Solar-Powered Asteroids Found

For the very first time, astronomers have witnessed the speeding up of asteroid rotation, and have shown that it is due to a theoretical effect predicted but never seen before.

Two separate asteroids have turned the Sun's rays into an engine of sorts, accelerating their spin rates by reflecting absorbed sunlight into space, according to a trio of new studies.

The asteroids, known as 2000 PH5 and 1862 Apollo, are the first to yield direct measurements of sunlight's spin-altering effect on relatively small space rocks, researchers said.

"Asteroids are among the least altered remnants from the formation of our solar system," astronomer Stephen Lowry, who led the 2000 PH5 study from of Queens University in Belfast, Ireland, told SPACE.com. "So by studying them we are looking back in time to the conditions present when our solar system formed some 4.5 billion years ago."

When a large Sun-facing portion of an asymmetrical space rock rotates away from the star and into night, it can radiate more energy than that of smaller areas and tweak its spin rate. The phenomenon, long inferred but now spotted directly, is named the YORP effect (Yarkovsky-O'Keefe-Radzievskii-Paddack) after the researchers who first described it.

Although this is an almost immeasurably weak force, its effect over millions of years is far from negligible. Despite its importance, the effect has never been seen acting on a solar system body, until now.

"YORP also plays an important role in changing the orbits of asteroids between Mars and Jupiter, including their delivery to planet-crossing orbits," Lowry said. A "planet crossing orbit" is the sort that makes astronomers on Earth worry, of course.

Lowry said the YORP effect could ultimately spin 2005 PH5 so fast that one "day" on the asteroid could run as short as 20 seconds. The YORP effect could also lead to the asteroid's destruction, forcing it to spin so fast it sheds mass or loses cohesion.

"Who knows, perhaps we could witness one of these objects spontaneously breaking apart," Lowry said. "That would be quite a show!"

Want A Better Memory? Stop and Smell the Roses

People who want to learn things might do better by simply stopping to smell the roses, researchers reported on Thursday.

German researchers found they could use odors to reactivate new memories in the brains of people while they slept--and the volunteers remembered better later.

Writing in the journal Science, they said their study showed that memories are indeed consolidated during sleep, and show that smells and perhaps other stimuli can reinforce brain learning pathways, Reuters says.

Jan Born of the University of Lubeck in Germany and colleagues had 74 volunteers learn to play games similar to the game of "Concentration" in which they must find matched pairs of objects or cards by turning only one over at a time.

While doing this task, some of the volunteers inhaled the scent of roses. The volunteers then agreed to sleep inside an MRI tube. Functional magnetic resonance imaging was used to "watch" their brains while they slept.

At various stages during sleep, Born's team wafted in the same scent of roses.

The volunteers were tested again the next day on what they had learned. "After the odor night, participants remembered 97.2 percent of the card pairs they had learned before sleep," the researchers wrote.

But they only remembered 86 percent of the pairs if they did not get the rose smell while sleeping.

And the stage of sleep was important too, the researchers said in a finding that will add to the debate over whether people "learn" in their sleep the way some animals have been shown to.

People who want to learn things might do better by simply stopping to smell the roses, researchers reported on Thursday.

Research has shown, for example, that rats learning a new maze will rehearse their movements during sleep, and that songbirds rehearse their songs.

Born's team said the scent improved learning when it was administered during slow-wave sleep, but had no effect during rapid eye movement or REM sleep.

The MRI showed that the hippocampus, the part of the brain associated with learning new things, was activated when the odor was wafted over the volunteers during slow wave sleep.

Gold Nanorods Promise Invisible Objects

Rice University chemists have discovered that tiny building blocks known as gold nanorods spontaneously assemble themselves into ring-like superstructures.

This finding, which will be published as the inside cover article of the March 19 international edition of the chemistry journal Angewandte Chemie, could potentially lead to the development of novel nanodevices like highly sensitive optical sensors, superlenses, and even invisible objects for use in the military, EurekAlert.com reports.

"Finding new ways to assemble nano-objects into superstructures is an important task because at the nanoscale, the properties of those objects depend on the arrangement of individual building blocks," said principal investigator Eugene Zubarev, the Norman Hackerman-Welch Young Investigator and assistant professor of chemistry at Rice.

Although ring-like assemblies have been observed in spherical nanoparticles and other symmetrical molecules, until now such structures had not been documented with rod-shaped nanostructures.

"When nanorods are organized into a ring, significant changes in their optical and electromagnetic properties occur," Zubarev said. "These can have technological applications in the area of metamaterials, which have enormous potential in opto-electronics, communications and military applications."

Zubarev said thousands of well-defined rings can be produced in a matter of seconds using the approach from his study. "This method is surprisingly simple and can be used for organizing nanocrystals of various shapes, size and chemical composition into circular arrays."

Step Toward Reducing Organ Transplant Rejection

A new study involving a type of stem cells from the lungs of transplant patients demonstrates for the first time that these progenitor cells reside in adult organs and are not derived from bone marrow, which leads to the possibility that the cells may be able to help with the rejection of donated organs and with various kinds of lung disease.

According to UPI, the study by University of Michigan Health System researchers is significant because of the large number of lung transplant patients who experience chronic rejection of donated lungs, with rejection rates of about 60 percent during the first five years after transplantation.

The researchers studied mesenchymal stem cells (MSCs), a type of progenitor cell that most commonly originates in the bone marrow. In this study, lead author Vibha N. Lama, M.D., M.S., and her research team found that the MSCs in lung transplant patients are not derived from bone marrow, but rather that they reside--sometimes for many years--in the lungs. The researchers also found that these cells have the capacity to differentiate into multiple connective tissue cell types.

One of the most telling findings was that, in cases where the transplant donor and recipient were not of the same sex, nearly all the MSCs (about 97 percent) originated in the donor, indicating that they were present in the tissue since the time of transplantation. "We were able to isolate the cells derived from the donor as far as 11,5 years after transplantation," says Lama, assistant professor in the Division of Pulmonary and Critical Care Medicine at the U-M Medical School. "We discovered the existence of a population of MSCs that reside and self-renew in the tissues of the adult lung--something that might hold true for other organ systems as well.

New Microjet Delivers Protein Drugs Without Needles

In collaboration with colleagues from UC Berkeley and StrataGent Life Sciences, a team of UCSB researchers of Los Gatos, California, has designed a novel pulsed microjet system engineered to deliver protein drugs into the skin without the pain or bruising that deeper penetration injection systems cause. The research was published in the Proceedings of the National Academy of Sciences.

The effort to create needle-free drug delivery systems is driven by a combination of factors, including needle phobia, pain and discomfort, infections, and accidental needle sticks to healthcare providers, Science Daily says.

The pulsed mircrojets engineered by the researchers combine high velocity (more than 100 meters per second) with very small jet diameters (between 50 and 100 micrometers), delivering only 2 to 15 nanoliters of liquid drug at a time. The research showed that the pulsed microjet system could be used to effectively deliver drugs for local and systemic applications without using needles.

"The microjet system delivers precise doses into superficial skin layers, thereby mitigating pain," says Samir Mitragotri, a professor of chemical engineering at UCSB and a lead author of the paper. The system was designed as an alternative to the macro-scale systems that had been causing pain and bruising. "We realized that we had to find a way to stop the jets from going deep into the skin," says Mitragotri. "Speeding the delivery, combined with using extremely small jet diameters and less liquid per pulsation, was shown to be more effective."

Researchers Learn What Sparks Plant Growth

A secret long held by plants has been revealed by Howard Hughes Medical Institute researchers. The new discovery, which builds on more than a decade of painstaking surveillance of cellular communication between different types of plant tissues, shows clearly for the first time how plants "decide" to grow.

Science Daily says the research, conducted by Sigal Savaldi-Goldstein and Howard Hughes Medical Institute investigator Joanne Chory at The Salk Institute for Biological Studies, puts to rest a century-old debate over which tissue system in plants drives and restricts cell growth.

"Our work exposes the presence of cell-cell communication during growth, from the epidermis to the inner layers. Such a mode of communication is important for plants to maintain a coherent and coordinated growth of the shoot," said Savaldi-Goldstein, a postdoctoral fellow in Chory's lab.

Chory's research group is interested in identifying the mechanisms by which plants alter their shape and size in response to changes in their environment. Chory studies Arabidopsis, a member of the mustard family that is to plant biologists what the mouse is to mammalian geneticists.

"How do organisms decide when to grow and when to stop growing? These questions are especially important in plants because they are rooted in the ground and must alter their shape and size in response to their local environment. Thus, it's a question of survival," added Chory. "It took us 10 years to develop the tools to ask the question. It is very satisfying for me to see the results."

Roots and shoots are a plant's two major organ systems. For this study, published in the March 8, 2007, issue of the journal Nature, the scientists examined shoots and the three layers of tissues that make up the shoot system: the epidermis, which is the waxy, protective skin; the mesophyl tissue, which contains the plant's chloroplasts--cells that conduct photosynthesis; and the vascular tissue through which water and nutrients are transported.

The research is an important addition to the fundamental knowledge of plant growth and survival. But the work to follow has much broader implications.

"If we want to feed over nine billion people by the year 2050, then understanding the basic mechanics of plant growth is required," said Chory. "This knowledge will ultimately lead to our ability to increase yield, while decreasing the need for fertilizer and pesticides."

Robot Salamander Helps Understand Spinal Cord

Small steps for a robot salamander may just be a leap toward understanding spinal cord injuries, according to a study released Thursday by French and Swiss scientists.

The robot can change speed and gait in response to electronic impulses, indicating that the distributed nervous function of the spinal cord may hold the key to understanding the complex locomotion of vertebrates, according to the study released in the March 9 issue of the magazine Science, AFP reported.

Scientists of the University of Bordeaux, France, and the Ecole Polytechnique Federale de Lausanne, Switzerland (EPFL), created Salamandra Robotica, a four-legged yellow creature that follows the impulses of a simple computerized drive.

EPFL professor Auke Ijspeert said, "We used the robot to show that our model actually reflects reality.

Scientists have created a salamander-like robot that married biology and robotics and enabled them to explore ideas about the first vertebrates that emerged from water to land hundreds of millions of years ago.

"The robot was very useful to validate that our model could effectively modulate speed, direction and gait--aspects that need a mechanical 'body' to be properly evaluated--and also to verify that the generated movements are close to those of a real salamander."

Because the research may lead to better understanding of the human spinal cord circuitry, it may help remedy spinal cord injuries, the paper said.

"Nature found a nice way of making a sophisticated circuit in the spinal cord and then controlling the muscles from there," said Ijspeert.

"Its a fantastic solution for coordinating multiple degrees of freedom in a simple distributed way."

Hmm ... Rats Think Like Humans

Rats appear capable of reflecting on what they know and don't know, a complex form of thinking previously found only in humans and other primates.

"If rats can do it, this capability may be more widespread than imagined," Jonathon Crystal, a comparative psychologist at University of Georgia, told LiveScience.

Humans are often aware of what knowledge they possess or lack and what they are or are not capable of.

"Imagine, for instance, that you're a student going into a classroom to take an exam," Crystal said. "You will often have some idea how well you're going to do on the test. You know before you answer the questions whether you know or don't know the answers. This pretty complex form of cognition, known as metacognition, is at the heart of the human condition."

Increasingly, evidence of metacognition is found in rhesus monkeys and other primates, but little research has been done on it in other mammals.

Crystal and his colleague Allison Foote decided to push the limit and see if rats were capable of it.

The scientists found the rats appeared capable of judging whether they had enough information to pass the test. The more difficult the test was, the more often rodents opted to decline the test.

The discovery of this form of thinking in rats opens up further experiments into the brain anatomy and chemistry underlying metacognition in rats, "which could impact human health," Crystal said. "For instance, two human health issues linked with metacognition that come to mind are Alzheimer's disease and amnesia."

Foote and Crystal detailed their findings yesterday in the online version of the journal Current Biology.