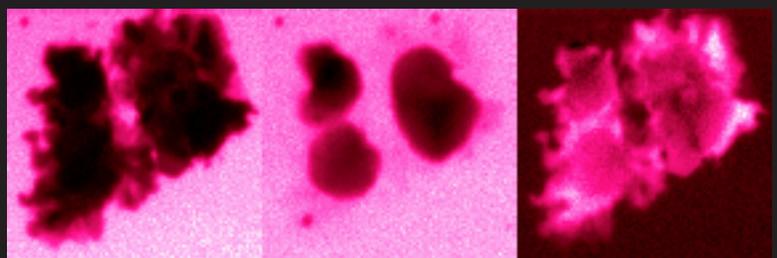
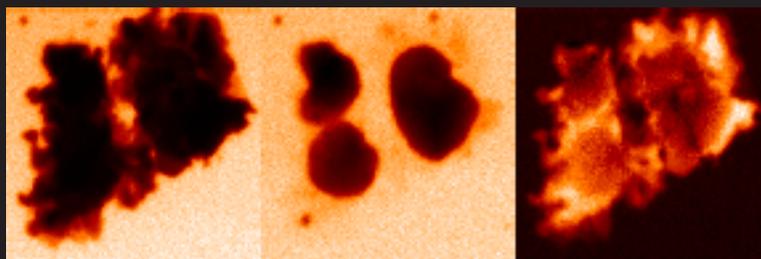
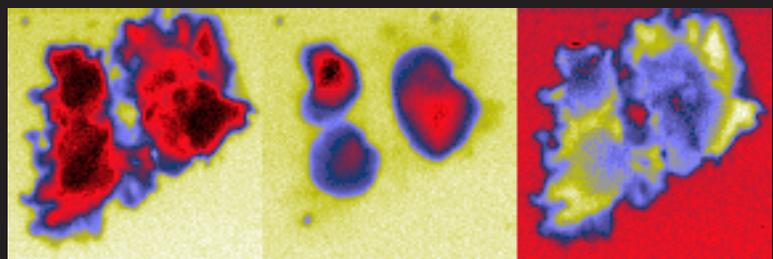
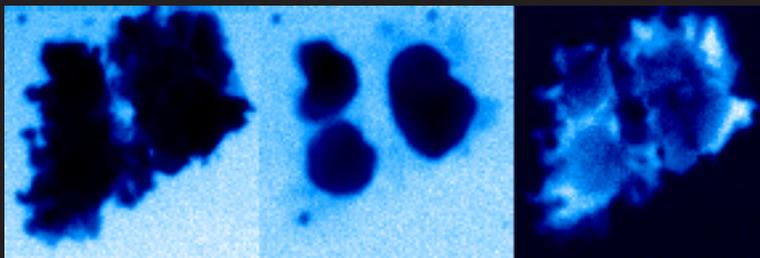
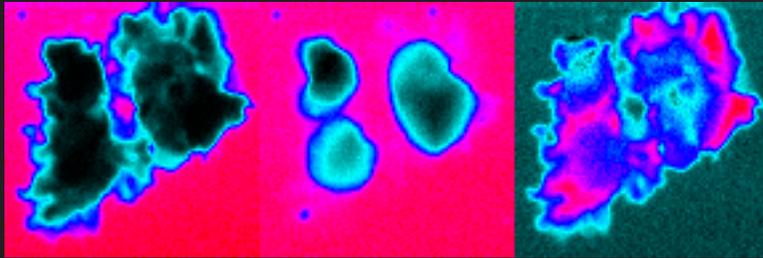


# BNL

## NATIONAL SYNCHROTRON LIGHT SOURCE ACTIVITY REPORT 1998



*Cover Figure: In our everyday life we encounter oil-water emulsions in many different forms, both in nature (e.g. milk) as well as in industrial products like cosmetics and pharmaceuticals. In order to be stable, oil-water emulsions require some kind of emulsifying agent which prevents the oil phase droplets from coalescing and eventually forming separate oil and water phases. While the liquid fats in milk are stabilized naturally by proteins and protein-like compounds, industrial emulsions usually require high amounts of additives called surface active agents. These surfactants can be hazardous to humans and the environment and it is desirable to substitute them with harmless substances. One approach is to use colloids as emulsifying agents. The front cover shows an image of an oil-water emulsion containing 1% v/v paraffin oil in water with 0.1 % w/w colloidal Ca/Al layered double hydroxide (LDH) as emulsifying agent, taken with the Stony Brook X1A scanning transmission x-ray microscope. Imaging near the calcium-L-absorption edge allows us to map the calcium containing LDH with a spatial resolution of around 70 nm and therefore distinguish LDH from oil and water. When tuning the photon energy to high absorption for calcium (left image), the LDH can be highlighted. For pre-edge energies, the LDH becomes transparent because its absorption coefficient is almost equal to that of water and the oil droplets inside the LDH envelope can be revealed (center image). The right image shows a quantitative calcium map in a range between 0 and 2 micrograms per square centimeter, calculated from the other two images. Studying these emulsions in their natural hydrated state at atmospheric pressure with high spatial resolution is important to better understand the stabilization mechanism and its dependencies and compare it to existing models from colloid chemistry. To our knowledge, the information obtained is currently not accessible by any other techniques.*

*U. Neuhaeusler (SUNY Stony Brook, U. Goettingen), S. Abend (U. Kiel), C. Jacobsen (SUNY Stony Brook), G. Lagaly (U. Kiel)*

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# NATIONAL SYNCHROTRON LIGHT SOURCE

# ACTIVITYREPORT

For the period October 1, 1997 through September 30, 1998

## May 1999

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*E.Z. Rothman*

Science Editor

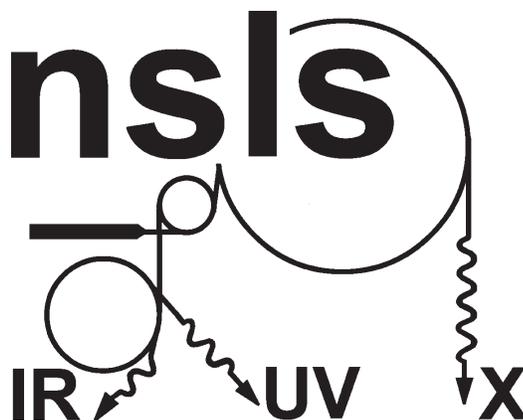
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# NSLS

## INTRODUCTION

**Michael Hart**  
NSLS Chairman

In FY 1998, following the 50<sup>th</sup> Anniversary Year of Brookhaven National Laboratory, Brookhaven Science Associates became the new Managers of BNL. The new start is an appropriate time to take stock of past achievements and to renew or confirm future goals.

During the 1998 NSLS Annual Users' Meeting (described in Part 3 of this Activity Report), the DOE Laboratory Operations Board, Chaired by the Under Secretary for Energy, Ernest Moniz met at BNL. By chance all the NSLS Chairmen except Martin Blume



The NSLS Annual Users' Meeting and the Laboratory Operations Board meeting held at BNL the same week made possible this unusual gathering of current and former administrators of BNL's National Synchrotron Light Source (NSLS). (from left) **Michael Knotek**, NSLS Chair 1985-1989, and now program advisor for Science & Technology in the Office of the Under Secretary of Energy; current NSLS Chair **Michael Hart**, who has held the post since 1995; current Deputy NSLS Chair **Samuel Krinsky**, who served as Acting Chair from 1989-1990; **Denis McWhan**, NSLS Chair 1990-1995, and now BNL's Associate Director for Basic Energy Sciences; **Arie Van Steenbergen**, who headed the NSLS Construction Project 1977-1982, and who is now actively retired from BNL; and **John McTague**, NSLS Chair 1982-1984, and now Vice President, Technical Affairs, Ford Motor Company. Not shown is **Martin Blume**, who was Acting NSLS Chair 1984-1985 and is now Editor-in-Chief of the American Physical Society.

(acting NSLS Chair 84 – 85) were present as recorded in the picture. Under their leadership the NSLS has improved dramatically:

- The VUV Ring current has increased from 100 mA in October 1982 to nearly 1 A today. For the following few years 10 Ahrs of current were delivered most weeks - NSLS now exceeds that every day.

- When the first experiments were performed on the X-ray ring during FY1985 the electron energy was 2 GeV and the current up to 100 mA – the X-Ray Ring now runs routinely at 2.5 GeV and at 2.8 GeV with up to 350 mA of current, with a very much longer beam half-life and improved reliability.

- Starting in FY 1984 the proposal for the Phase II upgrade, mainly for a building extension and a suite of insertion devices and their associated beamlines, was pursued – the promises were delivered in full so that for some years now the NSLS has been running with two undulators in the VUV Ring and three wigglers and an undulator in the X-Ray Ring. In addition two novel insertion devices have been commissioned in the X13 straight.

- At the start of FY 1998 the NSLS welcomed its 7000<sup>th</sup> user – attracted by the opportunity for pursuing research with high quality beams, guaranteed not to be interrupted by “delivery failures”, and welcomed by an efficient and caring user office and first class teams of PRT and NSLS staff.

R & D have lead to the possibility of running the X-Ray Ring at the higher energy of 2.8 GeV. **Figure 1** shows the first user beam, which was provided thereafter for half of the running time in FY 1998. In combination with the development of narrow gap undulators this mode opens the possibility of new undulators which could produce hard X-rays in the fundamental, perhaps up to 10 keV.

On 27 September 1998, a low horizontal emittance lattice became operational at 2.584 GeV. This results in approximately a 50% decrease in the horizontal beam-size on dipole bending magnet beamlines, and somewhat less of a decrease on the insertion device lines. The beam lifetime is not degraded by the low emittance lattice. This represents an important achievement, enhancing for all users the x-ray ring brightness. The reduced horizontal emittance electron beam will produce brighter x-ray beams for all the beamlines, both bending magnets and insertion devices, adding to other recent increases in the X-Ray ring brightness. During FY 1999 users will gain

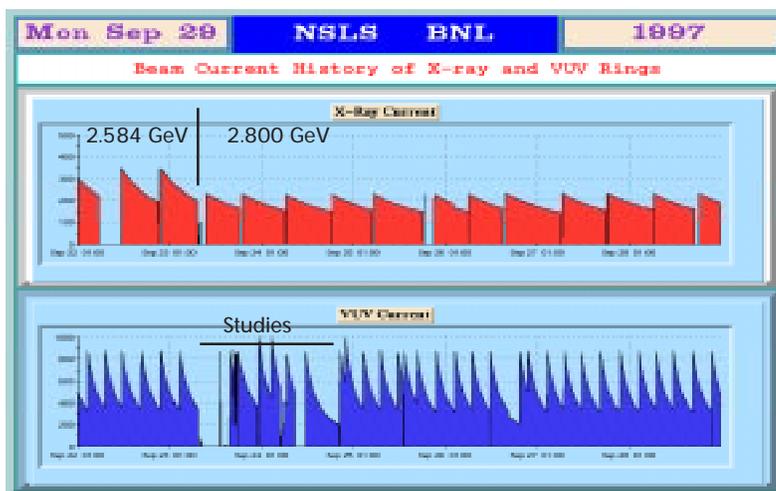


Figure 1: The first week of user beam time at 2.800 GeV.

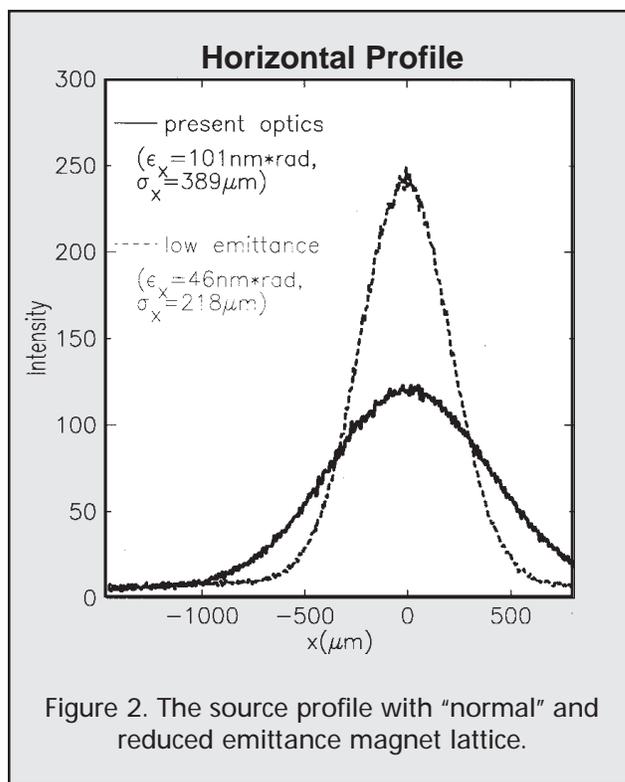


Figure 2. The source profile with “normal” and reduced emittance magnet lattice.

experience of the new running mode and plans are in place to do the same at 2.8 GeV during further studies sessions. Independent evidence of the reduced emittance is shown in **Figure 2**. This is a pinhole camera scan showing the X-ray beam profile, obtained on the diagnostic beamline X28.

Finally, work has begun to update and refine the proposal of the Phase III upgrade endorsed by the Birgeneau panel and BESAC last year. With the whole NSLS facility in teenage years and with many demonstrated enhancements available, the time has come to herald in the next stage of life at the Light Source. ■

# NSLS

## USERS' EXECUTIVE COMMITTEE

John B. Parise  
SUNY @ Stony Brook  
UEC Chair

The UEC represents the interests of the users to NSLS and BNL Administrations as well as to the community outside BNL. Those interests include continued access to reliable X-ray and UV beams and to a working environment supportive of their research. Almost 2400 users carried out experiments at the NSLS during 1998. "Users" are defined as researchers who actually showed up at the User Administration Office and were given access to the experimental floor to perform experiments on a beamline. With over 97% reliability on both X-ray and UV storage rings, most users are satisfied that the NSLS can provide what they need to fulfil their research obligations. More and more of these users however, are regarding the NSLS as an extension of their home laboratory and this raises issues of access to resources and infrastructure. In order to transmit those interests as "cleanly" as possible, the UEC has studiously cultivated its independence from the NSLS Administration, while closely coordinating efforts with it to improve services for the user. The UEC provides independent advice with minimal influence from the Laboratory or Light Source.

There are several avenues for users to express opinions and suggestions, on subjects as varied as the availability of consumables for experiments to the impact of changing the characteristics of the storage rings. Examples include prompting the NSLS to send out regular news announcements to keep the user community informed about the general goings on. A problem of security for privately ordered specialty gas bottles was brought to the attention of the UEC and a commitment to provide a locked and controlled space under management of the operations coordinator was made by the NSLS. Several Special Interest Groups (SpIGs) serve specific experiments or techniques and information on these can be found at the following web address - <http://www.nsls.bnl.gov/UserGrp/spiginfo.html>. The SpIG-representatives, as members of the UEC, can transmit a user's concerns. These representatives were elected in an electronic ballot for the first time in 1999 thanks to the efforts of Malcolm Capel (BNL - Biology) and Carl Zimba (NIST). Quarterly town meetings are held in the NSLS

seminar room and this provides another opportunity for users to voice users' concerns. While most of the attendees at these meetings are frequent users, local beamline contacts and NSLS staff, I urge everyone who can make these meetings to do so or to email concerns to any UEC member or SpIG representative. Again, details are posted on the NSLS web site. With the NSLS and BNL staff in attendance, there are opportunities for immediate discussion and feedback. The UEC then meets with NSLS and BNL staff and management to discuss relevant issues after the Town Meeting.

The main topics at recent UEC meetings have been the fate of the weekend food service and participation in a Community Advisory Committee (CAC) formed to advise the laboratory on its operations and their potential impact on the broader Long Island community. The users attending the town meetings were able to assure BNL Management of their strong desire to have access to food on the BNL campus during weekends, and as a result of this input Management established expanded food service hours on both Saturdays and Sundays at the Center. As for maintaining a reasoned voice in the CAC, the UEC is grateful to Jean Jordan-Sweet (IBM) for advancing our interests from the early planning stages of the advisory group. Peter Stephens (SUNY @ Stony Brook, past UEC-chair) has recently joined her as an alternate UEC-representative. The relationship between BNL and the community is a delicate one. It is one with the potential to help or harm the interests of NSLS users. We all hope the independent voice of the UEC will be heeded in this forum.

Many users operate research programs at more than one light source, and the four DOE-funded synchrotrons (NSLS, APS, SSRL and ALS) have similar interests in terms of maintaining viable and expanding research programs. In recognition of their common interests in synchrotron radiation research, the chairs of the User groups at NSLS, APS and SSRL co-signed a letter urging the implementation of a BESAC-report recommendation for increased funding for synchrotron research. The letter read, in part: "Our communities are growing rapidly, and demand for beam time continues to increase at each

facility. . .we'd like to offer the assistance of our community by providing full support of DOE efforts to acquire the necessary additional funds to fully implement the Birgeneau-Shen recommendations and continue support for other important areas in the ER program." In addition to such joint letters, further user group coordination on issues such as funding and joint meetings of the light source chairs are in the best interests of the whole synchrotron community.

The Annual Users' Meeting, funded largely out of registration and vendor fees, is the most visible function organized by the UEC. Along with celebrating scientific accomplishments, the meeting serves to bring changes and proposed changes, which have the potential to alter the physical and intellectual environment in which the users operate, to their attention. This meeting is an opportunity for the UEC to devise workshops, invite overview talks from leaders in the arenas of science and science administration, and to set a tone for the year to come by electing representatives to join the UEC. The 1998 meeting was a great success thanks mainly to the efforts of workshop organizers, and particularly John Hill who attracted one of the best slate of speakers on record for the one-day Users' meeting. Excellent presentations emphasized science, the future of the NSLS, and DOE funding initiatives. The need to improve infrastructure and user support were common themes of the talks by

John Marburger, Director of the BNL, Michael Hart, Chairman of the NSLS, Robert Marianelli, Director of the Division of Chemical Sciences for the Office of Basic Energy Sciences (BES) and Dr. Ernest J. Moniz, Under Secretary of Energy at the US Department of Energy. A complete report appears in Section 3 of this Activity Report. Apart from the annual meeting, the UEC from time to time uses its funds to further the science agenda and advertise the capabilities of the Light Source. To this end the UEC was among the sponsors of the Montauk conference on Inelastic X-ray Scattering in November 1998 and helped with other activities which raised the profile of the NSLS at other conferences.

I am grateful to all the members of the UEC (see photograph with this article), to the User Administration Office and to the staff of the NSLS for all their efforts over the past year. Some, such as the restoration of power during the unscheduled shutdown in December 1997, were Herculean efforts. More typically they involve the steady production of high quality beams. They also include patient implementation of DOE directives, and mollifying users who run afoul of these, the planning of meetings, the compilation of this Activity Report, and many other efforts impacting every user. Whether they are aware of them or not, the user community depends on these efforts to produce the science presented in this annual report. I am grateful to you all. ■



Users' Executive Committee and  
Special Interest Group Representatives

Seated: Malcolm Capel (BNL-Biology), Lisa Kelly (U. of Maryland); Michael Dudley (SUNY @ Stony Brook); John Parise (SUNY @ Stony Brook); Jean Jordan-Sweet (IBM); Luz Martinez-Miranda (U. of Maryland); Carol Hirschmugl (U. of Wisconsin); Mark Chance (Albert Einstein College of Medicine).

Standing: Eva Rothman (NSLS); George Cody (Carnegie Inst. of Wash.); Joel Brock (Cornell U.); Steve Whisnant (U. of S. Carolina); Paul Stevens (Exxon); Gwyn Williams (NSLS); Larry Carr (NSLS); Barbara Illman (U. of Wisconsin/USDA Forest Products Lab).

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