NSLS Summer Sunday, August 12, 2001

John Galvin

This Sunday, August 12, Summer Sunday visitors to BNL can take a tour of the National Synchrotron Light Source, where more than 2,200 visiting scientists from 350 institutions worldwide come annually to perform experiments. Visitors will see how infrared, ultraviolet, and x-ray synchrotron light produced in the NSLS is used for scientific research by visitors and BNL staff in biology, chemistry, medicine, physics, and many other fields, including criminal investigations.

In addition, visitors may take guided bus tours of the Lab site that will run continuously throughout the day; participate in the Whiz Bang Science Show, presented four times between 10 a.m. and 3 p.m. in Berkner Hall; and view the Camp Upton Historical Collection, which displays the history of the BNL site during its pre-Lab days as a U.S. Army camp in World Wars I and II.

Organized by BNL's Museum Programs of the Community Relations Office, BNL's Summer Sunday tours begin at 10 a.m. and visitors must arrive before 3 p.m. The tours are free, open to the public, and no reservations are needed.

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Physicists Detect Clue to Material's Unusual Electrical Properties

Karen McNulty Walsh

BNL physicists are studying a mysterious material that may lead to significant advances in the miniaturization of electronics. In the July 27, 2001, issue of *Science* magazine, they offer the first clues explaining the material's newly discovered, unusual electrical properties.

This understanding may result in applications using the material to store electrical charge in high-performance capacitors, and offer insight into how charges behave on the nanoscale—on the order of billionths of a meter.

The material is unusual in that it has an extremely high dielectric constant, a property that determines its ability to become electrically polarized — i.e., separate positive and negative electrical charges. The higher the dielectric constant, the more charge that can be stored, and the smaller the electronic circuits can be made.

In addition, unlike most dielectric materials, this one retains its enormously high dielectric constant over a wide range of temperatures — from 100 to 600 Kelvins (K), or -173 to 327°C — making it ideal for a wide range of applications.

Yet the material's dielectric constant drops precipitously — 1,000-fold — below 100K, with no evidence of structural or phase changes in the atoms.

Therein lies the mystery.

"Such a large change in the electronic properties has implications for the way that charge is distributed within the material," said Christopher Homes, Physics Department. "It's difficult to imagine how those electronic properties can undergo such a large change while the atomic structure remains unaffected."

Previously, scientists at BNL and elsewhere, including Tom Vogt, Stephen Shapiro, and Young-June Kim