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Career Cornerstone News

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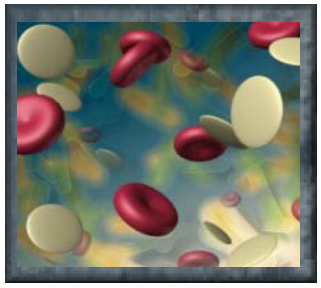
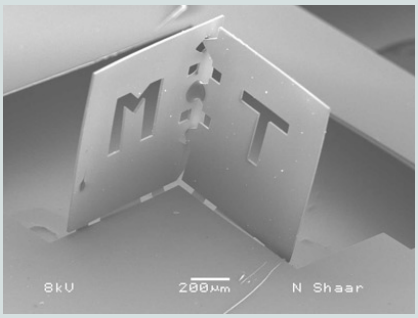


Career Cornerstone News is a Publication of the Sloan Career Cornerstone Center, the Premier Online Resource for Exploring Career Paths in Science, Technology, Engineering, Mathematics, Computing, and Healthcare.

Inside this issue:

Nano-Origami!

Folding paper into shapes such as a crane or a butterfly is challenging enough for most people. Now imagine trying to fold something that's about a hundred times thinner than a human hair and then putting it to use as an electronic device. A team of MIT researchers is developing the basic principles of "nano-origami," a new technique that allows engineers to fold nanoscale materials into simple 3-D structures. The tiny folded materials could be used as motors and capacitors, potentially leading to better computer memory storage, faster microprocessors, and new nanophotonic devices. Traditional micro- and nano-fabrication techniques such as X-ray lithography and nano-imprinting work beautifully for two-dimensional structures, and are commonly used to build microprocessors and other micro-electrical-mechanical (MEMS) devices. However, they cannot create 3-D structures. The MIT team uses conventional lithography tools to pattern 2-D materials at the nanoscale, then folds them into predetermined 3-D shapes. Getting the materials to fold back and forth into an accordion-like structure has been one of the researchers' biggest challenges, along with getting the faces and edges to line up accurately.



A team of MIT researchers folded this polymer sheet into one corner of a cube. The edge of each face is about 800 microns.
Image Source: MIT
Photo Credit: Nader Shaar

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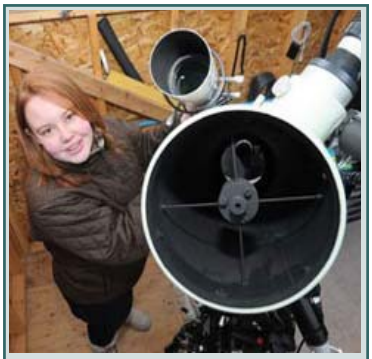
Student Discovers Supernova

There is no age restriction on the chance to make a significant contribution to our understanding of the universe. Caroline Moore, a 14-year-old from Warwick, NY, has made such a mark on astronomy with the discovery of Supernova 2008ha. Not only is she the youngest person to discover a supernova, but this particular supernova has been identified as a different type of stellar explosion. "It's really a strange supernova," said Moore. "A supernova is a huge explosion deep in the core of a star, whereas a nova is an explosion on the outside surface of a star. Of Supernova 2008ha she says, "It's somewhere between a supernova and a nova. So it's not nearly as big as the explosion of a supernova."

Find out about careers in physics and astronomy at www.careercornerstone.org, and learn about why 2009 is the International Year of Astronomy at www.astronomy2009.org.



Caroline Moore at work in her home observatory. With her recent discovery of Supernova 2008ha, 14-year-old Caroline Moore has shown that age is not a limiting factor when it comes having an impact on the sciences.
NSF Image; Credit: Robert E. Moore

Communication Key to Healthy Coral Reefs

Corals, it appears, have a genetic complexity that rivals that of humans, have sophisticated systems of biological communication that are being stressed by global change, and are only able to survive based on proper function of an intricate symbiotic relationship with algae that live within their bodies, say researchers at Oregon State University. Disruptions in these biological and communication systems are the underlying cause of the coral bleaching and collapse of coral reef ecosystems around the world. Corals are tiny animals, polyps that exist as genetically identical individuals, and can defend themselves and kill plankton for food. In the process they also secrete calcium carbonate that becomes the basis for an external skeleton on which they sit. The calcified deposits can grow to enormous sizes over long periods of time and form coral reefs--one of the world's most productive ecosystems — harboring over 4,000 species of fish and other marine life forms. But corals are not really self-sufficient. Within their bodies they harbor highly productive algae that use the energy of the sun to conduct photosynthesis and produce sugars. The scientists learned that there is a delicate communication process from the algae to the coral, telling it that the algae belong there and everything is fine. Otherwise the corals treat the algae as a parasite or invader and attempt to kill it. Find out more about careers in biology at www.careercornerstone.org.

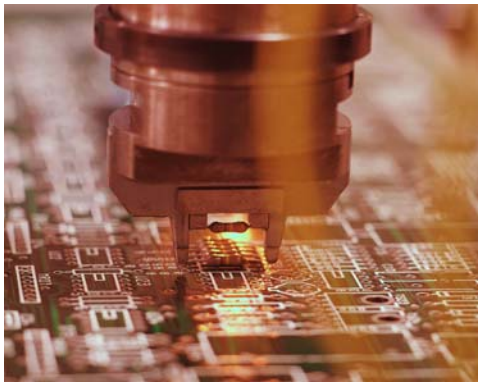
"Communication" is all-important, scientists are finding, on coral reefs.
Credit: NASA

Degree Profile: Semiconductor Processors

Semiconductors are unique substances, which, under different conditions, can act as either conductors or insulators of electricity. Semiconductor processors turn one of these substances -- silicon -- into microchips, also known as integrated circuits. These microchips contain millions of tiny electronic components and are used in a wide range of products, from personal computers and cellular telephones to airplanes and missile guidance systems. To manufacture microchips, semiconductor processors start with cylinders of silicon called ingots.

First, the ingots are sliced into thin wafers. Using automated equipment, workers or robots polish the wafers, imprint precise microscopic patterns of the circuitry onto them using photolithography, etch out patterns with acids, and replace the patterns with conductors, such as aluminum or copper. The wafers then receive a chemical bath to make them smooth, and the imprint process begins again on a new layer with the next pattern. A complex chip may contain more than 20 layers of circuitry. Once the process is complete, wafers are then cut into individual chips, which are enclosed in a casing and shipped to equipment manufacturers.

The manufacturing and slicing of wafers to create semiconductors takes place in cleanrooms -- production areas that are kept free of all airborne matter because the circuitry on a chip is so small that even microscopic particles can make it unusable.



Many associate degrees are offered in semiconductor manufacturing technology. Semiconductor processors hold about 42,000 jobs in the United States, and earn a median salary of about $33,000.

More information about a career as a semiconductor processor is at www.careercornerstone.org.

What is Cloud Computing?

Credit: © 2009 Jupiter Images Corporation

Cloud computing is a hot topic in the technology world these days. Chances are you've heard someone talking about cloud computing as the way of the future. So what exactly is cloud computing? There are varying definitions, but cloud computing is essentially a form of distributed computing that allows users the ability to tap into a vast network of computing resources through the Internet to complete their work. If, for example, someone wanted to analyze traffic patterns on the nation's highways, they could upload and store their data into the 'cloud' and have multiple computers crunch the data and then present the results back to them in a unified way as if the work were completed by one giant machine.

This may sound a bit like grid computing, another type of distributed computing that allowed users to tap into computing resources through a network to get their computational jobs done. With grid computing, you submit what you want computed to a batch scheduler, which puts your job in a queue for a specific set of computing resources, for example a supercomputer, to work on. Cloud computing is a little more flexible in that many cloud computing platforms allow users to know ahead of time how much computing capacity is available from the cloud, so the work can be done faster. Users can also configure a 'virtual machine' that exists within the cloud to meet the particulars of the jobs they are trying to accomplish. Once a user has configured the type of virtual machine they need for their work, they can go to different cloud computing providers and recreate the system they need to get their jobs done, making computation power a commodity.

Why the word 'cloud'? Kate Keahey, the lead on a cloud computing infrastructure project developed at Argonne National Lab, called Nimbus, believes the phrase was created when researchers were trying to visualize this type of computing on a whiteboard and made a circular set of squiggles that looked like clouds to represent the many components in the internet that would do the computational work. Nimbus is an open source cloud computing infrastructure that allows scientists working on data-intensive research projects to be able to use virtual machines with a cloud provider. Find out more at http://workspace.globus.org.

Find out more about careers in computing and engineering at www.careercornerstone.org.

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New Element is a Superconductor!

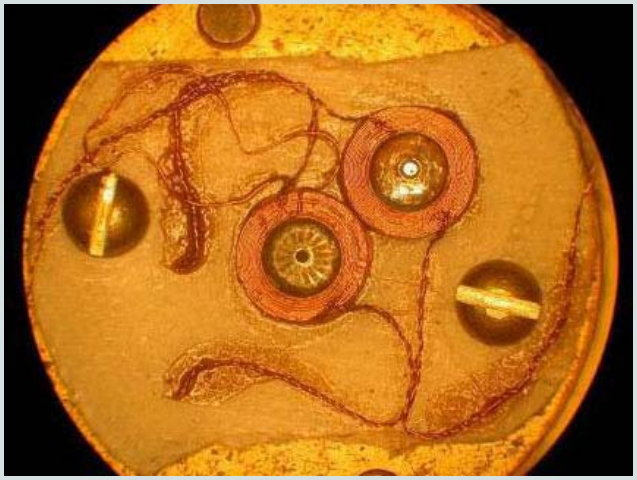
Of the 92 naturally occurring elements, add another to the list of those that are superconductors.

James S. Schilling, Ph.D., professor of physics in Arts & Sciences at Washington University in St. Louis, and Mathew Debessai, Ph.D., — his doctoral student at the time — discovered that europium becomes superconducting at 1.8 K (-456 °F) and 80 GPa (790,000 atmospheres) of pressure, making it the 53rd known elemental superconductor and the 23rd at high pressure.

"It has been seven years since someone discovered a new elemental superconductor," Schilling said. "It gets harder and harder because there are fewer elements left in the periodic table."

This discovery adds data to help improve scientists' theoretical understanding of superconductivity, which could lead to the design of room-temperature superconductors that could be used for efficient energy transport and storage.

Superconducting materials have unique electrical and magnetic properties. They have no electrical resistance, so current will flow through them forever, and they are diamagnetic, meaning that a magnet held above them will levitate.



Inside of the diamond cell: In the middle is the coil system around the diamond anvil, which picks up the shielding signal from the superconducting sample.
Image Source: Washington University in St. Louis

These properties can be exploited to create powerful magnets for medical imaging, make power lines that transport electricity efficiently or make efficient power generators.

However, there are no known materials that are superconductors at room temperature and pressure. All known superconducting materials have to be cooled to extreme temperatures and/or compressed at high pressure.

Schilling's research is supported by a four-year $500,000 grant from the National Science Foundation, Division of Materials Research. Find out more about careers in science and physics at www.careercornerstone.org.

STEM Salary Levels Positive for 09 Grads

The college Class of 2009 held its ground with its overall average starting salary offer, according to a new report published by the National Association of Colleges and Employers (NACE). NACE's Summer 2009 Salary Survey report showed that the average starting salary offer for new college graduates now stands at $49,307. That's off less than 1% from the average $49,693 that 2008 graduates posted last year at this time. Accounting majors did better than the average, and posted a 1.9% increase for an average offer of $48,993. Computer science grads saw their average salary offer rise 1.6% to $61,407. As a group, engineering graduates enjoyed the highest salary increase. Overall, the average offer to engineering graduates rose 3.7% to $59,254. Chemical engineering graduates posted a 2.7% increase to their average salary offer, which now stands at $64,902. Computer engineering graduates saw their average offer rise 3.6% to $61,738. Much of that bump up can be attributed to the types of positions these graduates were offered. Electrical engineering graduates earned one of the larger increases; their average offer rose 5.6% to $60,125. Civil engineering graduates, however, saw their average offer just nudge up slightly — 0.8%—to $52,048.