inserts its DNA - a double-stranded helix containing the virus's genetic information - into the host cell. The virus hijacks the protein production machinery of the host cell to produce a viral protein called E1. By attaching to the viral DNA, E1 proteins can initiate the DNA replication process, so that more viruses can be formed, and later multiply further.

"The DNA double helix can be replicated only if it is 'unzipped,' which allows proteins called DNA polymerases to make copies of each strand," Joshua-Tor explains. "The E1 protein is known to initiate the 'unzipping' process, but how it does it is not very well understood."

To look carefully at how E1 proteins attach to viral DNA, Joshua-Tor and her postdoctoral associate, Eric Enemark, in collaboration with Arne Stenlund, a renowned papillomavirus expert at CSHL, grew crystals of E1 and papillomavirus DNA at two different stages of the attachment process, in which either two or four E1 proteins bind to DNA.

The researchers then used a technique called x-ray crystallography to determine the positions of the atoms making up the E1 proteins and DNA. X-rays produced by the NSLS were projected toward the crystals, and the positions of the atoms were determined by looking at how the x-rays scattered off the crystal.

To their surprise, Joshua-Tor and her colleagues observed that E1 uses two

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Figure 1. Crystal structure of two E1 proteins binding to papillomavirus DNA. Each E1 protein exhibits two modules: a loop (yellow) and a helix (red), each binding to a separate DNA strand, the loop binding more tightly than the helix to the DNA strands.

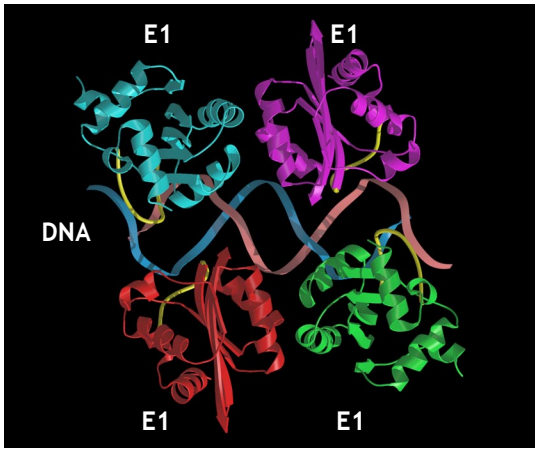


Figure 2. Crystal structure of four E1 proteins binding to papillomavirus DNA. The loops (yellow) of the two proteins on the right (purple and green) bind one DNA strand (pink), while the loops of the two proteins on the left (red and blue) bind the other DNA strand (blue).

separate modules, one shaped like a loop and the other like a helix, to bind DNA, each one binding to a different DNA strand (**Figure 1**). "This is very unusual," Joshua-Tor says. "We expected that both modules would bind the two strands simultaneously." The scientists also noticed that the loop binds more tightly than the helix, giving loops a larger role in E1-DNA binding than helices.

When two E1 proteins attach to the DNA, Joshua-Tor and her collaborators observed that the loops bind different strands (**Figure 1**). When four proteins bind to DNA, they form two pairs facing each other, with proteins in each pair binding the same DNA strand as the ones on the opposite side (**Figure 2**).

These results suggested a mechanism by which the double-stranded DNA might 'unzip' (**Figure 3**). "We already know that, ultimately, the unzipping process involves two bundles of six E1 proteins each, called hexamers, each 'unzipping' the DNA in opposite directions," Joshua-Tor says. "So, we think that the initial assembly of the two hexamers from the four proteins shown in our structure is what causes the strands to separate by forming around the single strands."

Joshua-Tor and her colleagues suggest that the four proteins separate into two pairs, each recruiting four additional E1 proteins, thus creating two hexamers that would move in opposite directions (**Figure 3**). Each hexamer would encircle either strand, and act like a little propeller that rotates around the strand, thus 'unzipping' it from its partner DNA strand along the way.

"If this is the way these proteins operate, it is pretty clever," Joshua-Tor says. "This is the first time that it has been found that the two individual DNA strands bind to two separate protein modules prior to the DNA 'unzipping' process."

While Joshua-Tor and her colleagues are still investigating the papillomavirus-induced DNA replication, they are also starting to test compounds that interfere with papillomavirus DNA replication. For example, Anitra Auster, a graduate student, is developing compounds that could interfere with the DNA replication induced by a high-risk type of human papillomavirus that can lead to cervical cancer.

"Understanding these binding mechanisms could significantly improve the treatment of this sexually transmitted disease," Joshua-Tor says. "We can now design and test drugs aiming to prevent E1 proteins from attaching to the viral DNA, which is one of the first steps to making much-needed antivirals against HPV infections and HPV-induced cervical cancer."

For more details of this work, see: E. Enemark, et al., "Crystal structures of two intermediates in the assembly of the papillomavirus replication initiation complex," *EMBO J.*, **21**, 1487-1496 (2002).

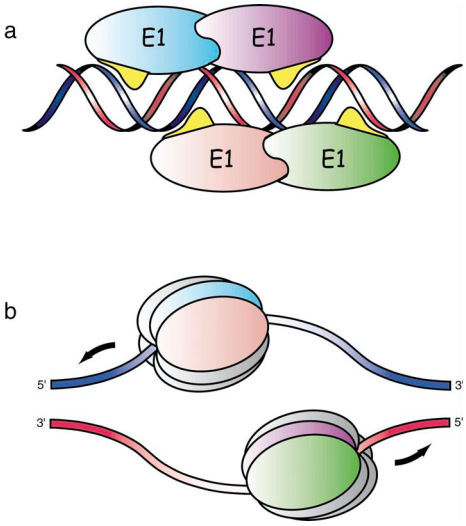


Figure 3. Schematic representation of how hexamers are formed and the DNA 'unzipping' process is initiated. (a) When four E1 proteins bind to the double stranded DNA (red and blue), they link DNA strands with a separate loop (yellow) that acts like a clip and allows E1 to hold tight onto the strand. Note that two proteins facing each other hold onto the same strands: The blue and red E1 proteins bind to the blue DNA strand, while the purple and green E1 proteins bind to the red DNA strand. (b) The E1 proteins that face each other (blue and red on one side, purple and green on the other side) attach to each other, and recruit four more E1 proteins to form a hexamer on each side of the DNA. The hexamers act like little propellers moving in opposite directions and 'unzipping' each DNA strand from its partner.

CHAIRMAN'S INTRODUCTION

Steve Dierker
NSLS Chairman

Several important events have occurred during the past several months. These events concern our safety practices and procedures, new regulations governing visits by foreign users, personnel changes in support of the accelerator systems, a new policy for user access to the NSLS, and the significant progress recently achieved by the Deep Ultraviolet Free Electron Laser (DUV-FEL).

Regarding safety, a number of serious incidents occurred over the past several months which prompted us to re-evaluate our safety practices and procedures. As part of this review, we are currently establishing much clearer guidelines for beamline personnel, including new training requirements. These revised guidelines are being reviewed by the Users' Executive Committee (UEC), and we are looking forward to their comments. We would like to implement these new guidelines and requirements at the beginning of the next calendar year.

As you are probably aware, DOE is in the process of tightening up its regulations governing foreign visits and assignments, so I call users' attention to these new requirements, which are detailed in Tom Sheridan's article in this Newsletter. I thank you for cooperating in these efforts, which will help us come into compliance with DOE directives.

We recently made some changes in duties and assignments of personnel that support the operation of the accelerator systems. Of course, it takes the dedicated effort of a very large team of people, especially from the Electrical Systems Section and Mechanical Engineering Section, to keep the accelerator systems running with the high reliability our users expect. However, in the face of this challenge, we must not lose sight of the importance of the quality of the electron and photon beams. For example, while testing the new Mini-Gap Undulator recently installed in X13B and to be installed in X29, we discovered that the emittance of the X-ray ring is about 74 nm, compared to a minimum achievable value of about 52 nm. This occurs because the magnet lattice has gotten out of tune over the years and results in about a factor of two reduction in brightness for these devices. We need to institute a program of periodic monitoring and tuning of the lattice to ensure that we are delivering the highest quality photon beams to our users.

These and other events have made it clear that we need to promote enhanced emphasis on maintaining, and especially improving, the quality of electron and photon beams. Therefore, most of the accelerator physicists responsible for the storage rings and injection system have moved from the Operations Section in the Operations and Engineering Division to two newly-created sections in the Accelerator Division: the Linac Section and the Storage Ring and Insertion Device Section. As head of the Operations Section, Richard Heese retains responsibility for operation of the storage rings and injection system and coordination of activities for their support. Steve Ehrlich (ehrlich@bnl.gov) has been and will continue to be the point of contact between the users and the facility on issues related to the photon beams. Users are invited to communicate their concerns and problems to him, and he will make sure they are passed along to the appropriate person in a timely fashion.

The development of new policies for user access to the NSLS is making good progress. Last August, the directors of the four DOE synchrotrons met with officials from DOE's Office of Basic Energy Sciences (BES). At the meeting, BES asked the four facilities to jointly draft a general user access policy statement. The facilities worked together to draft the document, which was subsequently reviewed and approved by BES. The general policy seeks to provide maximum flexibility to accommodate the widely varying needs of the users of the DOE synchrotrons. The resulting draft was discussed at the latest UEC meeting and the UEC has collected the comments of the user community and provided some suggested revisions. Although the general user access policy statement was drafted by all four facilities, its detailed implementation will vary from one facility to another. Accordingly, the NSLS is in the process of developing an implementation plan outlining how these general principles will be applied at the NSLS. We expect to propose an implementation plan for the NSLS in the very near future, and look forward to the comments of the UEC and user community.

I am very pleased that, a few weeks ago, scientists, engineers and technicians working at the DUV-FEL produced for the first time very intense deep ultraviolet light using the high gain harmonic generation (HGHG) technique, which was uniquely developed at Brookhaven by Li-Hua Yu and his collaborators. I would like to extend my congratulations to the entire team for their hard work and accomplishment.

Because of this tremendous achievement, the DUV-FEL is now becoming a unique tool for chemical science experiments. Three scientists from the chemistry department, Arthur Suits, Louis DiMauro, and Michael White have already submitted proposals to use the DUV-FEL, and, at the beginning of next year, we will hold a user workshop to further discuss the scientific opportunities enabled by the DUV-FEL's capabilities.

Users' Executive Committee Involvement in PRT Changes, an Online Proposal System, and Recent Lobbying Efforts

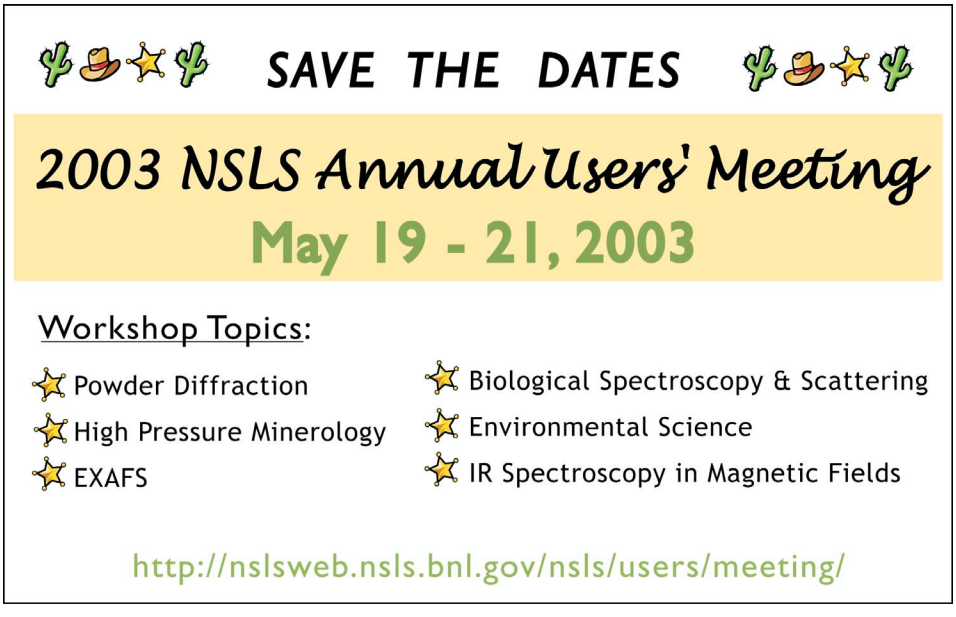
Leemor Joshua-Tor, Users' Executive Committee Chair
Cold Spring Harbor

This is both an exciting, as well as challenging, time at the NSLS. The recent announcement of the new Nanocenter, which will be built adjacent to the NSLS, will undoubtedly invigorate the science at NSLS. We are particularly optimistic about the prospects for a major NSLS upgrade in the not too distant future. In the meantime, changes are being made to improve the current NSLS efficiency, some more straightforward (e.g. the new proposal system) than others (e.g. the proposed changes to the PRT system).

The future of the PRTs at the NSLS is an important issue that has been on our minds lately. We realize that changes are going to be made and that the general philosophy will be coordinated between the four synchrotron directors and the Office of Basic Energy Sciences at the DOE. We, the user community, want to ensure that our voices are also heard! Therefore, we are working with management and others to ensure that the most important advantages of the PRT system are retained in the new mode of operation, while still leading to a more efficient and productive use of the beamlines to the benefit of the whole user community: PRTs and General Users. The UEC formed a subcommittee led by Peter Stephens (and including Mark Chance, Paul Stevens, Doon Gibbs, Dan Fischer, Jean Jordan-Sweet and Chi-Chang Kao) to monitor developments related to this issue and to formulate the main concerns the users have regarding the proposed changes. Please contact Peter (pstephens@notes.cc.sunysb.edu) or me (leemor@cshl.org) if you have any thoughts on this matter that you would like to express to the UEC. Please be assured that both NSLS management and DOE-BES management assured us that there are no plans to change healthy, well-funded beamlines, such as those supported by NIH, industry and others.

The UEC is very interested in the Proposal and Safety System (PASS), which is under development by Mary Anne Corwin in the Users Administration office to replace the current systems for general user proposals and safety review. The system may also be expanded to include scheduling time at beamlines. The lead-time between proposal and scheduling cycles could be reduced to as little as 30 days. Unused beamtime could be redeployed via a Rapid Access (RA) system and make RA a more viable option. Lead-time for this could be cut to as little as 1-7 days (notwithstanding any external requirements). The idea is that this new system would be done completely online. The UEC is working with the Users Administration office to provide feedback on this exciting new avenue.

The UEC is vigorously continuing its lobbying efforts to increase the budget of the Office of Science at the Department of Energy, which funds the operations of the four DOE-run synchrotrons, and thus increase funding for the light sources. The feedback we are getting is overwhelmingly positive, owing largely to these grassroots efforts. During our spring visit, Richard Mertens, the Chief of the Energy Branch at the Office of Management and Budget (OMB) invited us, representatives from the four synchrotrons, to return in September to update him and make our case once again before they start working (in earnest) on the 2004 budget. We prepared an updated brochure, which can be found at: *http://www.nslsuec.org/events/dc902.shtm*. Simon Bare and yours truly represented the NSLS during our visit on September 16-17. We came to realize that this would be a tough budget year, but we stressed the crucial need for an investment in the physical sciences and the importance of an efficient and productive operation of the light sources facilities for future growth of the economy. The point was made that nearly 50% of growth of the



U.S. economy in the last 50 years was due to federal investment in scientific and technological innovation and that, now more than ever, we must not let that falter. We also explained that, because of essentially flat funding for operational support for the synchrotrons for more than a decade, the DOE is not getting its full return on its investment since the synchrotrons are not utilized to their full potential.

We took this opportunity to meet with other officials, such as Kathie Olsen, the new Associate Director for Science, and Michael Holland, a senior policy analyst, at the Office of Science and Technology Policy (OSTP). We also met with professional staff members of the energy subcommittee of the House Committee on Science. We expressed our enthusiasm for the "Biggert Bill" (HR 5270) in the House, which calls for a substantial increase in funding for the Office of Science of the DOE (please see *http://www.aps.org/public_affairs/issues/hr5270.shtml* for more information). Though there appears to be sympathy for our mission, we as a user community cannot be complacent at this time. We don't want to be an easy target, nor an innocent bystander, if budget cuts are sought. That is why we ask for your help in visiting your local representative in their district office, and in letter writing campaigns. These letters do make a difference!

Simon and I also visited the offices of Senators Hillary Clinton and Charles Schumer and the office of Congressman Felix Grucci. We presented each of them with a framed photograph of the NSLS with a personalized dedication from the NSLS users thanking them for their support.

Our trip ended with a meeting with Ray Orbach, the Director of the Office of Science, and Pat Dehmer, the Associate Director of Science for Basic Energy Sciences at the DOE. We updated them on our visits and discussed other issues important to users such as the PRT/CAT issue and plans for upgrades. We also wanted to ensure that our lobbying efforts would indeed benefit our users.

Plans for the 2003 Users' Meeting are going full steam ahead. The meeting, organized by Tony Lanzirotti, will be held on May 19-21, 2003. Save the dates!! Workshops topics include: Powder Diffraction, High Pressure Mineralogy, XAFS, Biological Spectroscopy and Scattering, Environmental Science, and IR Spectroscopy in Magnetic Fields. More details can be found on the NSLS website at: *http://nslsweb.nsls.bnl.gov/nsls/users/meeting/Default.htm*.

NSLS UEC website:

http://www.nslsuec.org

for information on all ongoing Users' Executive Committee activities

Wear your Radiation Badge this way!

- When working in a Controlled Area
- Between your neck and belt
- Fully visible, not covered
- Yellow or blue color bar facing out
- Never wear anyone else's badge!

For Temporary Radiation Badge users:
If you are working at the NSLS over a badge exchange weekend, go to the NSLS User Administration Office or the NSLS Control Room to return your old badge and sign out a new one.

When your experiment is finished and before you leave, always put your radiation badge in any "Returned Badge" box located near the badge boards.

New Requirements for Foreign Visitors Approval

Tom Sheridan, Deputy Director for BNL Operations

Brookhaven's Foreign Visits and Assignments (FV&A) program has been struggling for the last couple of years to put in place a program that will work for Brookhaven and also be sufficiently compliant with the letter of the applicable DOE directives. This has taken us down several different paths: requests for deviation from the directives, pilot programs, etc. Most recently, a draft instruction on the subject came out that promised some relief from unworkable requirements. But, because the Laboratory was not in compliance with the "letter of the law," BNL received an "Unsatisfactory" rating in FV&A on its last two DOE Office of Counterintelligence inspections.

The time and patience for such trials has expired, and the Laboratory was told that it must come into compliance with the DOE directives by November 30, 2002. I have directed a rewrite of the Laboratory Special Practice Instruction (SPI) 5-09, "Visits and Assignments of Foreign Nationals," to reflect the requirements of the directives as they are now written. In addition, the following requirements are now in effect at BNL:

- All foreign nationals must have Form BNL-473 (Request for Foreign National Unclassified Visit or Assignment) approval PRIOR TO ARRIVAL AT BNL. Guests and visitors who do not have these approvals in advance of their arrival will not be allowed on Brookhaven Lab property. This includes all short-term (< 3-day visits) and long-term guests and visitors.
- All BNL-473 forms must be processed using the electronic Guest Information System (GIS), which is found online at: *https://fsd84.bis.bnl.gov/guest/guestRegist.asp*.
- Sensitive Country foreign nationals (see *https://sbms.bnl.gov/ld/ld12/ld12e061.htm* for a current list of sensitive countries) must also have an approved specific security plan before admittance to Brookhaven.
- Sponsors seeking access for guests from countries designated by the U.S. State Department as state sponsors of terrorism should contact the FV&A office at (631) 344-2355 for assistance.
- Any foreign national that goes "out of status" (visa expires, etc.) cannot be permitted onsite at BNL.
- Contractors, vendors, and open-to-the-public events (such as seminars) are currently exempt from this notice.

Unfortunately, the Laboratory could see some disruption of its programs due to these new directives. We are working on these and other items that can help us process the large number of requests, extensions, etc. that the new directives will necessitate. Everyone's cooperation and good nature will be needed to get us through this transition.

For more information on these new requirements, please refer to the NSLS homepage.

Upcoming Baseline Radiation Surveys

Bob Casey, Associate Chair for ESH&Q

The NSLS has standards for shielding secondary radiation resulting from experimental beamline operations. Over the next few months, each beamline in the X-Ray and VUV-IR Rings will be surveyed to document the baseline radiological conditions. As part of this effort, the existing radiation barriers on the various components, e.g. lead shielding and exclusion barriers, will be inspected to ensure they are still properly installed.

The radiological measurements will be conducted by the NSLS Radiological Control Division staff, Earl Edwards and Rudy Zantopp. A copy of the beamline survey results will be provided to the Local Contact at the beamline so the users and resident staff will have access to the data. Anytime radiological surveys are conducted, copies of the results will be provided to the Local Contact to maintain at the beamline.

The Facility Support Representative, Steve Musolino, is available in Room 1-177 or at (631) 344-4211 for questions or consultation on radiation protection.

NSLS Course on EXAFS Data Collection and Analysis is a Big Success

Simon Bare, UOP, LLC

Twenty-eight students participated in the NSLS EXAFS Course

The first ever NSLS hands-on EXAFS Data Collection and Analysis Course was a resounding success! Twenty-eight students participated in the course held September 23-25, 2002. The course was co-organized by Simon Bare (UOP LLC), Bruce Ravel (Naval Research Laboratory) and Syed Khalid (NSLS), with administrative support by Lisa Tranquada (SFA, Inc.), and held at the NSLS.

The three-day course was divided into two mornings of lectures, two afternoons of hands-on data collection using six different NSLS spectroscopy beamlines (X9B, X11A, X18B, X19A, X23B, and X26A), and one full day of data analysis. The instructors on the NSLS beamlines were beamline scientists Nebojsa Marinkovic, Kaumudi Pandya, Wolfgang Caliebe, Syed Khalid and Tony Lanzirotti as well as Scott Calvin from NRL.

The morning lectures were given by Matt Newville (University of Chicago), Rob Scarrow (Haverford College), Simon Bare (UOP LLC), Bruce Ravel (NRL), Shelly Kelly (Argonne National Laboratory), Anatoly Frenkel (Yeshiva University), Grant Bunker (Illinois Institute of Technology), and Trevor Tyson (New Jersey Institute of Technology) on topics ranging from sample preparation and data collection to EXAFS data analysis and interpretation of XANES spectra.

The participants attending the course were both diverse in their scientific disciplines and in their geographic location and represented universities, national laboratories and industry. They attended the lectures in the morning, then were divided up into small groups by research discipline to conduct the experimental part of the course. Each student became familiar with beamline operation and collected data on standard materials as well as on samples from their individual research projects. On the final day, the participants learned data analysis techniques in a computer laboratory established specially for the course. The participants also enjoyed ample time for informal discussion over coffee and in the evenings over meals and drinks.

There was a tremendous amount of information disseminated over the three days. All the participants left the course with new friends and armed with the basic tools to apply x-ray absorption spectroscopy to their own research.

The course was sponsored by the NSLS, with partial support by Oxford-Danfysik and Canberra.

It is hoped that the course will be offered again in 2003. For more complete information about the course go to: *http://www.x-11.bnl.gov/exafs_workshop.htm*.

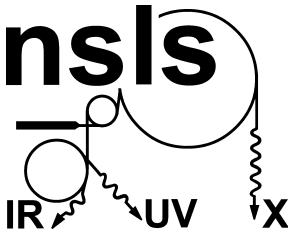
Faculty-Student Research Support Program

What is it? The Faculty Student Research Support Program is designed to encourage new faculty/student research groups to BNL's National Synchrotron Light Source. Faculty members that are new users to the NSLS and their research groups are eligible. In addition, newly appointed assistant professors (within 2 years of faculty appointment) and their students are also eligible, even if they are current or past NSLS users. The program covers expenses incurred during exploratory visits to the NSLS and while performing initial experiments. Expenses covered include travel, housing, per diem, and some incidental costs.

Who is it for? Members of U.S. academic institutions of higher education.

How do you apply? To find out more information and apply for the program online, visit:

http://nsls.bnl.gov/users/funding/fsrsp/



X-Ray Ring Long Range Schedule

X-Ray SCHEDULE – January 2003						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
			1 Holiday 00-2400 Maint.	**2** 00-2400 Maint.	**3** 00-2400 Maint.	**4** 00-2400 Maint.
5 00-2400 Maint.	**6** 00-2400 Maint.	**7** 00-2400 Equip. Commissioning	**8** 00-2400 Equip. Commissioning	**9** 00-2400 Cond.	**10** 00-2400 Cond.	**11** 00-2400 Cond.
12 00-2400 Cond.	**13** 00-2400 Cond.	**14** 00-2400 Cond.	**15** 00-2400 Cond.	**16** 00-2400 Cond.	**17** 00-2400 Cond. and/or Ops.	**18** 00-2400 Cond. and/or Ops.
19 00-2400 Cond. and/or Ops.	**20 Holiday** 00-2400 Ops	**21** 00-2400 Ops.	**22** 00-2400 Ops.	**23** 00-2400 Ops.	**24** 00-2400 Ops.	**25** 00-2400 Ops.
26 00-2400 Ops.	**27** 00-1200 Ops. 12-2400 Studies	**28** 00-0800 Studies 08-2400 Maint.	29 00-2400 Maint.	30 00-1200 Studies 12-2400 Ops.	31 00-2400 Ops.	

X-Ray SCHEDULE – February 2003						
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X-Ray SCHEDULE – March 2003						
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X-Ray SCHEDULE – April 2003						
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		1 00-1200 Ops. 12-2400 Studies	**2** 00-0600 Studies 06-1200 Intlk. 12-2400 Studies	**3** 00-1200 Studies 12-2400 Ops.	**4** 00-2400 Ops.	**5** 00-2400 Ops.
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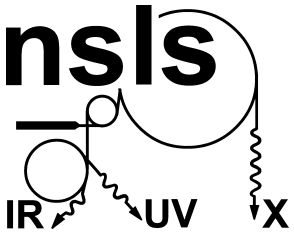


VUV Ring Long Range Schedule

VUV SCHEDULE – January 2003						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
			1 Holiday	**2** 00-2400 Cond.	**3** 00-2400 Cond.	**4** 00-2400 Cond.
5 00-2400 Cond.	**6** 00-2400 Cond.	**7** 00-2400 Cond. and/or Ops.	**8** 00-2400 Ops.	**9** 00-2400 Ops.	**10** 00-2400 Ops.	**11** 00-2400 Ops.
12 00-2400 Ops.	**13** 00-2400 Ops.	**14** 00-2400 Studies	**15** 00-2400 Studies	**16** 00-2400 Ops.	**17** 00-2400 Ops.	**18** 00-2400 Ops.
19 00-2400 Ops.	**20 Holiday** 00-2400 Ops	**21** 00-2400 Ops.	**22** 00-2400 Ops.	**23** 00-2400 Ops.	**24** 00-1800 Ops. 18-2400 Studies	**25** 00-2400 Ops.
26 00-2400 Ops.	**27** 00-2400 Ops.	**28** 00-0800 Ops. 08-2400 Studies	29 00-2400 Maint.	30 00-2400 Maint.	31 00-1800 Ops. 18-2400 Timing	

VUV SCHEDULE – February 2003						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
						1 00-2400 Ops.
2 00-2400 Ops.	**3** 00-1800 Ops. 18-2400 Timing	**4** 00-2400 Ops.	**5** 00-2400 Ops.	**6** 00-2400 Ops.	**7** 00-1800 Ops. 18-2400 Studies	**8** 00-2400 Ops.
9 00-2400 Ops.	**10** 00-2400 Ops.	**11** 00-0800 Ops. 08-2400 Studies	**12** 00-2400 Studies	**13** 00-2400 Ops.	**14** 00-2400 Ops.	**15** 00-2400 Ops.
16 00-2400 Ops.	**17 Holiday** 00-2400 Ops	**18** 00-2400 Ops.	**19** 00-2400 Ops.	**20** 00-2400 Ops.	**21** 00-1800 Ops. 18-2400 Studies	**22** 00-2400 Ops.
23 00-2400 Ops.	**24** 00-2400 Ops.	**25** 00-0800 Ops. 08-2400 Studies	26 00-2400 Maint.	27 00-2400 Maint.	28 00-1800 Ops. 18-2400 Timing	

VUV SCHEDULE – March 2003						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
						1 00-2400 Ops.
2 00-2400 Ops.	**3** 00-1800 Ops. 18-2400 Timing	**4** 00-2400 Ops.	**5** 00-2400 Ops.	**6** 00-2400 Ops.	**7** 00-1800 Ops. 18-2400 Studies	**8** 00-2400 Ops.
9 00-2400 Ops.	**10** 00-2400 Ops.	**11** 00-0800 Ops. 08-2400 Studies	**12** 00-2400 Studies	**13** 00-2400 Ops.	**14** 00-2400 Ops.	**15** 00-2400 Ops.
16 00-2400 Ops.	**17** 00-2400 Ops	**18** 00-2400 Ops.	**19** 00-2400 Ops.	**20** 00-2400 Ops.	**21** 00-1800 Ops. 18-2400 Studies	**22** 00-2400 Ops.
23 00-2400 Ops.	**24** 00-2400 Ops.	**25** 00-0800 Ops. 08-2400 Studies	26 00-2400 Maint.	27 00-2400 Maint.	28 00-1800 Ops. 18-2400 Timing	29 00-2400 Ops.
30 00-2400 Ops.	**31** 00-1800 Ops. 18-2400 Timing					

VUV SCHEDULE – April 2003						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1 00-2400 Ops.	**2** 00-2400 Ops.	**3** 00-2400 Ops.	**4** 00-1800 Ops. 18-2400 Studies	**5** 00-2400 Ops.
6 00-2400 Ops.	**7** 00-2400 Ops.	**8** 00-0800 Ops. 18-2400 Studies	**9** 00-2400 Studies	**10** 00-2400 Ops.	**11** 00-2400 Ops.	**12** 00-2400 Ops.
13 00-2400 Ops.	**14** 00-2400 Ops.	**15** 00-2400 Ops.	**16** 00-2400 Ops.	**17** 00-2400 Ops.	**18** 00-1800 Ops. 18-2400 Studies	**19** 00-2400 Ops.
20 00-2400 Ops.	**21** 00-2400 Ops	**22** 00-0800 Ops. 18-2400 Studies	**23** 00-2400 Maint.	**24** 00-2400 Maint.	**25** 00-1800 Ops. 18-2400 Timing	**26** 00-2400 Ops.
27 00-2400 Ops.	**28** 00-1800 Ops. 18-2400 Timing	**29** 00-2400 Ops.	30 00-2400 Ops.			

Nanoscale Self-Assembly of Thin-Film Molecular Materials for Electro-optic Switching

M.E. van der Boom[1], P. Zhu[2], G. Evmenenko[2], J. E. Malinsky[2], W. Lin[2], P. Dutta[2], and T. J. Marks[2]
[1]Weizmann Institute of Science in Rehovot, Israel; [2]Northwestern University in Evanston, Illinois

Scientists from Northwestern University in Evanston, Illinois and the Weizmann Institute of Science, Rehovot, Israel, have devised a two-step assembly technique to make highly ordered, intrinsically acentric organic materials which can be integrated into electro-optic (EO) and related devices, such as light modulators and switches. The scientists have shown that the self-assembled photonically/electronically functional materials are competitive in terms of EO responses with the highest efficient polar films reported to date, and are more efficient than inorganic systems, such as $LiNbO_3$.

Forming nanoscale organic films and integrating them into semiconductor electronics and all-organic microphotonic circuits has stimulated intense academic and industrial research, but progress is currently hampered by the lack of device-quality functional molecule-based thin films, driving the need for new reliable film-growth methods.

A general applicable method has been developed generating thermally robust multilayered materials. This new synthetic approach involves two alternating deposition steps, as shown in **Figure 1**. First, monolayers (one-molecule-sized layers) of chromophores are covalently

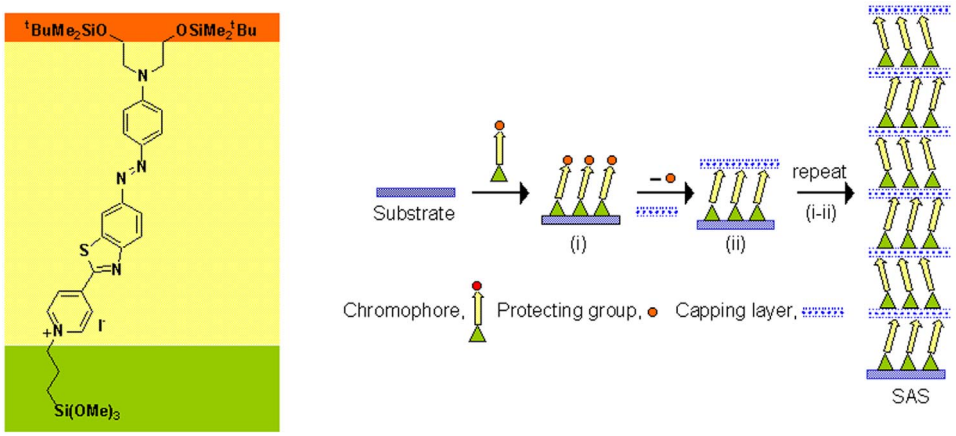


Figure 1. *Two-step, layer-by-layer self-assembly process generating intrinsically acentric superlattices (see text for details).*

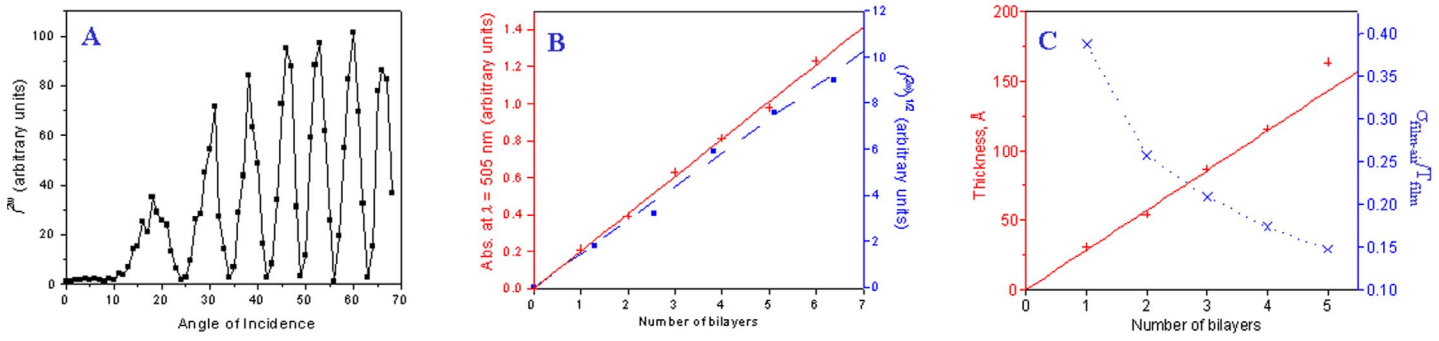


Figure 2. *(A) Second harmonic generation response at λ_o = 1.06 μm as a function of fundamental beam incident angle from a float glass slide having a polar monolayer on either side. (B) Optical transmission and second harmonic generation as a function of the number of bilayers. Left y-axis: absorption at λ_{max} = 505 nm (+). Right y-axis: square root of the SH intensity (■). (C) Specular X-ray reflectivity measurements. Left y-axis: film thickness (Å) as a function of the number of bilayers (+). The solid line is the fit by linear regression for 1-4 bilayers, indicating T = 28.6 ± 0.6 Å × n. Right y-axis: relative film roughness, $\sigma_{film\text{-}air}$/T film, as a function of the number of bilayers (×). The dotted line is drawn as a guide to the eye.*

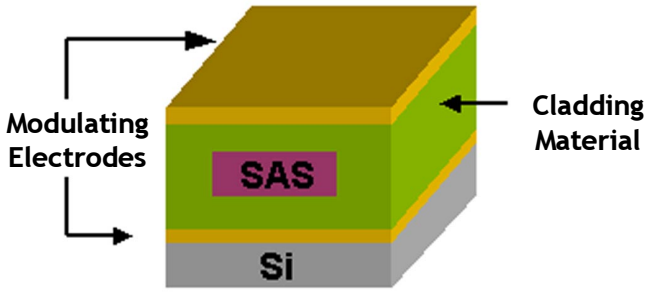


Figure 3. Schematic view of a prototype "all-organic" electro-optical modulator based on intrinsically acentric self-assembled superlattices (SAS). Commercially available polymers such as Cyclotene™ and/or Cytop™ can be used as cladding layers.

bound on hydrophilic substrates (step (i)). The siloxy removal step (ii) renders the surface hydrophilic, thus allowing the rapid build-up of a covalently-bound siloxane-based capping layer. The resulting films are intrinsically acentric, so no post-deposition steps such as high-voltage poling to align the molecular building blocks are necessary, as in other film growth techniques.

We have developed a film growth process based on chemically reliable steps, amenable to automation - by using a single reaction vessel or dip-coating - and allowing an excellent control of material properties - which is of great interest for optical telecommunications and electronic applications. The high degree of control over film dimensions, texture, and properties has been unambiguously demonstrated using various physicochemical analytical tools, including second harmonic generation measurements and synchrotron x-ray reflectivity measurements (XRR) performed at NSLS beamline X23B (**Figure 2**).

The XRR experiments afforded crystal-clear structural information on the chromophore density (~50 $Å^2$/chromophore), film thickness (~2.8 nm for each chromophore + siloxane-based capping layer), and surface morphology. The robust capping layer is ~8 Å thick. The streamlined two-step assembly process shown in **Figure 1** could be extended to a wide range of molecular building blocks, and become a major synthetic route for the formation of various functional submicrometer-sized solids with superb control of material characteristics at the nanoscale level. This assembly process is also part of an ongoing investigation aimed at creating "all-organic" electro-optical modulators (**Figure 3**).

*For more details of this work see: Van der Boom, M. E.; Zhu, P.; Evmenenko, G.; Malinsky, J. E.; Lin, W.; Dutta, P.; Marks, T. J., "Nanoscale Consecutive Self-Assembly of Thin-Film Molecular Materials for Electrooptic Switching. Chemical Streamlining and Ultrahigh Response Chromophores," Langmuir **18**, 3704 (2002).*

Weekly NSLS Activities

WEDNESDAYS

X-Ray Users' Meeting: 11:30 a.m., Conference Room A. Experimenters and staff meet weekly to decide on any proposed short-term schedule changes, to make announcements, and to discuss issues of relevance to operations. To subscribe to the email list for meeting minutes and schedules, follow the instructions at the URL below:
http://nslsweb.nsls.bnl.gov/nsls/announcements/listservers.htm#xray-minutes

Coffee for Users and Staff: 3:30 p.m., NSLS Lobby. The NSLS hosts a coffee break as an opportunity for users to meet one another and NSLS staff.

THURSDAYS

VUV Users' Meeting: 11:30am, Conference Room A. Experimenters and staff meet weekly to decide on any proposed short-term schedule changes, to make announcements, and to discuss issues of relevance to operations. To subscribe to the email list for meeting minutes and schedules, follow the instructions at the URL below:
http://nslsweb.nsls.bnl.gov/nsls/announcements/listservers.htm#vuv-minutes

FRIDAYS

Student/Postdoc Pizza Get-Together: Every other Thursday, 4:00 p.m, NSLS x-ray ring kitchen (across from vending machines). Funded by the Users' Executive Committee (UEC). Organized by NSLS Postdoc, Gregory Smith (gdsmith@bnl.gov). All local and visiting students and postdocs are invited to attend.

Friday Lunch Seminars: 12:00 to 1:00 p.m., Seminar Room. Anyone interested in learning about the exciting research being done at the NSLS is invited to the Friday lunch time seminar. Two unannounced, informal, half-hour presentations are made weekly by experimenters. Attendees can bring their own lunch or can place a sandwich order by contacting Joan Marshall at (631)344-3887 or jmarshall@bnl.gov by 10:00 a.m. on Friday. Orders must be paid upon delivery.

Journal Club: 3:00 to 4:00 p.m., Conference Room B. Students, postdocs, and staff present hot new research publications of their choice for group discussion. Everyone is invited to attend and volunteers are always welcome. For more information, contact Cecilia Sanchez-Hanke, (631)344-5699 or hanke@bnl.gov.

NSLS Accelerator Complex Update

Richard Heese, Head of NSLS Operations

During fiscal year 2002, the staff of the NSLS continued to keep the machines running with high reliability, delivering user beam for at least 96.0% of the scheduled hours for the X-ray ring and 96.6% for the VUV ring, when averaged over the whole year. For those users who can take advantage of unscheduled operations time gained from studies or faster than anticipated recovery from maintenance activities, availability is actually greater than the scheduled hours on both machines. In addition, significant enhancements in machine capability were also implemented during the year and more are planned for the upcoming shutdown to support the research of our user community.

Although the average performance is high, delivery on scheduled hours can be significantly reduced due to equipment failures in any given month. September 2002 fell into that category with reliability of 87.4% on the UV and 93.1% on X-ray. Details for each machine follow, but the common thread in both is the aging of our facility, and the manpower intensive nature of both maintaining and repairing its equipment. Keeping the current machines running at their present performance while we work toward a major facility upgrade will present a significant challenge for our reduced staff in the years ahead.

VUV-IR Operations

Overall, the VUV-IR ring has been operating very reliably. The major downtime in September was the result of an arc developing within the coaxial bias leads to the power amplifier tube for the 52 MHz RF system. The short was repaired, but after part of a weekend it failed again due to an underlying problem within the amplifier, which took some time to diagnose. The amplifier was rebuilt in place using spares from other equipment, but since we lack personnel to work around the clock on RF systems, the repair took about 48 hours to complete. It should be remembered that this system has worked without a similar problem for more than 12 years of 24/7 operation. That's an excellent record for any piece of equipment, let alone such a high power system.

The major improvement to the ring was to the digital feedback system, which reduced the 60 Hz vertical beam fluctuations by >20dB. A digital filter that enhanced the gain of the system at 60 Hz was added to the broadband system response. The ease and simplicity with which this change was implemented shows the real advantage of the digital system over the older analog system that it replaced more than a year ago. The digital system has performed so well that the old analog system was removed and the rack space made available for other diagnostic systems. The replacement of the front-end interlock system with modern PLC units is continuing. The new electronics sense the numerous inputs and perform the logic functions that insure the safe operations of the ring and the beam lines. The flexibility of this new system will allow additional inputs and logical functions that were not possible in the older hardwired system.

Preparation for the December shutdown is well underway. No vacuum break of the ring is anticipated, which means that beam should come back rather quickly in January 2003. Only four days are planned for conditioning of the ring; most of the proposed work is to improve the maintainability of the ring and its subsystems. This will allow continued reliable operation of the ring well in the future, with the level of manpower available.

X-ray Operations

The most significant change in the X-ray ring was the implementation of digital feedback in the vertical plane during operations. This system replaces both the analog global and local feedback systems. The challenge was to produce a digital global system that would stabilize the beam in the insertion device straight sections as well as the finely tuned analog local feedback systems. Some beam lines with particularly demanding requirements, such as X1, have seen a dramatic improvement in beam stability. In the past, X1 has seen beam intensity vary by as much as 25% with the booster running. As a result we had restricted the operation and testing of the booster during x-ray operations, a procedure no longer necessary. The digital feedback reduces the fluctuations to below 1%.

This improvement follows many months of work by Boris Podobedov, Emil Zitvogel, and Brian Kushner to understand the behavior of the trim power supplies as they approach their output limits, and to measure the frequency response of the various trim magnets. Implementation of digital feedback in the horizontal plane depends, at least in part, on completion of the ongoing improvement project to the horizontal trim magnets and their power supplies. This project includes the addition of cooling to the skew trim magnets, and installation of higher current power supplies with better voltage compliance.

Another stability improvement realized this year was through the upgrade of the feed-forward orbit correction around the X13 Elliptically Polarizing Wiggler (EPW). A new local control system was implemented which stores the disturbance waveforms measured at XPUE 26 and 29 (ninety degrees out-of-phase from each other) and applies properly

phased and scaled waveforms to the EPW end correctors. Many hours of studies time were spent in determining the correct scale factors as well as the optimal delay of the correction waveform. With the implementation of this system, users around the ring are unable to observe the effects of the 22 Hz switching operation of the EPW. In the upcoming year this work will be extended to allow 2 Hz operations, which is also utilized by the research program at X13.

Early in the year, a circulator was installed in the RF drive system for cavity #2. A circulator serves to isolate the transmitter cavity from the ring cavity. It eliminates the need for precision lengths of transmission line between cavity and transmitter and allows easier and more efficient tuning of the transmitter by diverting the reflected power from the ring cavity to a load. This eliminates the necessity to take into account the phase relationship between ring and transmitter cavity and increases reliability considerably. The circulator broke down after several weeks of operation due to a manufacturing flaw; the repaired unit will be reinstalled in the winter shutdown. RF system #1 received a solid-state 3 kW driver that has been operating flawlessly.

Early in September we experienced a failure of a power supply that drives a dipole magnet (BXD5) in the transfer line from the booster to the x-ray ring. The supply had been in use for over 10 years when it failed, and ultimately a special process spares supply was brought in to replace it, which was itself more than 10 years old. Because of the timing of the failure, overlapping studies/maintenance, only one day of user beam was lost. However returning to normal function of the transfer line was a process of five days from start to finish, most of which was invisible to users. The power supply group worked long and hard to adapt the spare supply to normal computer control, since these supplies are no longer made and wiring diagrams were no longer available. Most scheduled studies time and unscheduled operations were lost.

The December shutdown schedule is well established at this point, and major changes are planned. The third of our new RF cavities from ACCEL will be installed in the X-29 straight, which will make space for a new Mini-Gap Undulator (MGU). In parallel, the saw tooth for the X-29/30 front end will be modified to allow more floor space for the beam line on the experimental floor.

Injection System

The linac/booster system has been running relatively trouble-free since the installation of a high gain klystron for system #1. At the moment the spare klystron situation is precarious, but a spare klystron is in the procurement process.

The winter shutdown will allow installation of the last modified modulator, drastically lessening the chances of a fire similar to the one that occurred in January 1998.

FACILITY UPDATE

NSLS Facility Report

Gerry Van Derlaske, NSLS Building Manager

Recent organizational changes have given rise to the relocation of staff and allocation of office space in the following areas:

• The new Information and Outreach (I&O) Office, lead by Lisa Miller, is now located in room 2-102, which is diagonally across the hall from NSLS User Administration. Members of the I&O office include Patrice Pages, the NSLS science writer; Steve Giordano, the NSLS web administrator; and Nancye Wright, the NSLS publications specialist. This office manages all of the NSLS publications, the web site, and the outreach programs.

• Sam Krinsky, our Chasman-Green Distinguished Scientist, has moved to room 2-143, where he will take up residence upon his return from a long-awaited sabbatical.

• Ilan Ben Zvi, director of the Accelerator Test Facility (ATF), has transferred to Bldg. 817, which is closer to the ATF. The ATF project is now under the direction of the Physics department.

• Erik Johnson, head of the Operations and Engineering Division, is moving from room 2-203 to his new quarters in room 2-129, adjacent to Conference room A.

Engineering designs are presently out for review and bids as the NSLS second floor user office addition draws closer to construction start-up next quarter. Once contractors are on site, we expect the addition to be completed within a two-year time frame.

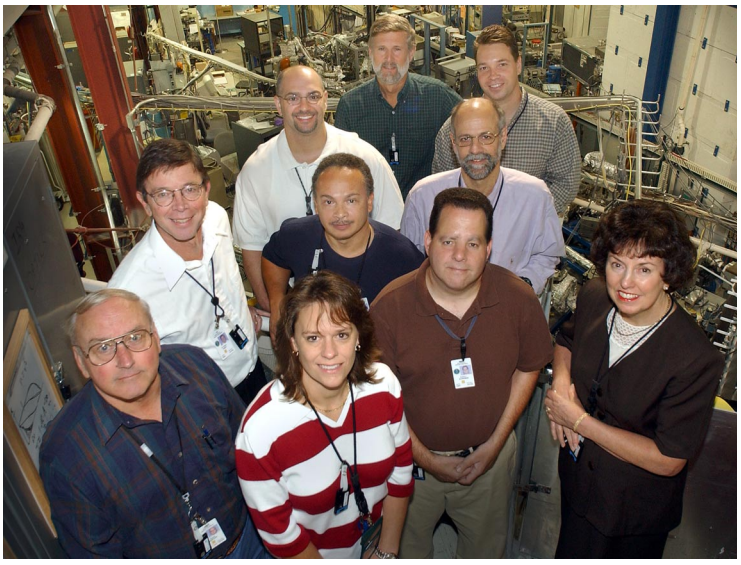
New hutch construction is fully underway in the X-17 Suite area. Two hutches are being erected to house experimental groups representing the SUNY Stony Brook High Pressure Diamond Cell Center, and the Carnegie Geophysical Lab Facility. Upon completion of the hutch installation, various technical and trades groups will provide the necessary electrical, plumbing, and other utilities required prior to operation. In addition, interlocks and personnel safety related items will be installed.

Finally, security concerns continue to affect all of us... Please do not leave any packages unattended, especially in the main lobby or at any of the entrances.

Environment, Safety, Health & Quality (ESH/Q) Division

Bob Casey, Associate Chair for ESH/Q

This small division within the department strives to work closely with all department staff and users to ensure safe and productive work within our facility. Working safely is one of the highest priorities within the Laboratory, and our mission at the NSLS is to help that be a reality. The following personnel are members of the ESH/Q Section - feel free to call any of them at any time if you have a question:



From Left: (bottom), Rudy Zantopp, Deborah Bauer, Andrew Ackerman, Charlotte Nielson, (middle) Bob Casey, Earl Edwards, Stephan Musolino, (back) John Aloi, Nick Gmür, and Mike Buckley.

Andrew Ackerman - Andrew is the NSLS Safety Officer and serves as the primary experimental safety reviewer. Just about any ESH issue at the NSLS will involve Andrew in some way.

John Aloi - John is the Deputy Safety Officer and also serves as the Electrical Safety Officer. In addition to backing Andrew up, he also has responsibility for our safety inspection programs, and our chemical and waste management programs.

Deborah Bauer - Debbie works in the BNL Environmental Services Division and works on NSLS activities about 1/3 of her time. She has the title of Environmental Compliance Representative and works with us to make sure that our activities are in full compliance with environmental regulations.

Mike Buckley - Mike serves as the department Quality Assurance Representative and also as our Conduct of Operations Coordinator. In addition, this busy man is responsible for the testing of our safety interlocks and most of our internal safety audits.

Bob Casey - Bob serves as the head of the division.

Earl Edwards - Earl is a member of the BNL Radiological Control Division and is assigned to the NSLS half-time. He is principally involved in our TLD personnel monitoring program and radiation surveys at the beam lines.

Nick Gmür - Nick wears so many hats that at times it is hard for him to keep his head up. His principal role is that of ESH Coordinator and will be involved in ESH reviews, emergency planning, NSLS safety authorization documents, and many other topics.

Stephen Musolino - Steve is the senior member of the BNL Radiological Control Division at the NSLS and provides support and oversight on all radiological issues. He spends most of his time with us, but provides similar support to the Physics and Chemistry departments as well.

Charlotte Nielson - Charlotte serves as the Quality Control Coordinator and works primarily in the NSLS drafting room. She ensures proper control of all designs and drawings and other important ESH/Q documents such as reviews and reports.

Rudy Zantopp - Rudy is a long-term veteran at the NSLS and is a member of the BNL Radiological Control Division. Rudy is involved in almost all radiological surveys at the beam lines and at other work locations in our department.

Please give any of us a call if you have a question - we want your day to be safe and effective.

Call for Science Highlights

Do you have a recent publication that you would like highlighted by the NSLS?

- on the NSLS homepage
- in the Annual Activity Report
- in the NSLS Newsletter
- in assorted brochures and posters

To apply:
Just send the publication reference and abstract to NSLSinfo@bnl.gov

NSLS Annual Awards Ceremony and Picnic

On Friday, September 21, 2002, the NSLS had its annual Awards Ceremony and Picnic. This year, the festivities were highlighted by a pig roast instead of the traditional barbeque, an excellent suggestion by Boyzie Singh. The picnic was coordinated by Laura Miller and executed by a number of NSLS staff members, including Charlie Nielson, Boyzie Singh, Bob Best, Joe Greco, Paul Humpert, Jim Lacy, Phil Marino, Jim Newburgh, and Tom Seda.

This year, Service Awards were given to 20 NSLS staff members: Charlie Nielson (35 years); John Smith (30 years); Wayne Rambo, Malry Tardd, Peter DeToll, Bob Kiss, Bob Malone (25 years); George Jahnes, Norm Cernyar, Randy Church, Li Hua Yu, Tony Kuczewski, Al Borelli (20 years); Michael Santana, Ron Beauman, Joe Greco, Andrew Mingino, Yoong Koh, Roger Hubbard, Jr., Tom Seda (10 years).

Spotlight Awards were presented to NSLS staff members for the completion of extraordinary accomplishments that were of significant benefit to the Department, Division, or Laboratory. This year's Spotlight Award winners were: (1) Bob Best, Patrick Moylan, Leonard Santangelo and Michael Schwarz for the reduction in Mini-Myte solenoid valve replacements which decreased machine and beamline downtime, (2) Michael Caruso for the timely design, assembly, and testing of a new joint system for a failed critical vacuum joint, (3) Ken Koebel for leading the NSLS Budget Group during the time period between Budget Group heads, (4) Michael Lehecka for designing and constructing a low-profile multi-axis alignment platform for magnet positioning, and (5) Corinne Messana for coordinating an important NSLS conference.

NSLS Chairman, Steve Dierker, presented the Service and Spotlight Awards at the Annual Picnic.

News and Notable

Brookhaven Lab's Raymond Davis Jr. Wins Nobel Prize in Physics

Raymond Davis Jr., a retired chemist at BNL, won the Nobel Prize in Physics this year for detecting solar neutrinos, ghostlike particles produced in the nuclear reactions that power the sun. Davis shares the prize with Masatoshi Koshiba of Japan, and Riccardo Giacconi of the U.S. For more information, see the BNL website at: *http://www.bnl.gov/bnlweb/pubaf/pr/2002/bnlpr100802.htm*

BNL Postdoc Wins Award for High-Pressure Research at NSLS

Yongjae Lee, a postdoctoral fellow in the Physics Department at BNL and frequent user of the NSLS, has won the 2002 Alvin Van Valkenburg Award for his work on a newly discovered class of materials that expand under pressure. This award is given every second year in the name of renowned physicist Alvin Van Valkenburg, co-inventor of the diamond anvil cell, to honor a young scientist who uses this device in his or her scientific research. For more details, see: *http://www.bnl.gov/bnlweb/pubaf/pr/2002/bnlpr062702.htm*

High School Student Studies Adult/Child Fingerprint Differences at NSLS

As part of the Community Summer Science Program at BNL, Lara Hershcovitch, a senior at Mount Sinai High School on Long Island, used an infrared microscope at the NSLS in an experiment to determine why adults' fingerprints can last longer than children's fingerprints. Lara's project was featured in several Long Island newspapers and will soon be submitted for publication. For more details, see: *http://www.bnl.gov/bnlweb/pubaf/pr/2002/bnlpr081402.htm*

Fun with Science on "Take our Sons to Work Day"

On October 14, over fifteen sons learned about work done at the NSLS, and even performed their own scientific experiments. The one-day visit was part of the national "Take our Sons to Work Day". For photos and details, visit: *http://nslsweb.nsls.bnl.gov/nsls/sci&tech/news/2002/sons.htm*

DOE Nanoscale Science Research Centers Workshop

On February 26-28, 2003, the first national users meeting for DOE's Nanoscale Science Research Centers will take place in Washington, DC. It will provide a forum for communication on nanoscience among agencies, policymakers, and scientific community. It will also provide a forum for discussion of user policies and research opportunities in nanoscale science. For more information, please see the workshop website at: *http://www.ornl.gov/ doe_nsrc_workshop/preliminary_program.htm*

NSLS Information and Outreach Office
Brookhaven National Laboratory
NSLS Building 725B
P.O. Box 5000
Upton, NY 11973-5000

Call for NSLS General User Proposals

For Beam Time in Cycle	Deadline
May - August 2003	Friday January 31, 2003

General User Proposal and Beam Time Request Forms including instructions can be found at:
http://nslsweb.nsls.bnl.gov/nsls/users/procedures/proposals/general_user.htm
Proprietary Proposal Forms including instructions can be found at:
http://nslsweb.nsls.bnl.gov/nsls/users/procedures/proposals/proprietary.htm

Safety Approval Forms

Safety Approval Forms (SAFs) are required for every experiment. Your SAF must be submitted online **at least one week before** your scheduled beam time. To submit, go to:

http://130.199.76.84/safety/default.asp

NSLS User Administration Office

General Information, User Registration, Training:
Phone: (631) 344-7976 Fax: (631) 344-7206

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For additional information about the NSLS (including this Newsletter in electronic format) see the NSLS Home Page on the World Wide Web at:

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