BROOKHAVEN NATIONAL LABORATORY

# Laboratory Link

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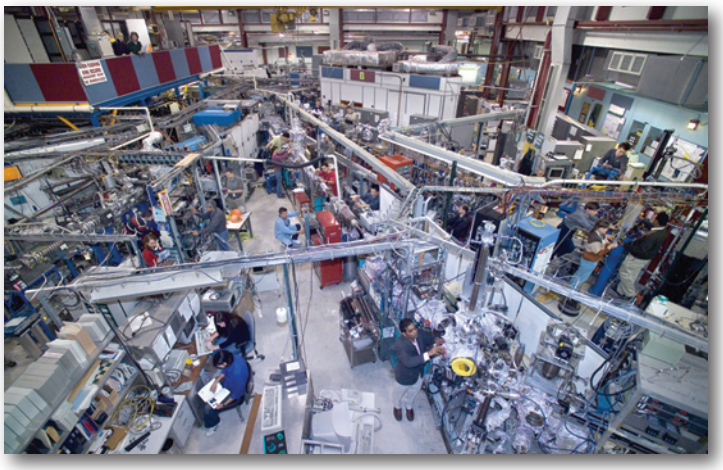
*A Visitors' Guide to Summer Sundays 2006*

## National Synchrotron Light Source: L.I.'s Brightest Light

***See for yourself why 2,200-plus researchers each year use NSLS's super intense light***

- On Sunday, July 30th, you are invited to see how intense infrared, ultraviolet and x-ray light is used to look into everything — at the National Synchrotron Light Source (NSLS) at Brookhaven Lab.
- Just as a flashlight illuminates small details that cannot be seen without its light, the NSLS shines its extremely bright and focused light for scientists' use in illuminating the structure and function of materials, specimens and surfaces at the atomic level.
- Funded by the Office of Science of the U.S. Department of Energy, the NSLS is one of the busiest scientific research facilities in the world.
- More than 2,200 guest scientists from nearly 400 universities, laboratories and corporations do their research at the NSLS at Brookhaven Lab each year.
- For example, a winner of the 2003 Nobel Prize in Chemistry did much of his Prize-winning work at the NSLS.
- At the hub of the NSLS are two electron storage rings which provide the "synchrotron" light used to illuminate the inner workings of the physical and biomedical worlds.
- Light from these rings is sent down the more than 60 beam lines, which radiate from the NSLS's two synchrotrons as do spokes from a wheel's hub. (For a better description of a synchrotron light source, see story at left.)
- At the end of the beam lines, light shines on experiments to: picture viruses responsible for the common cold and other ills infecting cells, explore techniques for making faster computer chips, develop a method that is better than mammography in detecting breast cancer, assist in crime-scene and other forensic investigations—and more (see story on back).



Beam lines and experiments at one of the two synchrotron storage rings at the National Synchrotron Light Source.

*Scientific Terms Used at BNL Explained*

### What Is a 'Synchrotron Light Source'?

- A "synchrotron" is a type of circular particle accelerator. When particles are accelerated in this type of machine, the particles' velocity is increased to near the speed of light and, as they go around, their direction keeps changing.
- In a "synchrotron light source," the particles being accelerated are electrons. During acceleration, beams of electrons are bent around the circular accelerator and focused into a beam by electromagnets. Electron beams are accelerated until they reach a certain energy. They are then stored, or kept circulating within the synchrotron "storage ring" for hours.
- Electrons have a negative charge. When any charged particle such as an electron is accelerated, it releases light. In a synchrotron light source, this light goes off at a tangent to the circle in which the electrons are traveling.
- While the electrons are stored within the synchrotron, light is let out of the accelerator through "beam lines." *(continued on back)*

*Sundays Through August 20*

## Summer Sundays: August Line-Up

If you've experienced a Summer Sunday in July, then come back in August. If you haven't been here yet this summer, this is what you've been waiting for:

***Sunday, August 6***

**Future Facilities, a Site to See**

- See research facilities of the future in the planning and under construction! Climb aboard 'dozers, graders and other heavy equipment. Explore fire/rescue equipment!
- Learn about safety! And let a science magician entertain you!

***Sunday, August 13***

**Energy Use, Environmental Impact**

- Find out what scientists studying global climate change have discovered so far!
- Understand the environmental impact of energy use. See a bio-diesel burner at work!

***Sunday, August 20***

**RHIC, the Relativistic Raceway**

- Discover RHIC—the Relativistic Heavy Ion Collider—which is one of the world's largest particle colliders!
- Discover the new state of matter just uncovered at RHIC—a perfect liquid—and find out what it says about the early universe!

No reservations required! Stop by 10 a.m. to 3 p.m. BNL is off LIE exit 68, north 1.5 miles on Route 46, the William Floyd Parkway. Ages 16 and over, bring photo ID. More info: www.bnl.gov or (631) 344-BNL1.

*Meet the BNL Scientist Doing the Research*

# Biophysicist Lisa Miller Uses NSLS Light Beams To Study Alzheimer's Disease and Osteoporosis

- Within the NSLS's big, white futuristic facility and among all the metal tubes, aluminum foil and racks of computers and other equipment on its experimental floor, one NSLS staffer whom you'll most likely meet during the Light Source's Summer Sunday is biophysicist Lisa Miller.
- Not only is she the coordinator of NSLS information and outreach who organized your day at the Light Source, but she is also in charge of one of the NSLS's beam lines, where she performs research on Alzheimer's disease and osteoporosis.
- In the role of spokesperson, Dr. Miller oversees the schedule, experiments and scientists who use beam line U10B, which is one of the 16 experimental stations that is tangentially attached to the smaller of the NSLS's two synchrotron storage rings.
- At beam line U10B, Dr. Miller uses infrared light to image the chemical make-up of diseased organ tissue.
- One of her two primary research interests is to understand the chemical composition of bone tissue affected by osteoporosis and osteoarthritis.
- This interests her because, "osteoarthristis is prevalent in my family," says Dr. Miller, whose goal is to understand the cause of the disease so that treatments can be developed.
- Her other main scientific focus is to explore the correlation between the accumulation of metal ions within brain tissue and the occurrence of "protein-folding" diseases such as Alzheimer's disease and scrapie, which is the form of mad-cow disease found in sheep.

Lisa Miller, Ph.D., at NSLS beam line U10B

## *'Synchrotron Light Source' Explained*

*(continued from front)*

- Light is one form of electromagnetic radiation. Light emitted by electrons in a synchrotron light source is therefore called "synchrotron radiation." This light is very special because it is so very intense. The brighter light is, the more detail you can see with it.
- The light produced by a synchrotron can range in wavelength from x-rays to ultraviolet to visible to infrared. This "broadband" nature of synchrotron light, coupled with its intensity, makes it very suitable for studying a wide range of scientific problems.
- When the synchrotron light source at Brookhaven Lab was built in the 1980s, it was named the "National Synchrotron Light Source" (NSLS) because this research facility was designed so that researchers from across the country could come here for a day, a week, a month or longer to use its very intense light to study everything — from the AIDs virus to zeolites (you'll have to look up that word yourself!).
- Now that the NSLS is 20-plus years old, Brookhaven Lab is proposing to build NSLS-II — an even bigger and brighter light source to be used to meet the scientific challenges of tomorrow in the fields of structural biology and biomedical imaging, nanoscience and materials science, and energy and environmental science.