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World's Most Precise 'Hard X-Ray' Nanoprobe Activated

May 19, 2005, *PhysOrg* — Marking a major step forward in using X-rays to study some of the smallest phenomena in nature, the world's first "hard X-ray" nanoprobe beamline was activated on March 15, 2005. The unique nanoprobe is one of the featured instruments at the new Center for Nanoscale Materials (CNM), a U.S. Department of Energy (DOE) user facility at Argonne National Laboratory. CNM researchers expect to soon be using the X-ray nanoprobe to study individual atoms, molecules, and the unique physical interactions that occur at the nanoscale, where features are measured in nanometers. **Read more**.

Nanotube Water Doesn't Freeze - Even at Hundreds of Degrees Below Zero

May 17, 2005, *PhysOrg* — A new form of water has been discovered by physicists in Argonne's Intense Pulsed Neutron Source (IPNS) Division. Called nanotube water, these molecules contain two hydrogen atoms and one oxygen atom but do not turn into ice - even at temperatures near absolute zero. Instead, inside a single wall tube of carbon atoms less than 2 nanometers the water forms an icy, inner wall of water molecules with a chain of liquid-like water molecules flowing through the center. This occurs at 8 Kelvins, which is minus 509 Fahrenheit. As the temperature rises closer to room temperature, the nanotube water gradually becomes liquid. **Read more**.

Nanobubbles Cause Metal Fatigue

May 16, 2005, *Nature Publishing Group* — Metals with nanoscale grain sizes can be stronger than ordinary metals, but they may also be highly susceptible to fatigue: the gradual growth of cracks under repeated cycles of stress and release. Computer simulations of the atomic-scale processes involved in the cracking of a nanocrystalline metal have now helped to clarify the reasons for this Achilles' heel. **Read more**.

Chemists Adapt Casting Technique to Make Ordered Nanocarbons

May 11, 2005, *PhysOrg/Carnegie Mellon University* — Carnegie Mellon University scientists have harnessed an experimental technology to produce polymer films with long-range-ordered nanostructure and easily

convert them into highly ordered "nanocarbon arrays." Called zone casting, this technology could revolutionize the way industrial nanoelectronic components are made. **Read more**.

New Research Raises Questions About Buckyballs and the Environment

May 9, 2005, *Eurekalert* — In a challenge to conventional wisdom, scientists have found that buckyballs dissolve in water and could have a negative impact on soil bacteria. The findings raise new questions about how the nanoparticles might behave in the environment and how they should be regulated. **Read more**.

A Super Job of Spin Control

May 6, 2005, *National Science Foundation* — As the ever-increasing power of computer chips brings us closer and closer to the limits of silicon technology, many researchers are betting that the future will belong to "spintronics": a nanoscale technology in which information is carried not by the electron's charge, as it is in conventional microchips, but by the electron's intrinsic spin. If a reliable way can be found to control and manipulate the spins, these researchers argue, spintronic devices could offer higher data processing speeds, lower electric consumption, and many other advantages over conventional chips--including, perhaps, the ability to carry out radically new quantum computations. Now, University of Notre Dame physicist Boldizsar Janko and his colleagues believe they have found such a control technique. **Read more**.

Fountain Pen Writes on Nanoscale

May 6, 2005, *Northwestern University* — The first practical fountain pen was invented in 1884 by Lewis Waterman. Although pens with self-contained ink reservoirs had existed for more than a hundred years before his invention, they suffered from ink leaks and other troubles. Waterman solved these problems by inventing the capillary feed which produced even ink flow. Now fountain pen history is repeating itself in the tiny world of nanoscale writing. Researchers at Northwestern University have demonstrated writing at the sub-100 nanometer molecular scale in fountain-pen fashion. They developed a novel atomic force microscope (AFM) probe chip with an integrated microfluidic system for capillary feeding of molecular ink. **Read more**.

Scientists Create High-speed Integrated Nanowire Circuits

Apr. 27, 2005, *PhysOrg/Howard University* — The researchers, led by chemist Charles M. Lieber and engineer Donhee Ham, produced circuits at low temperature by running a nanowire-laced solution over a glass substrate, followed by regular photolithography to etch the pattern of a circuit. Their merging of low-temperature fabrication and nanowires in a high-performance electronic device is described this week in the journal

Nature. **Read more**.

'Magnetic' Bacteria Help Align Nanotubes

Apr. 27, 2005, *Nanotechweb* — Researchers at Pennsylvania State University have used magnetic nanoparticles from the bacterium Magnetospirillium magnetotacticum (MS-1) to grow laterally aligned multiwalled carbon nanotubes. The technique could ultimately help with the integration of nanotubes into nanoelectronic devices. **Read more**.

Sapphire Stars in Nanotube Support Role

Apr. 26, 2005, PhysOrg/University of Southern California — As a substrate for the creation of single wall nanotube (SWNT) devices, sapphire has a critical advantage, says Chongwu Zhou of the USC Viterbi School of Engineering's department of electrical engineering. Single walled carbon nanotubes will grow along certain crystalline orientations on sapphire. No template has to be provided to guide this structuring: it takes place automatically. Or more accurately, it sometimes happens automatically. With an elegant experiment, Zhou has resolved how and why this occurs. The process is potentially predictable and controllable, opening the door for systematic exploration of sapphire as a SWNT (single walll nanotube) transistor medium. **Read more**.

Nanotube Chemical Sensor Gains Speed

Apr. 20, 2005, *TRN* — Sensors that contain active elements that are around the same size as the molecules to be detected are potentially portable, low-power and quick. Such sensors could be deployed as networks of security and environmental monitoring devices. Researchers from the Naval Research Laboratory have made single-walled carbon nanotube chemical sensors that transmit information by measuring the charge in the nanotubes' capacitance, or ability to store electric charge. Carbon nanotubes are rolled-up sheets of carbon atoms that have useful electrical properties and can be narrower than a nanometer, or one millionth of a millimeter. **Read more**.

Sculpting Traps for Nanoparticles

Apr. 18, 2005, *Nature Publishing Group* — Nanoscale particles in solution diffuse along random, brownian trajectories. A new device opposes this meandering tendency with electrical forces that can be tuned to make arbitrarily shaped traps. **Read more**.

Nanowires Corralled for Interconnect Tasks

Apr. 18, 2005, *Electronic Engineering Times*, by R. Colin Johnson — A research group at the University of Delaware has demonstrated a way to precisely position and control the growth of organic nanowires atop a

pre-patterned substrate, potentially providing a means of interconnecting future nanocircuits. Until now, there has been no way to interconnect nanoscale devices such as carbon nanotube transistors, quantum dots and molecular-memory arrays. **Read more**.

New Look for Molecular Transistors

Apr. 4, 2005, *Physics Web* — Theoretical physicists in the US have proposed a new way to make a single-molecule transistor. David Cardamone, Charles Stafford and Sumit Mazumdar at the University of Arizona say the quantum interference effect transistor could be a realistic way to extend existing transistor technology down to the nanoscale. The device modulates the flow of current through a hydrocarbon ring by switching quantum interference "on" and "off". **Read more**.

Bacteria Act as Glue in Nanomachines

Mar. 25, 2005, *Nature Publishing Group*, by Prachi Patel Predd — Electric currents are being used to move bacteria around silicon chips and trap them at specific locations. The technique could help to assemble nanomachines from miniature parts, and to create a new generation of biological sensors. Nanodevices are typically built by connecting tiny components. But such a delicate task is not easy. So, many researchers are exploring ways to fix components in place using the binding properties of biological molecules, notably DNA. **Read more**.

New Look For Nanomotors

Mar. 24, 2005, *Nanotechweb* — Physicists in the US have built the first nanoelectromechanical device that exploits the effects of surface tension. The "relaxation oscillator" consists of two droplets of liquid metal on a substrate made of carbon nanotubes and can be controlled with a small applied electric field. Alex Zettl and colleagues at the University of California at Berkeley and the Lawrence Berkeley National Laboratory say the device could find use in various nanomechanical applications, including actuators and motors. **Read more**.

Nanoparticles Transmit the Heat

Mar. 24, 2005, *Nanotechweb* — Researchers at the University of Illinois and University of Minnesota have been looking at thermal transport in polymer-coated gold nanoparticles. They found that adding a solvent that caused the polymer coating to swell led to an unexpectedly large increase in the thermal conductivity of the layer. **Read more**.

Microdroplet Makes Mighty Microscope

Mar. 24, 2005, *TRN* — There is a point beyond which it is not possible

to magnify using lenses simply because a lightwave cannot be focused tighter than about half its wavelength -- the diffraction limit. Electron microscopes, which bounce electron beams off objects to create images, and scanning probe microscopes, which trace objects with mechanical probes, sidestep the problem by avoiding lightwaves. Near-field microscopes also beat the diffraction limit because they are positioned closer to the subject in the wavelength of light used. Researchers from the University of Maryland have found a way to reach nanometer-scale resolution using ordinary far-field optics. Far-field optics are generally less expensive and more convenient then electron, scanning probe and near-field microscopes. The method could be used for bioimaging and optical nanolithography, and promises to make it easier to make movies of extremely small objects, according to the researchers. **Read more**.

Big Hopes for Tiny, New Hydrogen Storage Material

Mar. 21, 2005, *Pacific National Laboratory* — Researchers at the Department of Energy's Pacific Northwest National Laboratory are taking a new approach to "filling up" a fuel cell car with a nanoscale solid, hydrogen storage material. Their discovery could hasten a day when our vehicles will run on hydrogen-powered, environmentally friendly fuel cells instead of gasoline engines. **Read more**.

Tiny Porphyrin Tubes Developed by Sandia May Lead to New Nanodevices

Mar. 17, 2005, *Sandia National Laboratory* — Sunlight splitting water molecules to produce hydrogen using devices too small to be seen in a standard microscope. That's a goal of a research team from the National Nuclear Security Administration's Sandia National Laboratories. The research has captured the interest of chemists around the world pursuing methods of producing hydrogen from water. **Read more**.

Engineers Study Whether 'Light on a Wire' is Wave of Future for Circuitry

Mar. 16, 2005, *PhysOrg.Com* — Surface plasmons are density waves of electrons -- picture bunches of electrons passing a point regularly -- along the surface of a metal. Plasmons have the same frequencies and electromagnetic fields as light, but their sub-wavelength size means they take up less space. Plasmonics, then, is the technology of transmitting these light-like waves along nanoscale wires. **Read more**.

Findings Could Break Down Brick Wall Of Miniaturization

Mar. 15, 2005, *Science Daily* — A project by University of Delaware researchers that could break down the brick wall of miniaturization and revolutionize modern electronics through the formation and control of wires made of molecules is featured on the cover of the Feb. 15 issue of the American Chemical Society journal, *Langmuir*. The important new results produced by the UD research team "are the ability to produce

molecular wires at very precise positions, and to control the length of the wires through confinement inside of molecule corrals," according to Thomas P. Beebe Jr., professor of chemistry and biochemistry. **Read more**.

Nanotubes Boost Molecular Devices

Mar. 9, 2005, *TRN* — Researchers from Stanford University have constructed an extremely small transistor from a pair of single-walled carbon nanotubes and organic molecules. A single-walled carbon nanotubes is a rolled-up sheet of carbon atoms. **Read more**.

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