TESS mission's discoveries

Three new planets and six supernovae outside the Solar System were observed by NASA's planet-hunting TESS (Transiting Exoplanet Survey Satellite) mission in its first three months, according to theguardian.com.

Indian scientists create 'space fuel' in lab

Scientists at the Indian Institute of Technology (IIT) Madras created what they call 'space fuel' by simulating interstellar conditions in the lab, a method that may be used to convert atmospheric CO2 into a next generation energy source on Earth.

The research, published in the journal Proceedings of the National Academy of Sciences (PNAS), could help curb greenhouse gases as well as provide a new, sustainable source of energy, economictimes.indiatimes.com reported.

financialexpress.com

"What we have found is that molecules like methane and ammonia in space could exist in a completely different form than what is known to us," Thalappil Pradeep of IIT Madras said.

Clathrate hydrates are molecules like methane and carbon dioxide, trapped in well-defined cages of water molecules forming crystalline solids.

They are formed at high pressures and low temperatures at places such as the ocean floor, hundreds of meters below the sea level. They are also found in glaciers such as in Siberia.

Such hydrates especially that of methane, are thought to be the future sources of fuel. Many nations across the world including India have programs to explore hydrates in the ocean bed.

IIT Madras researchers formed such hydrates in vacuum, one thousand billion times below the atmospheric pressure called ultra-high vacuum (UHV) and temperature close to minus 263°C. These are the conditions present in deep space.

This discovery of hydrates is highly unexpected at extremely low pressures and ultra-cold temperatures and may have several implications for the chemistry of such atmospheres, Pradeep said.

An experimental UHV was specially built for such studies, which housed several spectroscopic probes. Nanometer thin layers of ice and methane were prepared by condensing a mixture of the gases on a specially made single crystal of ruthenium metal.

The ruthenium metal surface was cooled to low temperatures initially.

The formation of hydrates was studied by spectroscopy. At first, when the gases were deposited, the spectroscopic features resembled solids of methane and water ice.

However, as the hydrate cage formed with methane trapped in it, the molecule became 'free' as in the gas phase. The observed changes were compared with theoretical simulations which confirmed the hydrate formation. The results were verified with the hydrate formed by standard methods.

Cages of water are not expected to form under such conditions as the water molecules are frozen and cannot move at very low temperatures.

"Normally, in UHV experiments, spectroscopic changes are monitored only for minutes, may be an hour. I thought that why not wait for days and keep observing the changes. After all, ice and methane have been sitting in the space for millions of years," said Pradeep.

"The excitement happened after three days. New features started coming. Then of course, several experiments were done under controlled conditions," he said.

Such hydrates were also formed with carbon dioxide, researchers said.

"Trapping carbon dioxide in hydrates is a way to reduce global warming. One can sequester carbon dioxide gas as solid hydrates under the sea bed," said Rajnish Kumar, the coauthor in this study.

In hydrates, molecular confinement can result in new chemistry, especially in presence of cosmic light present in interstellar environment. Understanding this chemistry may be important to better understand the origins of life.

Moonlight influences opening, closing of oysters' shells

GETTY IMAGES

The gentle glow of moonlight on water has moved musicians, poets and painters — and, it turns out, mollusks.

Researchers discovered the opening and shutting of oysters' shells appears to be tied to the lunar cycle, theguardian.com reported.

Biological clocks have intrigued scientists for centuries, and researchers in the field won the 2017 Nobel Prize for studies into the 24-hour body clock.

However, organisms do not necessarily have biological processes linked only to the rhythm of day and night, the circadian clock. Other patterns that include links to the tides have been found for species including the horseshoe crab, and to the phases of the Moon for creatures including the bristle worm. Some have suggested the latter may also affect humans.

Now experts say they have found evidence that oysters not only have a circadian clock and a tidal clock, but are also attuned to lunar rhythms.

"It was a surprise to see that there is such an effect of the moonlight," said Laura Payton, the coauthor of the research from the University of Oldenburg, Germany.

Writing in the Biology Letters journal, Payton and her colleague, Damien Tran, from the University of Bordeaux described how they tracked the behavior of 12 Pacific oysters submerged off the French coast over the course of three and a half lunar cycles from the end of 2014.

The team used electrodes to track the mollusks' degree of opening every 1.6 seconds and looked at astronomical data to assess how much of the Moon was illuminated.

The results revealed the oysters were most open in the buildup to — and presence of — a new moon, and less open as the Moon entered first quarter and full phases.

The team said that suggests oysters can sense moonlight — even though it is far less intense than the Sun's rays.

However, Payton said the situation was complex, noting the creatures appeared to be able to tell if the Moon was waxing or waning: The oysters were generally more open during the third quarter than the first quarter.

Payton said one possibility was that the benthic bivalves may have evolved an internal lunar clock, rather than passively relying on direct cues. In that case, she added, the moonlight sensed by the oyster would help keep this clock in sync with the environment rather than directly triggering the opening and shutting of the shell — similar to how humans use daylight to keep their internal 24-hour clock on track.

The team suggested the increased opening of the oysters when moonlight levels are lower might be linked to the possibility that more food is available at low light levels: Previous studies have suggested the movement of plankton also appears to be influenced by light.

"We know that oysters open their valves when there is food," Payton said.

However, the study did not look at the impact of the Moon on oysters' behavior in all seasons, or take into account cloud cover — and hence the actual level of moonlight the mollusks experienced.

David Wilcockson, a senior lecturer in aquatic biology at Aberystwyth University, said there were still many mysteries in the field.

"We know that, for example, tidal, lunar and circadian clocks appear to have separate mechanisms, but they are to some extent linked — and we don't know quite how and to what level," he said.

Wilcockson said human activity could cause unexpected problems in marine environments — an issue research like the latest study could help examine.

"If you have coastal lighting, for example, or lighting on marine structures, then of course we don't really know what the impacts of those might be," he said.

'Birth control' insecticide could stop mosquitoes being able to hatch

A form of 'birth control' for mosquitoes could be used to tackle populations of the creatures in areas where insect-borne diseases are rife.

The discovery of a key protein involved in forming mosquito eggs has provided scientists with a new target in the fight against them, independent.co.uk reported.

FRANK HADLEY COLLINS/CDC

Globally more than 500 million people are afflicted with diseases carried by mosquitoes, like malaria, Dengue fever and the Zika virus, which claim the lives nearly one million people.

Previous efforts to prevent the disease have included sterilizing male mosquitoes and editing their genes to block female reproduction.

But the new strategy being proposed by a team of researchers from the University of Arizona, the US, would involve an insecticide that tampers with the newly discovered protein.

The scientists found that blocking the activity of this substance resulted in females laying eggs with defective shells. These caused the insect developing inside to die.

Crucially, the researchers found this protein only exists in mosquitoes, meaning if a drug that prevents it from functioning can be widely applied, it will only harm these insects.

"We think this strategy may have a much lower chance of harming other organisms than what is being used today," said Professor Roger Miesfeld, one of the scientists behind the research.

Conventional pesticides work well at killing mosquitoes and were initially viewed by researchers as a viable way of wiping out diseases like malaria.

However, the potency of these chemicals mean they can have far-reaching effects in ecosystems, killing other insects and harming larger animals.

It has also become apparent in recent years that mosquitoes are beginning to develop resistance to some of the most widespread chemicals used to control them.

With this in mind, the scientists said they were hopeful their discovery will provide a way to drive down mosquito numbers in high-risk areas without affecting beneficial insects like honeybees.

"Since the days of DDT (Dichlorodiphenyltrichloroethane), we have known that mosquito population control works to reduce the incidence of human disease," said Miesfeld.

"This could be a next-generation tool that could be applied to bed nets and other areas frequented by mosquitoes."

Dr. Jun Isoe, who led the project, identified the protein by searching for genes that were unique to mosquitoes, ultimately settling on the previously unknown EOF-1 gene.

The team then created small molecules that stop the proteins working properly, and found that once inserted into mosquitoes these molecules prevented the female insects from producing functional eggs until the end of their lifespan

While techniques that wipe out huge numbers of mosquitoes are tempting, there are concerns that such large-scale engineering of ecosystems could have unintended knock-on effects, even if limited to a single species.

London remains top destination for European tech funding

London remained the top destination in Europe for technology investment in 2018, with nearly double the amount being plowed into companies in the British capital than nearest rival Berlin, data showed on Wednesday.

Technology companies in London attracted £1.8 billion ($2.3 billion) in venture capital funding, 72 percent of the total 2.5 billion pounds raised by UK tech businesses, according to data from funding database PitchBook on behalf of the Mayor of London, Reuters reported.

Eileen Burbidge, a partner at venture capital firm Passion Capital, said London was the leading hub for financial technology thanks to its position as one of the world's biggest financial centers, while its universities helped to create companies offering artificial intelligence (AI).

"We get a lot of calls and inquiries from investors in the US and Asia looking for fintech opportunities," she told Reuters.

"In fintech, AI and a few other sectors such as life sciences and robotics, London genuinely leads the world."

London's tech sector and its mayor, Sadiq Khan, have warned that Britain's departure from the European Union could damage its appeal. However, Burbidge said there was no sign of this happening yet, beyond companies asking many more questions when looking to hire from abroad.

The data from PitchBook showed that both Berlin and Paris gained ground against London in the race for funds across Europe, and that London failed to match the record levels it attracted in 2017, but the gap still remained significant.

KACPER PEMPEL/REUTERS

Berlin attracted £937 million of investment in 2018, almost double the previous year's total, while £797 million went to tech groups in Paris as President Emmanuel Macron stepped up his promotion of the country.

In Britain as a whole, investment in AI rose 47 percent to £736 million while £1.2 billion went into the booming fintech sector and companies such as digital banks Revolut and Monzo.

Total venture capital funding in European tech slipped slightly in 2018, with £10.44 billion raised, against £10.47 billion in 2017.