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# Science Service

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### STAKEHOLDERS COUNTER STUDY ON ILL-EFFECTS OF CANOLA OIL

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After a recent US study linked canola oil intake with impaired memory and weight gain, industry stakeholders claim that the research was conducted on mice and provides no evidence of harmful effect in humans.

The study, titled “Effect of canola oil consumption on memory, synapse and neuropathology in the triple transgenic mouse model of Alzheimer’s disease,” by Elisabetta Lauretti and Dominico Pratico at Temple University in the US was published in the journal *Scientific Reports*.

Canola oil is extracted from the seed of a yellow flowering plant of the genus *brassica* belonging to the mustard family.

The study linked the consumption of canola oil in the diet with impaired memory, worsened learning ability and weight gain in mice which model Alzheimer’s disease - the most common form of dementia.

However, the Canola Council of India (CCI) claims that the paper in the journal did not show any causal link to the disease in humans.

It asked consumers to disregard reports of the study purporting to establish that canola oil may be harmful to memory and may cause weight gain.

The Canola Council of Canada too refuted the claims of the Temple University study.

“(The) mouse model is a huge stretch from what you may see in humans,” Peter Jones of University of Manitoba in Canada was quoted as saying by the council in a statement.

“Animal models of Alzheimer’s lack predictive validity. We have a series of major phase III clinical trials with drugs in Alzheimer’s disease. The drugs ‘worked’ in the animal models but failed in humans,” the council quoted Richard Bazinet, Associate Professor at University of Toronto as saying.

According to the Temple University researchers, long-term consumption of canola oil was not beneficial to brain health.

“Even though canola oil is a vegetable oil, we need to be careful before we say that it is healthy,” Pratico wrote in the study.

Ravinder Pal Singh Kohli, spokesperson of Jivo Wellness, said in a statement that a “scientific rebuttal is being filed by a university-based expert to submit to the Journal that published this study.”

For the Temple University study, researchers used mice genetically engineered to mimic Alzheimers in humans, progressing from an asymptomatic phase in early life to full-blown disease in aged animals.

Researchers found that the canola oil-fed mice gained weight compared to those fed the control diet.

However, the council quoted Jones as saying that the finding is not surprising given that the canola oil diet was higher in calories than the control diet.

“The two diets were not balanced for fat content,” said Jones.

“We know that higher fat diets are more palatable and lead to increased food intake and weight gain, which is what happened here,” Jones said.

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### IIT SCIENTISTS USE ONION SKIN TO GENERATE ELECTRICITY

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Scientists at IIT Kharagpur have used waste onion skins to develop an inexpensive device that can generate ‘green’ electricity from body movements, and may power pacemakers, smart pills and wearable electronics.

The non-toxic, biodegradable and biocompatible device takes advantage of the suitable piezoelectric properties of the onion skin, researchers said.

Piezoelectric materials have the ability to convert energy from everyday mechanical motions into electricity.

“This homespun inexpensive innovative finding can be a breakthrough scientific research in new direction; even common people can generate energy in any circumstances using this simple novel cost-effective idea,” Bhanu Bhusan Khatua, professor at Indian Institute of Technology (IIT) Kharagpur in West Bengal, told PTI.

Increasing population, industrialisation, and ubiquitous use of electronics and vehicles are playing a huge role in destroying the environment day by day.

The rising burden on fossil fuels and depletion of natural resources has made the development of sustainable and alternative green energy technologies a pressing requirement in current energy deficiency world, researchers said.

Piezoelectric materials can be used to convert simple body movements into green energy without adding any pollution to our environments.

However, piezoelectric nanogenerators are difficult to synthesise and are often very expensive. They are also usually highly toxic or pose environmental hazards, which means their use in real life application remains limited.

These drawbacks prompted researchers at IIT Kharagpur and Pohang University of Science and Technology in South Korea to develop a non-toxic, biodegradable and biocompatible piezoelectric nanogenerator (BPNG).

Among various cellulose containing bio-materials, onion skin is the most abundant bio-waste, said Khatua.

“This motivated us to study the piezoelectric co-efficient of the onion skin and its suitability as a bio-piezoelectric material,”

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Khatua said.

“The uniqueness of our work lies in the novelty of utilising naturally abundant biocompatible and biodegradable onion skin directly as efficient piezoelectric material, which is thrown as tonne-scale garbage in every day worldwide,” he said.

The device could be used in various biomedical applications such as pacemakers powered by heart beats or edible devices that can track health from inside the body.

Researchers estimate that the device could be manufactured easily at a cost of less than a rupee, with existing technologies. This would make the system accessible to people the economically weaker sections of the society.

To build the device, the researchers coated an onion skin with a thin layer of gold and added copper wires with silver paste. It was then encapsulated in polymers.

The nanogenerator is capable of harvesting several types of mechanical energies, including body movements, wind flow and even machine vibrations.

The device developed by researchers has an output of 18 volts and can turn on 30 green LEDs under repeated human finger touch response, according to the study published in the journal NanoEnergy.

The device could withstand repeated cycles of pressing and releasing for up to five months. The voltage generated remained almost unchanged even after long cycles, indicating good mechanical stability of the device for bio-medical applications, researchers said.

“We also studied the durability of the device under sewing machine vibration for 10,000 cycles. From the result it can easily be said that the device had enough mechanical durability and chemical stability for realistic applications,” Khatua said.

The researchers, including Sumanta Kumar Karan and Sandip Maiti from IIT, are optimistic about commercialising the technology soon, although more research is required before it can be realised in practical applications.

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### TINY SENSORS ATTACHED TO BODY WILL HELP EXAMINE EFFECT OF AIR POLLUTION ON HEALTH

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As the national capital and some north Indian states battle severe air pollution, a team of researchers will use tiny sensors attached to the body to find out the amount of pollutant a Delhiite inhales everyday.

The multidisciplinary team of researchers, including computer scientists, doctors and exposure scientists from nine institutes in the UK and India - led by the University of Edinburgh - will examine links between long-term exposure to air pollution and health over a four-year period.

“The Delhi Air Pollution: Health and Effects (DAPHNE) project brings together best-in-class researchers from

India and the UK to address the pressing problem of the health effects of sustained exposure to high levels of air pollution,” Professor D K Arvind of the University of Edinburgh, who is leading the study, said.

“We believe this innovative research, funded by the UK research councils over the past 15 years, could eventually help millions of people in Delhi and countless other global cities,” the professor said.

According to a statement by the University of Edinburgh, air pollution levels in Delhi reached more than 16 times the safe limit, prompting the local government to declare an emergency situation.

The DAPHNE project involves 760 pregnant women, who will wear the air pollution monitors attached as adhesive patches and scientists will record the health of the mothers and their children following birth.

The researchers will also focus on 360 young people with asthma in order to examine the level of exercise they can tolerate amid air pollution.

The researchers would use battery-powered respiratory monitors, known as ‘RESpecks’ and the air pollution monitors, called ‘AIRSpecks’, utilise ‘Speckled Computing’, a technology being pioneered by scientists at the University of Edinburgh.

“‘Specks’ are tiny devices that can be placed on everyday objects, and people, in order to sense, compute and communicate data. In the DAPHNE project, these sensors transmit each person’s data wireless to their mobile phone, enabling the user to monitor their individual exposure to pollution,” the statement said.

The project will also provide for larger versions of the same types of monitors, with additional sensors to measure concentrations of nitrogen dioxide and ozone, it said, adding, “These will be attached to lamp posts in order to create a network of monitors to measure air pollution levels across Delhi.”

The data from the solar-powered lamp post monitors will then be uploaded via cellular network and shared with those taking part in the study.

The information will enable users find the cleanest and shortest route between places in the city based on up-to-date information, personalised to their condition.

The devices have been developed at the Centre for Speckled Computing in the School of Informatics at the University of Edinburgh.

According to the statement, the project was awarded 1,165,209 pounds by the UK’s Medical Research Council and Natural Environment Research Council, and is funded in India by the Department of Biotechnology and the Ministry of Earth Sciences.

The Indian partners include Sri Ramachandra University, Chennai, AIIMS, Delhi, Delhi University College of Medical Sciences, IIT Delhi, IIT Kanpur and INCLEN, which is a ‘not

for profit' research organisation conducting multi- disciplinary studies on high priority global health issues.

The UK Partners include the University of Edinburgh (Centre for Speckled Computing, School of Informatics and Centre for Cardiovascular Science), Imperial College (National Chest and Heart Institute) and the Institute for Occupational Medicine.

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### REGULAR YOGA CAN SLOW DOWN AGEING OF BRAIN: STUDY

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Practising yoga regularly can slow down ageing of the brain and helps it stay young, claims a study.

The study by the researchers of the Defence Institute of Physiology and Allied Sciences (DIPAS), said that yoga might help in prevention of age-related degeneration by changing cardiometabolic risk factors and brain-derived neurotrophic factors among men.

DIPAS is a laboratory of the Defence Research and Development Organisation (DRDO).

The research study, which was published in the American Ageing Association, focused not only on the brain but comparative studies were conducted on hypertension, blood pressure, heart rate, and stress.

According to the researchers, a brain develops till the age of 20-30. After that, development of the brain halts and after 40 years, its slow degeneration starts.

As part of the study, done by Rameswar Pal, Som Nath Singh, Abhirup Chatterjee and Mantu Saha, 124 healthy and physically active men aged between 20 and 50 years were randomly selected and divided into three age groups — 20–29, 30–39, and 40–50 years.

Inclusion criterion were normal healthy and physically active males, absence of disease which could have contributed to obesity, hypertension, and neurological disorders, not in medication and no prior knowledge of yoga. Smokers, alcoholics, and tobacco eaters were excluded from the study.

The respondents were made to practice yoga for one hour everyday for three months.

The blood pressure which was recorded at 122/69 in the age group of 20-29 before yoga reduced to 119/68 (systolic pressure is 119 and the diastolic pressure is 68) after doing yoga.

Similarly, the blood pressure which was 134/84 among the respondents (40-50) came down to 124/79 after yoga.

Cortisol, which is a stress hormone released by the adrenal glands and helps body deal with stressful situations was 68.5 per cent in the age group of 20-29 which declined to 47.4 after the exercise.

The cortisol level which was 95 before yoga reduced to 72.7 after three months of yoga in the group 40-50 years.

Further, dopamine and serotonin levels which effectively improve motivation, focus, mood and instill positivity were found to have improved in all the groups after yoga.

Those having low dopamine levels may experience feelings of depression, boredom, or apathy. They may lack the energy and motivation to carry out ordinary tasks, the researchers said.

“Based on the results of the study, it may be concluded that the ageing process has an active role on degenerative changes in autonomic functions, and monoamines as well as levels of BDNF, which may revert back towards normal or near- normal levels through yogic practice in healthy active males,” the study said.

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### INDIA, US WORKING TOGETHER TO FIGHT TB, DENGUE: US ENVOY

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India and the United States are working together to develop vaccines against diseases such as tuberculosis and dengue, Washington's envoy to New Delhi Kenneth Juster said today, describing issues related to health as an “important shared” responsibility.

In his first policy speech after taking over as the ambassador to India, Juster said the two nations were also engaged in the “Global Health Security Agenda”, which included acting to combat anti-microbial resistance and strengthening the detection and prevention of epidemics.

The agenda is a partnership of nations, international bodies and non-governmental stakeholders on health.

“Issues related to health, in particular, are an important shared responsibility, not just because of their direct impact on the safety and well-being of our people, but because of their indirect impact on economic productivity and overall social welfare,” he said.

Juster said India and the US were looking at novel ways to manage disease.

“We jointly developed the first indigenous Indian vaccine for rotavirus, and are now cooperating to develop vaccines to combat tuberculosis, dengue and other emerging global threats,” he added.

The health agenda of the two countries addressed the complex problem of HIV as well as the growing burden of non-communicable diseases, the envoy said.

“We are also engaged in the Global Health Security Agenda, which includes acting to combat antimicrobial resistance and strengthen detection, prevention (of) and response to epidemics,” he said.

Juster said a fourth pillar of the India-US partnership was the focus on sustainable and inclusive development with regard to the welfare of the people. This included critical work in science, technology and health, he pointed out.

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“Our US-India Science and Technology Endowment Fund has supported a range of innovative projects, including those to advance health care, improve the environment and modernise agriculture.

“And beyond earth and into space, NASA and ISRO scientists frequently collaborate – demonstrating that there truly are no boundaries to our partnership,” he said.

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### **SOCIAL SCIENCES DEAN CONFINED STUDENTS FOR ATTENDANCE, ALLEGES JNUSU**

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JNU Students Union today alleged that Dean of School of Social Sciences Prof Pradipta Chowdhary “wrongfully confined” a group of 25 students for boycotting the compulsory attendance.

“In a highly condemnable incident today, 25 students of Centre for Economic Studies and Planning of School of Social Sciences were wrongfully confined and forced to sign attendance sheets by Prof Chowdhary,” JNUSU President Geeta Kumari said in a statement.

Chowdhary did not respond to calls or messages.

The incident took place at 2.30 pm in ‘Monetary and Banking Institutions’ lecture when the students refused to sign the attendance sheet in accordance with the JNUSU’s call for boycott of compulsory attendance, the statement said, adding Chowdhary refused to allow students to leave without signing the attendance sheet.

In October last year, Chowdhary was appointed as Dean by the Vice Chancellor “superseding five senior professors”, one of the moves by the administration that attracted flak from the teachers community.

Jawaharlal Nehru University administration has made minimum 75 per cent attendance compulsory for all students.

Meanwhile, JNU Teachers Association yesterday announced its decision to boycott administration’s order making attendance compulsory for students, saying it was an “unproductive” and “meaningless” form of bureaucratic work for teachers.

Early this month, JNU Students Union had too announced its decision to boycott the administration’s move.

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### **INDIA, CANADA MOU ON SCIENTIFIC COOPERATION GETS CABINET NOD**

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The Cabinet today cleared a pact between India and Canada to enhance cooperation in the field of science and technology, ahead of the expected visit of Canadian Prime Minister Justin Trudeau to New Delhi.

The MoU will foster scientific cooperation between Research and Development and academic institutions of India and Canada.

“An innovative model of R&D cooperation between India and Canada will be implemented under a MoU concluded by the Department of Science and Technology with the Natural Sciences and Engineering Research Council (NSERC) of Canada,” a government statement said.

The MoU comes ahead of Trudeau’s India visit which is likely to take place in the first quarter of this year.

Under this MoU, the India-Canada Centre for Innovative Multidisciplinary Partnership to Accelerate Community Transformation and Sustainability (IC-IMPACTS) programme will be supported to promote India-Canada multidisciplinary research partnerships.

The participants will include researchers from scientific organisations, academia and R&D laboratories from India and Canada.

This will help to develop institutional networking and support the establishment of connections between scientific organisations, scientists and specialists of India and Canada, the statement said

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### **IIT-K STARTS TEXT, AUDIO SERVICE RELATED TO HINDU SCRIPTURES**

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Indian Institute of Technology, Kanpur, credited with developing many technological wonders including the world’s smallest satellite, has now started a text and audio service related to Hindu scriptures, an official said.

The move, which could prove to be controversial, is the first by an IIT and has led to a sudden spurt in the online readership of its decade-old dormant website.

IIT Director Mahendra Aggarwal rejected criticism that the step was an attempt to promote Hindu religion.

Srimad Bhagwad Gita, Ramcharitmanas, Brahma Sutra, Yoga Sutra, Shri Ram Mangal Das and Narada Bhakti are among the nine sacred texts uploaded on the IIT portal - [www.gitasupersite.iitk.ac.in](http://www.gitasupersite.iitk.ac.in).

The IIT’s official portal is also offering Sanskrit renditions of the Sundarkand and Balakkand of the ‘Valmiki Ramayan’.

Vedas, Puranas, Upanishads, Srimad Bhagwad Gita, Ram Charit Manas, Valmiki Ramayan, Brahma Sutra, Yog Sutra, Vedanta concept map, Narada Bhakti Sutra concept map — anything and everything spiritual - is available on this repository of Indian philosophical texts, according to officials.

Though the original texts are in Sankrit, these can be viewed in Assamese, Bengali, Devnagari, Gujarati, Kannada, Malayalam, Oriya, Punjabi, Tamil, Telugu and Roman scripts. Audio clips of various ‘shlokas’ have also been made available.

Earlier, the website was registering the visits of just few hundred users which has now been crossed a record of 25,000

hits a day, Professor, Computer Science and Engineering, IIT-K, T V Prabhakar told PTI.

“This project was aimed at converting ancient Indian knowledge into a contemporary format accessible on the internet. Earlier the website used to register only 500 hits a day on an average,” he said.

Previously the site was popular only among serious students of Gita and other philosophical texts but now the common man can also access it, he said.

IIT Director Mahendra Aggarwal rejected criticism in certain quarters that the website was an attempt to promote Hindu religion through these services.

With the new services on Hindu sacred texts, people have come to know that the premier institute has also been working for the advancement of traditional Indian wisdom stored in scriptures like the Vedas, Puranas, Upanishads, Ramayana and the Gita, he said.

The institute has been decoding a number of such scriptures for the common man in different languages, he said. The website offers the facility of instant transliteration in a preferred language along with Sri Sankara’s commentary.

“We hope to put up English translations of Sutras as well as Sankara’s commentary very soon,” Prabhakar said. IIT-K is already credited with developing innumerable technological wonders, including the world’s smallest satellite, he said.

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### GOVT HEALTHCARE PROFESSIONALS OPPOSE NMC BILL IN ITS PRESENT FORM

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Healthcare professionals in the government sector, including the faculty and resident doctors of AIIMS, have rejected the National Medical Commission Bill in its present form, that seeks to replace the Medical Council of India with a new body.

The bill has been sent to a parliamentary standing committee following protests by doctors across the country claiming that the proposed legislation would “cripple” the functioning of medical professionals by making them completely answerable to the bureaucracy and non-medical administrators.

The committee has been asked to give its report before the Budget session of Parliament set to commence on Jan 29.

According to AIIMS resident doctors, the National Medical Commission (NMC) Bill requires a complete makeover rather than amendments.

“It (the Bill) promotes bureaucratisation and politicisation of medical education and doesn’t provide independence to the NMC. It will be more like a puppet in the hands of government and bureaucrats. Most of the members are nominated by government and suggested by bureaucrats,” they said in a statement.

Discussion on the NMC Bill was organised by Resident Doctors’ Association (RDA) of AIIMS and attended by the vice

president of Delhi Medical Association and president Joint Action Council of Service Doctor Organisation (JACSDO) Dr Rajeev Sood, Delhi Medical Council registrar Dr Girish Tyagi.

Representatives of RDA AMU, Aligarh, PGI Chandigarh, Lady Hardinge hospital, RML hospital were among those who attended the meeting.

Participants of the meeting said the proposal of fees regulation of up to 40 per cent and providing free hand to private medical colleges over it will promote capitalisation and will increase the cost of medical education.

They said there was no strict guideline in the Bill to regulate functioning of private medical colleges.

While welcoming the National Licentiate Examination (NLE), which all medical graduates will have to clear to get practising licences, as proposed in the Bill, the participants of the meeting claimed that there is no clear description on how will this exam will be conducted.

They opposed the Bill’s proposal of allowing practitioners of alternative medicines, such as homoeopathy and ayurveda, practise allopathy after completing a “bridge course”

“This is most unacceptable. Medical sciences and modern medicine are complicated issues to understand and the government must consult medical professional before taking such irrelevant decisions because by doing so it will play with the health of Indians,” a senior doctor said.

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### CIC PULLS UP APPLICANT SEEKING ANSWERS TO COMPLEX MEDICAL TOPICS

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The Central Information Commission has pulled up an RTI applicant for seeking answers to “inane” medical science queries saying it was a “misuse” of the act to harass public officials.

The case pertains to Suraj Prakash who had approached AIIMS, ILBS, GB Pant Hospital, PGIMER, Chandigarh, and National Organ and Tissue transplant organisation at Safdarjung hospital here.

When the appeal filed by G B Pant Hospital came before the Central Information Commission, Information Commissioner Yashovardhan Azad termed it as misuse of the RTI Act.

The applicant had sought to know from the premier institutes the definitions (as per King’s College, London criteria), symptoms, causes, treatment, precautions monitoring 18 complex medical conditions related to liver transplant, Pneumonitis Sepsis, Small For Size syndrome, Ischemic Necrosis of liver, bile duct dilation, portal vein thrombosis etc.

He had also sought to know information on handling of liver transplant patients, technical causes of conditions developing after that, waiting period criteria for the patients among others.

During the hearing before the CIC, noted RTI activist

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Subhash Agrawal represented the G B Pant hospital to argue against the disclosure of the information as it was available in medical journals and the application seemed like abuse of the RTI Act.

“These are academic queries, to be studied from medical books and journals, not information as envisaged under Section 2(f) of the RTI Act,” Azad said while agreeing with the contention of Agrawal.

Azad said seeking these information through an RTI application actually is a abuse of the process of law and if such a request is allowed, the day will not be far when information from any textbook will be sought to be answered by filing an RTI application.

“Clearly, that was neither the Legislative intent nor purpose behind the enactment of the RTI Act aimed at transparency and establishing a practical regime of disbursement of information,” Azad said.

He said simply because the RTI Act does not mandate any reason to be furnished by the information seeker to state his intent behind the RTI application, does not grant the citizen the liberty to misuse the act to “harass” the public officials with inane queries.

Dismissing the application, Azad warned the applicant to be careful in future and refrain from abusing the RTI Act “as a weapon or toy at his whims and fancies.”

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### **PROTON THERAPY MAY BE SOON USED FOR CANCER TREATMENT AT TWO HOSPITALS: OFFICIAL**

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Proton beam therapy is expected to be soon used for cancer treatment at two hospitals in the country, the Principal Scientific Advisor to the Centre said.

R Chidambaram said research will be taken up to develop indigenous version of proton beam therapy (PBT).

“Proton beam therapy is expected to be put to use to treat cancer patients at Tata Memorial Centre, Mumbai and at a private hospital in Chennai shortly,” he said.

Chidambaram was talking to reporters after taking part in the inaugural session of the Indian Particle Accelerator Conference (InPAC- 2018) at Raja Ramanna Centre for Advanced Technology here.

The four-day meet has been organised by the Board of Research in Nuclear Sciences of the Department of Atomic Energy, and the Indian Society for Particle Accelerators (ISPA).

Chidambaram, a noted experimental physicist, said research to develop a fully indigenous version of proton beam therapy is going to be started soon.

He said research projects are underway to bring forth scientific aspects of the Indian traditional medicine systems like Aryurveda.

Proton therapy is a type of radiation treatment that uses protons to treat cancer. A proton is a positively charged particle. At high energy, protons can destroy cancer cells.

The therapy painlessly delivers radiation through the skin from a machine outside the body.

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### **INDIA'S FASTEST SUPERCOMPUTER ESTABLISHED AT PUNE'S IITM**

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Union Minister for Science and Technology Harsh Vardhan dedicated India's fastest and first “multi-petaflops” supercomputer to the nation here.

Petaflops is a measure of a computer's processing speed.

Christened “Pratyush”, meaning the sun, the High Performance Computing (HPC) facility has been established at the Indian Institute of Tropical Meteorology (IITM), Pune, and will be a national facility for improving weather and climate forecasts, an IITM release said.

While inaugurating the facility, the minister said that it would be India's number one HPC facility in terms of peak capacity and performance.

The IITM release added that the facility would help the country with better forecasts in terms of monsoon, extreme events, tsunamis, cyclones, earthquakes, air quality, lightning, fishing, hot and cold waves, flood and drought among others.

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### **ENV MINISTRY SEEKS IMPROVED AIR CONNECTIVITY FOR GIR**

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The issue of poor air connectivity with Gir National Park in Gujarat has been taken up with the Ministry of Civil Aviation, the environment ministry has told a parliamentary panel.

The environment ministry stated this in its action taken report to a parliamentary standing committee on science and technology, environment and forest.

The ministry has also said that the Gujarat government has also been asked to take action regarding the recommendation of the committee to remove encroachments from around the Park.

“Encroachments and construction around the national parks and sanctuaries are in purview of the states. In so far as Gir National Park is concerned, state government of Gujarat has been communicated to take action according the recommendation of the committee.

“The ministry has also taken up the matter with Ministry of Civil Aviation regarding poor air connectivity of Gir National Park and requested for improving air connectivity,” the Ministry told the panel chaired by Congress leader Anand Sharma.

The panel in its 308th report has said that although encroachments and construction around national parks and sanctuaries is in the purview of the states, the Ministry can always

impress upon the concerned state governments to comply with the law in this regard.

The action taken report came after the committee in one of its earlier reports had observed that Gir national park is very poorly connected with air and had recommended that the environment ministry should take up the matter with the central and state government agencies so that it can be improved.

The committee in one of its earlier reports had noted that granting of licences to dhabhas and hotels being run near the national park needs to be reviewed keeping in view the fact that a lot of garbage is generated and thrown by them in the area.

The committee had then recommended that illegal construction or encroachment in and around national park should be viewed “seriously” and stringent steps must be taken in this direction.

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### IITKGP AWARDS 1ST LEARN-EARN-RETURN FELLOWSHIP TO 3 STUDENTS

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IIT Kharagpur has awarded the first ever Learn-Earn-Return Fellowship to three of its 1st year students on the occasion of Annual Alumni Meet.

The award had been instituted by IIT KGP Director Prof P P Chakrabarti in July 2016 with the funding crowd sourced from the alumni.

Jyoti Agrawal, Jyotisman Das and Rathin Singha from the Department of Computer Science and Engineering were the recipients.

Each of the students will receive Rs 10,000 per month for 4 years as cash award.

At the end of the first semester of the 1st year, the fellowship will be awarded based on JEE Advanced rank. From second semester onward the recipients of the award would have to maintain a CGPA (Cumulative Grade Point Average) 9.

The fellowships were awarded on the occasion of the Annual Alumni Meet on January 13, 2018 in the presence of about 300 alumni who came from India and abroad.

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“The concept of Learn-Earn-Return (LER) Fellowship is to support a student and enable him/her with the vision of extending similar support as an alumnus towards future generations of students at IIT Kharagpur. So it’s a full circle of life which LER represents,” Prof Chakrabarti said.

About 120 alumni from all over the world and India donated for the fellowship since its launch.

“LER is unique in the way that it enables us to meet various expenses of students associated with academics and research projects. I have taken the pledge to give back to my Alma Mater as I grow in my life,” said Jyotisman Das.

Rathin Singha pointed out that LER would help him pursue his studies without worrying about financial burden.

“I am elated with the fellowship as it is an honour to stand in front of the alumni and be recipient of their care and affection for us. Also I feel the girls in the country and their parents should know about it and feel motivated to pursue career in engineering,” said Jyoti Agrawal.

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### TALKS UNDERWAY WITH WESTINGHOUSE FOR NUCLEAR POWER PROJECT: GOVT

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Discussions are underway with Westinghouse Electric Company for a “viable project proposal” to set up six nuclear power reactors, the government informed Rajya Sabha.

The project is planned to be set up at Kovvada in Andhra Pradesh and comprises six units of 1,208 MW each, Union Minister of State Jitendra Singh, who holds multiple portfolios, said in a written reply to a question.

“Presently, discussions with M/s. Westinghouse Electric Company (WEC) are in progress to arrive at a viable project proposal for setting up six nuclear power reactors,” he said.

Details on the cost and schedule of the project will emerge after the proposal is finalised.

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### **NASA SCIENTISTS TO SURVEY UNEXPLORED STRETCH OF ANTARCTIC ICE**

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A team led by two NASA scientists is all set to embark on a 750-kilometre expedition in one of the most barren landscapes on Earth to survey an unexplored stretch of Antarctic ice.

On December 21, they will begin their two-to three-week traverse in an arc around the South Pole, the NASA said.

The expedition will ultimately provide the best assessment of the accuracy of data collected from space by the Ice Cloud and land Elevation Satellite-2 (ICESat-2), set to launch in 2018, according to the US space agency.

They are packing extreme cold-weather gear and scientific instruments onto sleds pulled by two tank-like snow machines called PistenBullys, the NASA said.

With a fast-firing laser instrument, ICESat-2 will measure the elevation of ice sheets and track change over time.

Even small amounts of melt across areas as vast as Greenland or Antarctica can result in large amounts of meltwater contributing to sea level rise.

To help document this, ICESat-2's height change measurements will have a precision of less than an inch- ground-truthed, in part, with efforts like this Antarctic campaign.

The team will collect precise GPS data of the elevation at 88 degrees south, where ICESat-2's orbits converge, providing thousands of points where the survey measurements can be compared to satellite data.

"This traverse provides an extremely challenging and extremely cold way to assess the accuracy of the data," said Kelly Brunt from NASA.

"ICESat-2's datasets are going to tell us incredible things about how Earth's ice is changing, and what that means for things like sea level rise," Brunt said.

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### **'NASA TO SCREEN NEW STAR WARS FILM IN SPACE'**

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NASA is planning a special screening of the latest Star Wars film for astronauts onboard the International Space Station (ISS).

According to a NASA official, 'Star Wars: The Last Jedi' will be screened for the crew members aboard the orbital space laboratory.

"(I) can confirm the crew will be able to watch it on orbit," NASA Public Affairs Officer Dan Huot was quoted as saying by Inverse.

However, there is no timetable on when this screening will take place.

"Don't have a definitive timeline yet. They typically get movies as digital files and can play them back on a laptop or a standard projector that is currently aboard," Huot said.

It is possible that the movie, which releases worldwide on December 15, will be sent inside the SpaceX dragon capsule headed to the ISS this week, the report said.

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### **STUDENT SATELLITE HELPS SOLVE MAJOR SPACE MYSTERY**

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A 60-year-old mystery regarding the source of some energetic and potentially damaging particles in the Earth's radiation belts has been solved, using data from a student operated shoebox-sized satellite.

The results indicate energetic electrons in Earth's inner radiation belt - primarily near its inner edge - are created by cosmic rays born from explosions of supernovas, said Professor Xinlin Li from University of Colorado at Boulder in the US.

Earth's radiation belts, known as the Van Allen belts, are layers of energetic particles held in place by the planet's magnetic field.

The team showed that during a process called "cosmic ray albedo neutron decay" (CRAND), cosmic rays entering Earth's atmosphere collide with neutral atoms, creating a "splash" which produces charged particles, including electrons, that become trapped by Earth's magnetic fields.

The findings have implications for understanding and better forecasting the arrival of energetic electrons in near-Earth space, which can damage satellites and threaten the health of space-walking astronauts, said Li.

"We are reporting the first direct detection of these energetic electrons near the inner edge of Earth's radiation belt," said Li, lead author of the study published in the journal Nature.

"We have finally solved a six-decade-long mystery," said Li.

Soon after the discovery of the Van Allen radiation belts in 1958, both American and Russian scientists concluded that CRAND was likely the source of high-energy protons trapped in Earth's magnetic field.

However, over the intervening decades, no one successfully detected the corresponding electrons that should be produced during the neutron decay.

The CubeSat mission, called the Colorado Student Space Weather Experiment (CSSWE), houses a small, energetic particle telescope to measure the flux of solar energetic protons and Earth's radiation belt electrons.

Launched in 2012, CSSWE has involved more than 65 CU Boulder students and was operated for more than two years from a ground station they built on the roof of a building on campus.

“This is really a beautiful result and a big insight derived from a remarkably inexpensive student satellite, illustrating that good things can come in small packages,” said Daniel Baker, co-author of the study.

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### ROWLING, MALALA, USAIN BOLT PICKED OUT IN CONSTELLATIONS

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Astronomers have selected a new set of shapes for constellations representing stars from sports, entertainment and politics, including a book in honour of Malala Yousafzai and Harry Potter’s glasses for JK Rowling.

The new constellations based on modern day inspirational figures were created in a bid to get more children looking up to the stars and interested in the universe.

The new star alignments created by researchers at The University of Birmingham in the UK also honour well-known figures such as tennis star Serena Williams and athlete Usain Bolt.

Some of the other shapes include the boots of Paddington Bear and the trademark round-rimmed glasses worn by Harry Potter.

The new constellations were created after research showed that the traditional classical star formations, based on the zodiac and characters from ancient mythology, are failing to inspire children today.

“We really hope these new creations will help people of all ages develop their interest in space and astronomy, working to inspire the next generation of astronomers to take an interest in the field,” said Emma Willett, who led the university’s research team.

There are currently 88 existing constellations officially recognised by the International Astronomical Union. The new creations include well known stars to make it easier to find them in the night sky, researchers said.

Although they are not official, children are still invited to attempt to pick them out, they said.

The process of developing the new constellations involved a careful analysis of star maps for different regions of the sky by researchers.

They were developed alongside the Big Bang Fair, an annual festival designed to encourage children to take an interest in science and engineering.

Beth Elgood, Director of Communications at EngineeringUK, who organise The Big Bang Fair, said: “Stargazing is a great way to spark young people’s interest in the universe and inspire them to find out more.

“Inspiration is at the heart of The Big Bang Fair, where young visitors, their teachers and parents have the chance to get hands-on with engaging STEM activities, workshops and shows

and discover where science and maths could take them in the future,” said Elgood.

Paddington Bear, in recognition of the author Michael Bond who died in June, is most visible in December, taking in stars including Bellatrix and Betelgeuse, researchers said.

Usain Bolt’s pointing stance is best seen in November and incorporates eight stars including Orionis, Tau Tauri and Aldebaran, they said.

Serena Williams’ racket can be seen best in April and takes in Pherkad, which was once half of a binary north star, Kochab, which has a planet and is heavier than Jupiter, and Thuban, which was once the north star.

The Babylonians are thought to have been the first to create constellations, almost 4,000 years ago. The system was adopted by the Ancient Greeks and one of the oldest descriptions of them comes from a poem written by Aratus in about 270 BC.

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### ‘LOVE HORMONE’ WITH LESS COMPLICATIONS CREATED

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Researchers have developed a synthetic version of the ‘love hormone’ oxytocin, which is less likely to have side effects.

The hormone regulates labour and fundamental social behaviours such as maternal care, partnership bonding, social interactions, and stress and anxiety responses.

“The downside to oxytocin is that it activates a number of receptors, some of which can lead to unwanted side effects,” said Markus Muttenthaler from University of Queensland in Australia.

“For example, oxytocin is used to progress labour but it can have serious side effects such as cardiovascular problems or uterine rupture when used for too long or at a too-high dose,” said Muttenthaler.

The team created a new molecule by introducing small modifications to the structure of oxytocin, which reduced the activity of receptors linked to some side effects.

“The new compound we have developed is just as potent as oxytocin, but shows improved selectivity for the oxytocin receptor, potentially reducing dangerous side effects,” said Muttenthaler.

“It did not activate heart muscle cells, and produced a more regular contraction pattern in uterine tissue, which indicates improved safety for mother and baby,” he said.

Oxytocin is being investigated as a treatment for a variety of high-profile conditions such as autism, migraine, schizophrenia, anxiety and stress, researchers wrote in the journal *Science Signaling*.

The researchers also tested the new compound in a mouse model and found those treated with the new compound overcame social fear rapidly, highlighting its therapeutic potential to treat social phobia and anxiety, or autism.

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“The new compound is not only a promising lead for future treatments but also important for understanding the role of the oxytocin receptor in health and disease,” Muttenthaler said.

“We are hoping to secure funding to improve the drug properties of this lead and carry out more extensive preclinical studies,” he said.

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### **NEW HORIZONS' NEXT TARGET MAY HAVE A MOON: NASA**

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The next flyby target of NASA's New Horizons' mission, which is a peanut-shaped object a billion miles past Pluto, might have company in the form of a small moon, astronomers say.

The latest theory on the object named 2014 MU69 comes as New Horizons team continues to analyse telescope data on the target of a New Year's Day 2019 flyby, NASA said.

“We really won't know what MU69 looks like until we fly past it, or even gain a full understanding of it until after the encounter,” said New Horizons science team member Marc Buie, of the Southwest Research Institute in the US.

“But even from afar, the more we examine it, the more interesting and amazing this little world becomes,” said Buie.

The data that led to these hints at MU69's nature were gathered over six weeks in June and July, when the team made three attempts to place telescopes in the narrow shadow of MU69 as it passed in front of a star, NASA said.

The most valuable recon came on July 17, when five telescopes deployed in Argentina were in the right place at the right time to catch this fleeting shadow - an event known as an occultation - and capture important data on MU69's size, shape and orbit.

That data raised the possibility that MU69 might be two like-sized objects, or what is known as a binary.

The prospect that MU69 might have a moon arose from data collected during a different occultation on July 10, by NASA's airborne Stratospheric Observatory for Infrared Astronomy (SOFIA).

Focused on MU69's expected location while flying over the Pacific Ocean, SOFIA detected what appeared to be a very short drop-out in the star's light.

Buie said further analysis of that data, including syncing it with MU69 orbit calculations provided by the European Space Agency's Gaia mission, opens the possibility that the “blip” SOFIA detected could be another object around MU69.

“A binary with a smaller moon might also help explain the shifts we see in the position of MU69 during these various occultations.

“It's all very suggestive, but another step in our work to get a clear picture of MU69 before New Horizons flies by, just over a year from now,” Buie added.

That flyby will be the most distant in the history of space exploration. Ancient Kuiper Belt object MU69, just discovered in 2014, is more than 6.5 billion kilometres from Earth, NASA researchers said.

Kuiper Belt is a circumstellar disc in the outer solarsystem, extending from the orbit of Neptune to about 50 AU from the Sun.

It appears to be no more than 30 kilometres long, or, if a binary, each about 15-20 kilometers in diameter.

Like other objects in the Kuiper Belt, MU69 offers a close-up look at the remnants of the ancient planet-building process, small worlds that hold critical clues to the formation of the outer solar system.

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### **'LESS MEAT, EXERCISE MAY CAUSE MENTAL DISTRESS IN YOUNG ADULTS'**

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Young adults who eat meat less than three times a week and exercise less may be at an increased risk of mental distress, a study claims.

However, the mental health of a mature adult (aged over 30 years) seems to be more sensitive to regular consumption of coffee and carbohydrates.

Researchers found that mood in young adults (18-29) seems to be dependent on food that increases availability of neurotransmitter precursors and concentrations in the brain (meat).

“Young adult mood appears to be sensitive to build-up of brain chemicals,” said Lina Begdache, from the Binghamton University in the US.

“Regular consumption of meat leads to build-up of two brain chemicals (serotonin and dopamine) known to promote mood. Regular exercise leads to build-up of these and other neurotransmitters as well,” Begdache said.

“In other words, young adults who ate meat (red or white) less than three times a week and exercised less than three times week showed a significant mental distress,” she said.

However, mood in mature adults may be more reliant on food that increases availability of antioxidants (fruits) and abstinence of food that inappropriately activates the sympathetic nervous system (coffee, high glycemic index and skipping breakfast).

The findings were published in the journal *Nutritional Neuroscience*.

“Mature adult mood seems to be more sensitive to regular consumption of sources of antioxidants and abstinence of food that inappropriately activates the innate fight-or-flight response (commonly known as the stress response),” Begdache

added.

“With ageing, there is an increase in free radical formation (oxidants), so our need for antioxidants increases. Free radicals cause disturbances in the brain, which increases the risk for mental distress,” she said.

“Also, our ability to regulate stress decreases, so if we consume food that activates the stress response (such as coffee and too much carbohydrates), we are more likely to experience mental distress,” she added.

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### BRAIN MECHANISMS BEHIND DEPRESSION IDENTIFIED: STUDY

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People suffering from major mental disorder have activity and connectivity alterations in their brain regions responsible for reward and memory, according to a study.

The findings, published in the journal *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*, provide clues as to which regions of the brain could be at the root of symptoms, such as reduced happiness and pleasure, in depression.

Researchers at the University of Warwick in the UK used a new approach to measure the influence of one brain region on another, referred to as effective connectivity, in depression.

The approach goes beyond the limitations of previous brain imaging studies, which show if - but not how - activity of different brain regions is related.

“The new method allows the effect of one brain region on another to be measured in depression, in order to discover more about which brain systems make causal contributions to depression,” said Edmund Rolls, from the University of Warwick.

The researchers compared 336 people with major depressive disorder to 350 healthy controls.

Brain regions involved in reward and subjective pleasure received less drive (or reduced effective connectivity) in patients, which may contribute to the decreased feeling of happiness in depression.

In addition, brain regions involved in punishment and responses when a reward is not received had decreased effective connectivity and increased activity, providing evidence for the source of sadness that occurs in the disorder.

Memory-related areas of the brain had increased activity and connectivity in people with depression, which the authors suggest may be related to heightened memory processing, possibly of unpleasant memories, in depression.

“These findings are part of a concerted approach to better understand the brain mechanisms related to depression, and thereby to lead to new ways of understanding and treating depression,” said Rolls.

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### SHATTER-PROOF SMARTPHONE SCREENS IN THE OFFING

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Scientists have found a novel way to alter the structure of glass to improve its resistance to fractures, an advance that may lead to the development of shatter-proof smartphone screens.

“Everyone knows how frustrating it is when you drop your mobile device and get a large crack in the screen,” said Charles Le Losq from Australian National University (ANU).

He said that glass appeared to be structured randomly, but it was actually quite ordered at the microscopic level of a few atoms.

The researchers worked on a type of glass called aluminosilicate, which is used in the screens of mobile devices.

“The glasses we analysed are mostly composed of aluminium and silicon oxides, and can also contain various elements such as sodium, potassium, calcium or magnesium - each element influences the flexibility and resistance of the glass,” said Le Losq, who led the study published in the journal *Scientific Reports*.

Le Losq said the findings also shed light on the crucial role that lava oceans and volcanoes played in the geological evolution of Earth.

The researchers measured the viscosity of molten glass at more than 1,000 degrees Celsius and the density of the glass when cooled and formed.

“Our research findings allow better modelling of present volcanic activity, as well as of the lavas involved in the original formation of Earth and its surface,” Le Losq said.

He said the research could also inform ways to produce glass suitable for storing nuclear waste more effectively than current practices.

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### STAR WARS-LIKE BIONIC HAND MAY HELP AMPUTEES PLAY PIANO, DRUMS

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Scientists have created an ultrasonic sensor that allows amputees to control each of their prosthetic fingers individually, paving the way for a Star Wars-like bionic hand.

The sensor provides fine motor hand gestures that are not possible with current commercially available devices.

The first amputee to use this technology is Jason Barnes, a musician who lost part of his right arm five years ago.

Barnes is now able to play piano and drums for the first time since his accident.

The device is inspired by the bionic hand given to Luke Skywalker in the Star Wars series, the researchers said.

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“Our prosthetic arm is powered by ultrasound signals,” said Gil Weinberg, from the Georgia Tech College in the US.

“By using this new technology, the arm can detect which fingers an amputee wants to move, even if they don’t have fingers,” Weinberg said.

Barnes no longer has his hand and most of his forearm but does have the muscles in his residual limb that control his fingers.

Earlier, Barnes was using prosthesis attached to his muscles and controlled by electromyogram (EMG) sensors.

“EMG sensors are not very accurate. They can detect a muscle movement, but the signal is too noisy to infer which finger the person wants to move,” Weinberg said.

“We tried to improve the pattern detection from EMG for Barnes but could not get finger-by-finger control,” he said.

The researchers have now attached an ultrasound probe to the arm. The same kind of probe doctors use to see babies in the womb could watch how Barnes’ muscles moved.

“If this type of arm can work on music, something as subtle and expressive as playing the piano, this technology can also be used for many other types of fine motor activities such as bathing, grooming and feeding,” said Weinberg.

“I also envision able-bodied persons being able to remotely control robotic arms and hands by simply moving their fingers,” he said.

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### **JUPITER’S GREAT RED SPOT ONE-AND-A-HALF EARTHS WIDE: NASA**

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Jupiter’s Great Red Spot - the solar system’s most famous storm - is almost one-and-a-half Earths wide and penetrates about 300 kilometres into the planet’s atmosphere, according to data collected by NASA’s Juno spacecraft.

Other revelations from the mission include that Jupiter has two previously uncharted radiation zones, NASA researchers said.

“One of the most basic questions about Jupiter’s Great Red Spot is: how deep are the roots?” said Scott Bolton, Juno’s principal investigator from the Southwest Research Institute in the US.

“Juno data indicate that the solar system’s most famous storm is almost one-and-a-half Earths wide, and has roots that penetrate about 300 kilometres into the planet’s atmosphere,” said Bolton.

The science instrument responsible for this in-depth revelation was Juno’s Microwave Radiometer (MWR).

“Juno’s Microwave Radiometer has the unique capability to peer deep below Jupiter’s clouds,” said Michael Janssen, Juno co-investigator from NASA’s Jet Propulsion Laboratory.

“It is proving to be an excellent instrument to help us get to the bottom of what makes the Great Red Spot so great,”

said Janssen.

Jupiter’s Great Red Spot is a giant oval of crimson-coloured clouds in Jupiter’s southern hemisphere that race counter-clockwise around the oval’s perimeter with wind speeds greater than any storm on Earth.

Measuring 16,000 kilometres in width as of April 3, this year, the Great Red Spot is 1.3 times as wide as Earth.

“Juno found that the Great Red Spot’s roots go 50 to 100 times deeper than Earth’s oceans and are warmer at the base than they are at the top,” said Andy Ingersoll, professor at Caltech and a Juno co-investigator.

“Winds are associated with differences in temperature, and the warmth of the spot’s base explains the ferocious winds we see at the top of the atmosphere,” said Ingersoll.

The future of the Great Red Spot is still very much up for debate. While the storm has been monitored since 1830, it has possibly existed for more than 350 years.

In the 19th century, the Great Red Spot was well over two Earths wide. However, in modern times, the Great Red Spot appears to be diminishing in size, as measured by Earth-based telescopes and spacecraft, NASA said.

At the time NASA’s Voyagers 1 and 2 sped by Jupiter on their way to Saturn and beyond, in 1979, the Great Red Spot was twice Earth’s diameter.

Today, measurements by Earth-based telescopes indicate the oval that Juno flew over has diminished in width by one-third and height by one-eighth since Voyager times.

Juno also has detected a new radiation zone, just above the gas giant’s atmosphere, near the equator. The zone includes energetic hydrogen, oxygen and sulphur ions moving at almost light speed.

“The closer you get to Jupiter, the weirder it gets,” said Heidi Becker, Juno’s radiation monitoring investigation lead at JPL.

“We knew the radiation would probably surprise us, but we didn’t think we would find a new radiation zone that close to the planet,” said Becker.

The new zone was identified by the Jupiter Energetic Particle Detector Instrument (JEDI) investigation.

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### **CLEANER, CHEAPER WAY TO TURN METHANE INTO FUEL**

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Researchers have developed a new cleaner and cheaper way to produce hydrogen fuel from methane and electricity in just one step.

Hydrogen is an excellent fuel which, due to its high energetic density and zero greenhouse gas emission, is essential in a great number of industrial processes, researchers said.

Its combination with oxygen in the atmosphere produces energy and water as its sole by-product, making it one

of the main candidates to substitute fossil fuels as a source of energy for the transport sector.

Results by researchers, including those from Valencia's Polytechnic University (UPV) in Spain, have applications in the field of hydrogen fuel cell vehicles as well as the chemical industry.

The new method is capable of generating hydrogen from methane gas and electricity in just one step and with near-zero energy loss.

"The development and introduction in the market of hybrid and electric cars will allow us to reduce the impact of transport in CO<sub>2</sub> emissions in coming years, and as a result, the greenhouse effect on the planet," said Jose Manuel Serra, research professor at Superior Council of Scientific Investigations (CSIC).

Researchers developed a gas separation membrane reactor which is operated electronically and allows for the endothermic production of hydrogen with a near-zero energy loss.

"Our investigations show that it is possible to generate compressed hydrogen in just one step with high efficiency from electricity and methane gas or biogas and, simultaneously, isolate the CO<sub>2</sub> and not release it into the atmosphere," Serra said.

"Our method allows for the hydrogen to be produced at high pressure in a distributed manner, which means it could be produced in petrol stations, residential areas, garages or farms," Serra added.

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### **NASA'S KEPLER PROBE USES GOOGLE AI FOR LATEST DISCOVERY**

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NASA's planet-hunting Kepler space telescope has made its latest discovery using machine learning from Google, the US space agency said.

NASA will announce the discovery made by Kepler, which has been searching for alien worlds since 2009, on December 14.

"The discovery was made by researchers using machine learning from Google," NASA officials said.

"Machine learning is an approach to artificial intelligence, and demonstrates new ways of analysing Kepler data," they said.

Kepler has gazed at more than 150,000 stars and continues to transmit back data that leads to important discoveries of celestial objects in our galaxy, including first-time observations of planets outside our solar system.

When Kepler launched in March 2009, scientists did not know how common planets were beyond our solar system, according to NASA.

Thanks to Kepler's treasure trove of discoveries, astronomers now believe there may be at least one planet orbiting every star in the sky, the US space agency said.

Kepler completed its prime mission in 2012 and went on to collect data for an additional year in an extended mission.

In 2014, the spacecraft began a new extended mission called K2, which continues the search for planets outside our solar system, known as exoplanets, while introducing new research opportunities to study young stars, supernovae and other cosmic phenomena.

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### **MARS ATMOSPHERE WELL PROTECTED FROM SOLAR WIND: STUDY**

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The atmosphere of Mars is well protected from the effects of the solar wind on ion escape from the planet, despite the absence of a global Earth-like magnetic dipole, a study has found.

Present-day Mars is a cold and dry planet with less than one per cent of Earth's atmospheric pressure at the surface.

However, many geological features indicate the planet had an active hydrological cycle about three to four billion years ago, said researchers from Swedish Institute of Space Physics.

An active hydrological cycle would have required a warmer climate in the planet's early history and therefore a thicker atmosphere, one capable of creating a strong greenhouse effect.

A common hypothesis maintains that the solar wind over time has eroded the early martian atmosphere, causing the greenhouse effect, and thus the hydrological cycle, to collapse.

Unlike Earth, Mars has no global magnetic dipole, but the solar wind instead induces currents in the ionised upper atmosphere (the ionosphere), creating an induced magnetosphere.

"It has long been thought that this induced magnetosphere is insufficient to protect the martian atmosphere," said Robin Ramstad, from Swedish Institute of Space Physics and Umeå University, Sweden.

"However, our measurements show something different," said Ramstad.

The Swedish-led ion mass analyser on Mars Express spacecraft has been measuring the ion escape from Mars since 2004.

In his research, Ramstad combined and compared measurements of the ion escape under varying solar wind conditions and levels of ionising solar radiation, so-called extreme ultraviolet (EUV) radiation.

The results show that the solar wind has a comparatively small effect on the ion escape rate, which instead mainly depends on the EUV radiation.

This has a large effect on estimations of the total amount of atmosphere that has escaped to space.

"Despite stronger solar wind and EUV-radiation levels under the early Sun, ion escape can not explain more than 0.006 bar of atmospheric pressure lost over the course of 3.9 billion years," said Ramstad.

"Even our upper estimate, 0.01 bar, is an insignificant amount in comparison to the atmosphere required to maintain a

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sufficiently strong greenhouse effect, about 1 bar or more according to climate models,” he said.

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### **DIAMOND TURNED INTO GRAPHITE USING X-RAYS**

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Scientists have for the first time turned diamond into graphite using ultra-short flashes of an X-ray laser.

It is a decisive step forward in understanding the fundamental behaviour of solids when they absorb energetic radiation, researchers said.

For the first time, the researchers including Franz Tavella from SLAC National Accelerator Laboratory in the US, were able to follow the graphitisation in a time-resolved manner.

“In addition to these fundamental aspects, understanding the graphitisation process is important for diamond-based technologies, since diamond is increasingly used for practical applications,” said Tavella, first author of the study published in the journal *High Energy Density Physics*.

Diamond and graphite are different forms of carbon that differ in their inner crystal structure. Diamond is the high-pressure phase that forms deep in the earth.

Under normal conditions, diamond is metastable, meaning that it converts back to graphite when the process is initiated with sufficient energy.

There are different ways to trigger the conversion of diamond to graphite, for instance by simply heating the diamond under exclusion of oxygen or even with an aimed mechanical stroke, researchers said.

With heat and high pressure, graphite can be converted into synthetic diamonds that already have quite a market worldwide, they said.

The team used the Italian soft X-ray free-electron-laser FERMI to shoot ultra-short flashes at tiny diamond slices with a thickness of just 0.3 millimetres.

“Usually, if you shoot such intense laser pulses at solid matter, it becomes unordered, or amorphous. Diamond is a different example,” researchers said.

It can switch its internal structure to a different order, thereby turning into graphite.

“In principle, it was known that if you send enough energy into diamond, it should graphitise. But it was not known exactly how this happens,” said Sven Toileikis from German national research centre DESY.

There are two possible paths: the common so-called thermal transition during which the absorbed energy is transferred to the internal crystal lattice of the diamond until it re-organises itself into the graphite structure.

Another is a non-thermal mode, where the energy absorbed by just a small fraction of the electrons in the diamond

changes the internal potential energy surface, triggering a re-arrangement of the crystal lattice, researchers said.

“Non-thermal transition is much faster than thermal, the latter occurring on picosecond timescales,” said Beata Ziaja from DESY. A picosecond is a trillionth of a second.

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### **NEW FORM OF MATTER ‘EXCITONIUM’ DISCOVERED**

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Scientists have proven the existence of new form of matter called excitonium - which was first theorised almost 50 years ago.

Researchers from University of California Berkeley and University of Illinois at Urbana-Champaign in the US studied non-doped crystals of the transition metal dichalcogenide titanium diselenide (1T-TiSe<sub>2</sub>).

Excitonium is a condensate - it exhibits macroscopic quantum phenomena, like a superconductor. It is made up of excitons, particles that are formed in a very strange quantum mechanical pairing, namely that of an escaped electron and the hole it left behind.

It defies reason, but it turns out that when an electron, seated at the edge of a crowded-with-electrons valence band in a semiconductor, gets excited and jumps over the energy gap to the otherwise empty conduction band, it leaves behind a “hole” in the valence band.

That hole behaves as though it were a particle with positive charge, and it attracts the escaped electron.

When the escaped electron with its negative charge, pairs up with the hole, the two remarkably form a composite particle, a boson - an exciton.

In point of fact, the hole’s particle-like attributes are due to the collective behaviour of the surrounding crowd of electrons. However, that understanding makes the pairing no less strange and wonderful, researchers said.

Until now, scientists have not had the experimental tools to positively distinguish whether what looked like excitonium was not in fact a Peierls phase.

Peierls phases and exciton condensation share the same symmetry and similar observables.

Abbamonte and his team were able to overcome that challenge by using a novel technique they developed called momentum-resolved electron energy-loss spectroscopy (M-EELS).

With their new technique, the group was able to measure collective excitations of the low-energy bosonic particles, the paired electrons and holes, regardless of their momentum.

“Ever since the term ‘excitonium’ was coined in the 1960s by Harvard theoretical physicist Bert Halperin, physicists have sought to demonstrate its existence,” said Peter Abbamonte, professor at University of Illinois.

“Theorists have debated whether it would be an insulator, a perfect conductor, or a superfluid - with some convincing arguments on all sides,” Abbamonte said.

“Since the 1970s, many experimentalists have published evidence of the existence of excitonium, but their findings were not definitive proof and could equally have been explained by a conventional structural phase transition,” he said.

The findings, published in the journal *Science*, holds great promise for unlocking further quantum mechanical mysteries, researchers said.

It could also shed light on the metal-insulator transition in band solids, in which exciton condensation is believed to play a part. Beyond that, possible technological applications of excitonium are purely speculative.

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### **NASA EXPLORES ARTIFICIAL INTELLIGENCE FOR SPACE COMMUNICATIONS**

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NASA scientists are planning to use artificial intelligence to better manage the increasing communications between its spacecraft and the Earth.

NASA spacecraft typically rely on human-controlled radio systems to communicate with Earth. Cognitive radio, the infusion of artificial intelligence into space communications networks, could meet demand and increase efficiency, researchers said.

“Modern space communications systems use complex software to support science and exploration missions,” said Janette C Briones, from the NASA’s Glenn Research Center in the US.

“By applying artificial intelligence and machine learning, satellites control these systems seamlessly, making real-time decisions without awaiting instruction,” said Briones.

Specific portions of the electromagnetic spectrum used for communications to various users. However, such channels are limited in number and can cause a bottleneck in the era of increasing communications.

Software-defined radios like cognitive radio use artificial intelligence to employ underutilised portions of the electromagnetic spectrum without human intervention.

These “white spaces” are currently unused, but already licensed, segments of the spectrum. A cognitive radio can use the frequency while unused by its primary user until the user becomes active again.

Cognitive radio switches from one white space to another, using electromagnetic spectrums as they become available.

“The recent development of cognitive technologies is a new thrust in the architecture of communications systems,” said Briones.

“We envision these technologies will make our communications networks more efficient and resilient for missions exploring the depths of space,” she said.

“By integrating artificial intelligence and cognitive radios into our networks, we will increase the efficiency, autonomy and reliability of space communications systems,” she said.

For NASA, the space environment presents unique challenges that cognitive radio could mitigate.

Space weather, electromagnetic radiation emitted by the sun and other celestial bodies, fills space with noise that can interrupt certain frequencies.

“Glenn Research Center is experimenting in creating cognitive radio applications capable of identifying and adapting to space weather,” said Rigoberto Roche, from NASA.

“They would transmit outside the range of the interference or cancel distortions within the range using machine learning,” said Roche.

In the future, a NASA cognitive radio could even learn to shut itself down temporarily to mitigate radiation damage during severe space weather events.

Adaptive radio software could circumvent the harmful effects of space weather, increasing science and exploration data returns.

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### GRAFFITI SKETCHED BY YOUNG ISAAC NEWTON DISCOVERED

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Scientists have discovered a drawing on the walls of the childhood home of Isaac Newton, thought to have been sketched by the celebrated British scientist as a young boy.

Researchers using cutting-edge light technology have discovered a picture of a windmill next to the fireplace in the 17th-century manor's downstairs Hall.

The drawing is thought to have been inspired by the building of a mill nearby during Newton's childhood.

The discovery adds a new layer of understanding to Newton's life at Woolsthorpe Manor in Lincolnshire, where he was born the son of a yeoman farmer in 1642, and where he returned in 1665 at the peak of his scientific studies.

It was here that Newton undertook his crucial experiment - splitting white light using a prism - and observed an apple fall from a tree, inspiring his law of universal gravitation.

Using Reflectance Transformation Imaging (RTI), a technique that uses light to capture the shape and colour of a surface not visible to the naked eye, Chris Pickup from Nottingham Trent University in the UK was able to survey the walls of the manor in painstaking detail to discover this previously unseen wall drawing, believed to have been carved into the wall around 350 years ago.

"It's amazing to be using light, which Newton understood better than anyone before him, to discover more about his time at Woolsthorpe," said Pickup.

"I hope that by using this technique we're able to find out more about Newton as man and boy and shine a light on how his extraordinary mind worked," he said.

Newton was well known for sketching and making notes on the walls of his rooms as he developed his scientific and mechanical knowledge.

Several sketches, thought to be his, had previously been uncovered by tenants removing old wallpaper in the 1920s and 30s.

"The young Newton was fascinated by mechanical objects and the forces that made them work. Paper was expensive, and the walls of the house would have been repainted regularly, so using them as a sketchpad as he explored the world around him would have made sense," said Jim Grevatte, Illuminating Newton Programme Manager at Woolsthorpe Manor.

"This discovery could be just the tip of the iceberg in terms of the drawings waiting to be uncovered, and it is fitting that we are using cutting edge science inspired by Newton's work to reveal more about his childhood and his thinking," said Grevatte.

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### RISE IN DEATH RATES OF WHITES LED TO TRUMP'S WIN: STUDY

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Significant increases in the death rates of white, middle-aged people over the last 15 years may have led to Donald Trump's win in the US presidential elections in 2016, a study has found.

Examining data for white people between the ages of 45 and 54, researchers found that Trump was more likely to win counties where the middle-aged white death rates increased significantly from 1999 until 2016 than his Democrat opponent, Hillary Clinton.

"We believe that counties where mortality has been increasing in the last decade have seen higher degrees of social disruption - such as changes in employment availability, health care accessibility and poverty levels - leading to changes in voting patterns," said Usama Bilal, researcher at Drexel University in the US.

On average, a 15.2 death increase per 100,000 middle-aged white people was tied to a one per cent vote swing for the Republican presidential candidate in 2016, according to the study published in the journal *Social Science and Medicine*.

Researchers, including those from Johns Hopkins University and Loyola University in the US, started thinking about a study looking into this on election night in 2016.

Public health scientists have noted often that white mortality rates appear to have changed in recent years.

Researchers studied this population in the context of another study that attributed these deaths to the increased availability of prescription opioids, drug overdoses and weaker public assistance programmes.

"We entertain the idea that mortality itself is a marker of underlying social conditions that are often reflecting in changing political landscapes," Bilal said.

Using data from 2,764 counties (roughly 91 per cent of the counties in the US), researchers found that counties that voted Republican, after being Democrat for 2008 and 2012, showed an average increase of 10.7 deaths per 100,000 middle-aged white residents over the last 15 years.

However, if counties that voted Democrat in 2008 and 2012 stayed Democrat for 2016, the death rates there actually declined over the last 15 years by 15.7 per 100,000, on average, the study found.

The researchers did not just focus on mortality rates and their potential affect on vote-swings. They also took a look at whether vote swings were more evident in counties with wider health inequalities.

"In our study, health inequality refers to the difference in life expectancy between the people in the top 25 per cent of income versus the bottom 25 per cent," Bilal said.

In any county that had gone Republican, just once, in 2000, 2004, 2008 or 2012, there were markedly higher levels of health inequality.

For counties that voted Republican in 2008 and 2012, the study showed almost 30 per cent wider inequalities.

However, that does not mean things were completely even in Democrat counties. On average, the difference in life expectancy was 7.23 years in Republican counties, but still 6.6 years in Democrat counties.

All of the mortality and inequity results were consistent when the researchers limited their data to six of the key states that helped flip the 2016 election to Republicans: Iowa, Ohio, Pennsylvania, Michigan, Wisconsin and Florida.

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### **MARS ATMOSPHERE WELL PROTECTED FROM SOLAR WIND: STUDY**

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The Martian atmosphere is well protected from the effects of the solar wind, despite the absence of an Earth-like magnetic dipole, a study has found.

Present-day Mars is a cold and dry planet with less than one per of Earth's atmospheric pressure at the surface.

However many geological features indicate the planet had an active hydrological cycle about 3-4 billion years ago.

An active hydrological cycle would have required a warmer climate in the planet's early history and therefore a thicker atmosphere, one capable of creating a strong greenhouse effect.

A common hypothesis maintains that the solar wind over time has eroded the early Martian atmosphere, causing the greenhouse effect, and thus the hydrological cycle, to collapse.

Unlike Earth, Mars has no global magnetic dipole, but the solar wind instead induces currents in the ionised upper atmosphere, creating an induced magnetosphere.

"It has long been thought that this induced magnetosphere is insufficient to protect the Martian atmosphere," said Robin Ramstad from Umea University in Sweden.

"However our measurements show something different," Ramstad said.

Researchers using measurements from the Swedish particle instrument ASPERA-3 on the Mars Express spacecraft.

The spacecraft has been measuring the ion escape from Mars since 2004. Researchers combined and compared measurements of the ion escape under varying solar wind conditions and levels of ionising solar radiation, so-called extreme ultraviolet (EUV) radiation.

The results show that the solar wind has a comparatively small effect on the ion escape rate, which instead mainly depends on the EUV radiation.

This has a large effect on estimations of the total amount of atmosphere that has escaped to space.

"Despite stronger solar wind and EUV-radiation levels under the early Sun, ion escape can not explain more than 0.006 bar of atmospheric pressure lost over the course of 3.9 billion years," said Ramstad.

"Even our upper estimate, 0.01 bar, is an insignificant amount in comparison to the atmosphere required to maintain a sufficiently strong greenhouse effect, about one bar or more according to climate models," he said.

The findings show that a stronger solar wind mainly accelerates particles already escaping the planet's gravity, but does not increase the ion escape rate.

Contrary to previous assumptions, the induced magnetosphere is also shown to protect the bulk of the Martian ionosphere from solar wind energy transfer.

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### **DISCRIMINATION HAS 'SPILLOVER EFFECTS' ON PARTNER'S HEALTH**

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Discrimination not only harms the health and well-being of the victim, but their romantic partner as well, a study has found.

The research, which analysed a sample of nearly 2,000 couples, is the first study to consider how the discrimination experiences of both people in a relationship are associated with their health.

"We found that when an individual experiences discrimination, they report worse health and depression. However, that's not the full story - this stress spills over and affects the health of their partner as well," said William Chopik, from the Michigan State University in the US.

The researchers studied the survey data of 1,949 couples ranging in age from 50 to 94.

The participants reported on incidents of discrimination, as well as on their health, depression and relationship strain and closeness.

The study, published in the journal *Social Psychological and Personality Science*, found that it did not matter where the discrimination came from (eg, because of race, age, gender or other factors).

"What matters is that they felt that they were unfairly treated. That's what had the biggest impact on the person's health," Chopik said.

That discrimination had a spillover effect on the person's spouse or partner. Since people are embedded in relationships, what happens in those relationships affects our health and well-being, he said.

"When one partner experiences discrimination, they bring that stress home with them and it strains the relationship. So this stress not only negatively affects their own health, but their partner's as well," Chopik added.

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## NEW FORM OF MATTER 'EXCITONIUM' DISCOVERED

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Scientists have proven the existence of new form of matter called excitonium - which was first theorised almost 50 years ago.

Researchers from University of California Berkeley and University of Illinois at Urbana-Champaign in the US studied non-doped crystals of the transition metal dichalcogenide titanium diselenide (1T-TiSe<sub>2</sub>).

Excitonium is a condensate - it exhibits macroscopic quantum phenomena, like a superconductor. It is made up of excitons, particles that are formed in a very strange quantum mechanical pairing, namely that of an escaped electron and the hole it left behind.

It defies reason, but it turns out that when an electron, seated at the edge of a crowded-with-electrons valence band in a semiconductor, gets excited and jumps over the energy gap to the otherwise empty conduction band, it leaves behind a "hole" in the valence band. That hole behaves as though it were a particle with positive charge, and it attracts the escaped electron.

When the escaped electron with its negative charge, pairs up with the hole, the two remarkably form a composite particle, a boson - an exciton.

In point of fact, the hole's particle-like attributes are due to the collective behaviour of the surrounding crowd of electrons. However, that understanding makes the pairing no less strange and wonderful, researchers said.

Until now, scientists have not had the experimental tools to positively distinguish whether what looked like excitonium was not in fact a Peierls phase.

Peierls phases and exciton condensation share the same symmetry and similar observables.

Abbamonte and his team were able to overcome that challenge by using a novel technique they developed called momentum-resolved electron energy-loss spectroscopy (M-EELS).

With their new technique, the group was able to measure collective excitations of the low-energy bosonic particles, the paired electrons and holes, regardless of their momentum.

"Ever since the term 'excitonium' was coined in the 1960s by Harvard theoretical physicist Bert Halperin, physicists have sought to demonstrate its existence," said Peter Abbamonte, professor at University of Illinois.

"Theorists have debated whether it would be an insulator, a perfect conductor, or a superfluid—with some convincing arguments on all sides," Abbamonte said.

"Since the 1970s, many experimentalists have published evidence of the existence of excitonium, but their findings were

not definitive proof and could equally have been explained by a conventional structural phase transition," he said.

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## NEW BREATHALYSER TEST FOR DRUGS DEVELOPED

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Testing for drug use and disease in humans could soon be much simpler, as researchers have developed a breathalyser that can identify drugs from exhaled breath.

In a study published in the Journal of Breath Research, the researchers demonstrate how collecting and analysing externally-produced compounds in the lining fluid of the airways allows for non-invasive testing and monitoring.

"Exhaled breath contains particles carrying non-volatile substances. The main components, lipids and proteins, are derived from the respiratory tract lining fluid," said Goran Ljungkvist, from the University of Gothenburg in Sweden.

"The collection procedure is non-invasive, can be repeated within a short time span and is convenient," Ljungkvist said.

"The small mass sampled is, however, an analytical challenge. Nevertheless, exhaled particles are a new and promising matrix for the analysis of biomarkers," Ljungkvist said.

The researchers took breath samples from 13 subjects who were undergoing methadone management, to explore whether traces of the drug could be detected via their breath, rather than using invasive techniques that disturb the integrity of the subject.

"We also wanted to discover the best method for collecting methadone particles in the exhaled breath, so our study compared two different sampling methods - electret filtration, and impaction," Ljungkvist said.

The electret filtration method potentially collected exhaled particles of all sizes, while the one based on impaction collected particles in the size range of 0.5 to 7µm, known to reflect respiratory tract lining fluid from the small airways.

The researchers used liquid chromatography-mass spectrometry to analyse the collected samples, as well as investigating the impact of different breathing patterns.

Their results showed methadone was present in all samples using both methods, but when using the method based on impaction, the concentration of methadone in exhaled breath was less than one per cent of the concentration collected by the method based on filtration.

"The difference in collected amounts of methadone between the two methods was, however, huge. That raised secondary questions on the origin of the collected particles, possible contamination from oral fluid, the breathing pattern and finally the design of the collection device," Ljungkvist said.