"Optical Cloaking" For Invisibility

Researchers using nanotechnology have taken a step toward creating an "optical cloaking" device that could render objects invisible by guiding light around anything placed inside this "cloak."

The Purdue University engineers, following mathematical guidelines devised in 2006 by physicists in the United Kingdom, have created a theoretical design that uses an array of tiny needles radiating outward from a central spoke, EurekAlert.com reported. The design, which resembles a round hairbrush, would bend light around the object being cloaked. Background objects would be visible but not the object surrounded by the cylindrical array of nano-needles, said Vladimir Shalaev, Purdue's Robert and Anne Burnett Professor of Electrical and Computer Engineering.

The design does, however, have a major limitation: It works only for any single wavelength, and not for the entire frequency range of the visible spectrum, Shalaev said.

"But this is a first design step toward creating an optical cloaking device that might work for all wavelengths of visible light," he said.

Calculations indicate the device would make an object invisible in a wavelength of 632.8 nanometers, which corresponds to the color red. The same design, however, could be used to create a cloak for any other single wavelength in the visible spectrum, Shalaev said.

"How to create a design that works for all colors of visible light at the same time will be a big technical challenge, but we believe it's possible," he said. "It is clearly doable. In principle, this cloak could be arbitrarily large, as large as a person or an aircraft."

Metals With Memory Fix Dents

Engineers have concocted metals that remember their original shapes and with a little heat can snap back to new after being crumpled or dented.?

"We showed for the first time that metal can snap back after deformation," lead author Taher Saif of the University of Illinois told LiveScience.

Normally, if you bend a hanger or even a paperclip, it's nearly impossible to restore the metal to a 100 percent unkinked state. Physical properties like this one are determined by the metal's crystalline and chemical structure. The crystalline structure, or microstructure, is the result of tiny groups of atoms that take on different sizes depending on how the atoms within each group are packed together.

Saif said that when the lab method gets scaled up, the memory metal could be used for any metal object that could get dented, ranging from cars and aircraft fuselages to everyday objects, such as garden tools and the metal frames on suitcases.?

Saif, a mechanical engineer, and his graduate students tried to mess with those grain sizes. They examined microstructures within thin films of aluminum and gold. By controlling the temperature during production, the team created metal films with very fine grains, under 100 nanometers. For comparison, the width of a human hair is about 100,000 nanometers.

"We found that the type of metal doesn't matter," Saif said. "What matters is the size of the grains in the metal's crystalline microstructure, and a distribution in the size."

The atom grains had to be small, but not too small, they reported Friday in the journal Science, to store a "memory" of their original state. Grains that are too tiny make a metal brittle and likely to snap when bent, while grains that are too large make a super malleable metal that bends and stays in a droopy position.

The key to making metals that snap back to their original shapes, the scientists found, is a balance between brittleness and bendiness, or a balance between teensy and relatively giant grains.

Scientists Create Flexible Electronics

Scientists are developing flexible electronic structures with the potential to bend, expand and manipulate electronic devices.

According to UPI, researchers at the U.S. Department of Energy's Argonne National Laboratory and the University of Illinois said such flexible structures could find applications as sensors and as electronic devices that can be integrated into artificial muscles or biological tissues.

In addition to a biomedical impact, flexible electronics are important for energy technology as flexible and accurate sensors for hydrogen.

The structures are being developed from a concept created by Argonne scientist Yugang Sun and a team of University of Illinois researchers led by John Rogers.

"The objective of our work was to generate a concept along with subsequent technology that would allow for electronic wires and circuits to stretch like rubber bands and accordions leading to sensor-embedded covers for aircraft and robots, and even prosthetic skin for humans," said Sun. "We are presently developing stretchable electronics and sensors for smart surgical gloves and hemispherical electronic eye imagers."

The team has fabricated ribbons of silicon, designing them to bend, stretch and compress without losing functionality. That research appeared in the Journal of Materials Chemistry.

Meanwhile, the University of Delaware's Institute of Energy Conversion (IEC) has developed new technology for the manufacture of flexible solar cells, which could reduce the costs associated with the use of photovoltaic energy while at the same time expanding possible applications, Science Daily says.

The system, in which there has been commercial interest, enables the more efficient manufacture of the flexible solar cells in long sheets using roll-to-roll reactors, much like newsprint speeding through a press.

As such, the system allows "extremely high production throughputs, thus reducing manufacturing costs," according to Erten Eser, associate scientist at IEC.

It also provides for lightweight and flexible solar cell panels that could find interest in the space, military and recreational markets. For standard applications, the solar cells can also be encapsulated into a more traditional rigid structure.

By being flexible, the solar cells can conform to different surfaces, Eser said, adding this is "particularly important for roofing applications for building integration, and for airships and balloons."

The solar cell sheets are created by depositing copper-indium-gallium-diselinide, which the IEC scientists call CIGS, on a 10-inch wide polymer web, which is then processed into the flexible solar cells. CIGS solar cells are currently the only thin-film technology that has achieved efficiencies comparable to silicon solar cells, presently the standard of the industry.

Exercise Fends Off Arthritis in Women

Get moving, Grandma! Exercise isn't just about improving your heart and fighting flab that comes with aging. It may also be the answer to preventing stiff, achy joints that can lead to debilitating arthritis. An Australian study suggests the more time older women spend exercising, the better their chances are of staying pain-free from one of the biggest chronic conditions plaguing developed countries, AP reports.

Even exercising as little as one hour and 15 minutes a week now can make a difference over the next three years, according to findings recently published in the journal Arthritis Research & Therapy.

"I don't think the results are suggesting that you should just become this maniac exerciser," said lead author Kristiann Heesch from the University of Queensland, Australia. "What it does suggest is that just adding some walking and moderate activity to your life can make a big benefit."

Doctors have long encouraged exercise among aging patients to keep joints flexible, muscles strong and to keep off weight, which is a leading risk factor for arthritis. This is the first study that focuses specifically on middle-aged and older women who did not have a history of stiff and painful joints. It looked solely at pain and symptoms reported by more than 8,700 Australian women over a three-year period, and could offer a vital clue about prevention.

The findings contradict some earlier research, which found no direct link between fitness and arthritis. The Australian study, published last week, focused on specific age groups of fairly healthy women predominantly from rural areas who had not been diagnosed with arthritis, which may partially explain the difference, Heesch said.

She said walking, swimming, yoga, tai chi and even some weight training were all great ways for older women to exercise after getting their doctors' approval. More women than men suffer from arthritis, and the risk increases greatly with age.

The fact that the study showed change in a short time speaks to the fact that exercise shows benefit quickly and is another reason to encourage people that exercise has a payback sooner than many people think.

Genetically Modified Plants Produce Insulin

Insulin produced by genetically modified plants--with a human gene added--could be on the market in three years, a Canadian company has claimed.

Most insulin is now produced by genetically modified bacteria, inside sealed tanks. According to BBC, the new technique uses GM plants grown out in the open.

The company is growing insulin in the seeds of safflower, a relatively little-used seed oil plant. The safflower is being grown on a trial basis in fields in Chile, the US and Canada.

Their crop is grown counter-seasonally to reduce the risks of the insulin-producing genes crossing to other plants.

If the firm can demonstrate that the plant-based insulin is identical with human insulin, it won't have to go through all the long and costly stages of full clinical trials.

There are also more projects under way to develop many other pharmaceutical crops.

Chile, the US and Canada are hosting safflower trials.

Professor Ed Rybicki of the University of Cape Town has modified tobacco so it produces a vaccine for cervical cancer. He said the aim was to help women in the developing world.

Furthermore, there are plans to produce spider silk from potatoes and to make non-polluting engine lubricants in seed oil plants.

A Danish company is even trying to create plants that will help clear minefields. The flowers of the modified thale cress would change from white to red if their roots absorb traces of explosives--showing where the landmines had been laid.

Autologous Transplants in Sheep

Four sheep have become pregnant after having their wombs removed and then reconnected, Swedish scientists say.

According to BBC, it is an important step towards successful womb transplants in humans.

Professor Mats Brannstrom and colleagues carried out an autologous transplant in the sheep

Professor Brannstrom and colleagues at the Sahlgrenska Academy at Gothenburg University in Sweden carried out autologous transplants in 14 sheep--where the same womb is removed and reconnected.

Four have become pregnant. Professor Brannstrom said the pregnancies are now at about 120 days, and the pregnancies will last for another 20 days.

The team will deliver the lambs by Caesarean.

They also now plan to carry out a womb swap between two ewes.

The team had previously achieved successful pregnancies after womb transplants in mice.

There is still work to do before such transplants are safe as New Scientist reported that half the sheep in the study developed fatal complications.

Earlier this year a team in New York announced their intention to carry out the first womb transplant in the US using a donor organ from a woman who had died.

The procedure would potentially allow women who have had their wombs damaged or removed to develop a pregnancy and give birth.

A womb transplant has been tried once before, in Saudi Arabia in 2000, but then the womb came from a live donor, and was rejected after three months.

One of the difficulties of a successful transplant is the complexity of the blood vessels that need to be reattached.

Pregnancy would put even more strain on these connections, with very dangerous consequences if something was to go wrong.

Laser Goes Tubing For Faster Body-Fluid Tests

University of Rochester researchers announce in the current issue of Applied Optics a technique that in 60 seconds or less measures multiple chemicals in body fluids, using a laser, white light, and a reflective tube. The technique tests urine and blood serum for common chemicals important to monitoring and treatment of diabetes and cardiovascular, kidney, urinary and other diseases, and lends itself to the development of fast batch testing in hospitals and other clinical settings.

Co-researchers Andrew J. Berger, associate professor of optics, and Dahu Qi, doctoral candidate, used low-refractive-index tubes instead of cuvettes or other bulky containers for holding biological specimens. And, to get more information from the fluids, they used white light--like that from an ordinary light bulb--along with the laser, EurekAlert.com reports. The tubes and light bulbs made all the difference.

In the laser technique called Raman spectroscopy, scientists shine laser light onto molecules and the light scatters off, gaining or losing energy. A spectrograph translates the changed energies into spectra. Each chemical presents a Raman spectrum that scientists recognize. The Raman approach is a favorite for finding chemicals that overlap and mix in fluid, much like musical instruments in an orchestra. But Raman spectroscopy comes with a problem.

Spectral tests use no chemical reagents and therefore offer the advantage of being nondestructive to fluid samples, unlike many lab tests. After analysis, practitioners could use undamaged samples for other kinds of tests.

"We squeeze a small amount of fluid into the tube," said Berger. "In 10 or 20 seconds, we have a chemical breakdown, and we can see the presence of a lot of chemicals all at once. There's no chemistry performed, and there's no touching of the fluid."

The tubing doesn't just help with the signal strength; it also makes it easy to move biofluids around. "We pump a sample into the tube, pass some light through it, and send it along its way--and then we're all set to pump in the next one," said Berger.

Too Much Sugar?

Treatment with insulin revolutionized the life of individuals with diabetes. However, because insulin acts to lower blood glucose levels, it can cause hypoglycemia (low levels of glucose in the blood), which, if prolonged, can lead to brain injury and coma. Although most brain defects can be corrected by restoring blood glucose levels to normal, extremely prolonged hypoglycemia can cause the death of neurons and irreversible brain damage.

Surprisingly, in a study appearing in the April issue of the Journal of Clinical Investigation, researchers from the University of California at San Francisco found that in mice, hypoglycemic neuronal death is triggered when the mice are treated with a large amount of glucose and not by the hypoglycemia itself, Science Daily says.

Raymond Swanson and colleagues showed that although hypoglycemia induced some neuronal death, the rapid infusion of glucose into hypoglycemic mice triggered more extensive neuronal death. The extent of neuronal death correlated with the production of superoxide by a molecule known as NADPH oxidase. Importantly, the amount of superoxide produced and the extent of neuronal death increased as the amount of glucose infused into the hypoglycemic mice was increased.

This suggests that it might be best to treat individuals in hypoglycemic coma by gradually increasing their blood glucose levels rather than by restoring glucose levels rapidly. However, in an accompanying commentary, Philip Cryer from Washington University School of Medicine, St. Louis, cautions that "The appropriate clinical extrapolation of these data is not entirely clear."