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खोज

तीन वैज्ञानिकों की टीम ने अध्ययन कर पता लगाया, तीव्र रेडियो विस्फोटों के बारे में मिलेगी और अधिक जानकारी

निष्क्रिय न्यूट्रॉन तारे भी सूर्य से ज्यादा होते हैं चमकदार

राजन राय

गोरखपुर। हमारी आकाशगंगा से बाहर करीब 130 लाख प्रकाश वर्ष दूर हुए खगोलीय घटना के अध्ययन में वैज्ञानिकों ने पाया है कि मैग्नेटार (विशेष प्रकार के न्यूट्रॉन तारे) निष्क्रिय अवस्था में भी सूर्य से एक लाख गुना ज्यादा चमकदार हो सकते हैं। इस खगोलीय घटना के अध्ययन में विस्फोट के चरम पर देखे गए, कई ऐसे स्पंदनों (दोलन) का रहस्योद्घाटन हुआ है, जिनसे इन खगोलीय पिंडों के बारे में अभी भी अल्पज्ञात विशाल चुंबकीय ज्वालाओं को समझना संभव हो पाएगा। इससे तीव्र रेडियो विस्फोटों के बारे में और अधिक जानने का मार्ग प्रशस्त होगा। जो अब तक के खगोल विज्ञान में सबसे गूढ़



असीम उपकरण से पता लगा विस्फोट का

घटनाओं में से एक है। नेचर पत्रिका ने अंडालूसिया शोध संस्थान (आईए-सीएसआईसी स्पेन) के वैज्ञानिक प्रो. अल्बर्टो जे. कास्त्रो-तिराडो के नेतृत्व में वैज्ञानिक सहयोग समूह के शोधपत्र को प्रकाशित किया है।

3.5 मिली सेकंड में गायब हो गए स्पंदन

कुछ मिलीसेकंड (एक सेकंड के हजारवें हिस्से) में चुंबकीय पुनः संयोजन प्रक्रिया समाप्त हो जाती है। कुछ इसी प्रकार ही, इस जीआरबी 200415 (मैग्नेटार) में भी स्पंदनों का पता लगा, जो मुख्य विस्फोट के बाद लगभग 3.5 मिली सेकंड में गायब हो गए।

अंतरराष्ट्रीय अंतरिक्ष स्टेशन पर स्थित असीम नामक उपकरण द्वारा इस विस्फोट का पता लगाया गया था। असीम सात में से एकमात्र उपकरण था, जो बिना संतुष्टि के अपनी पूर्ण ऊर्जा सीमा में विस्फोट के मुख्य चरमता का प्रेक्षण कर सका। मात्र एक सेकंड के डेटा के विश्लेषण के लिए एक वर्ष से भी अधिक समय लगा।

वैज्ञानिकों के इस समूह में भारत के आर्यभट्ट प्रेक्षण विज्ञान शोध संस्थान, नैनीताल (एरीज) के वरिष्ठ वैज्ञानिक डॉ. शशि भूषण पांडेय और जेवियर पास्कुअल (आईए-सीएसआईसी, स्पेन) और बार्सेलोन विश्वविद्यालय, नार्वे के

शोधकर्ता डा. ओस्टगार्ड भी शामिल थे। बुधवार को डॉ. शशि भूषण पांडेय गोरखपुर में थे और उन्होंने अमर उजाला से शोध के बारे में विस्तार से चर्चा की। डा. पांडेय ने बताया कि मैग्नेटार एक विशेष रूप से चुंबकीय प्रकार

न्यूट्रॉन तारे क्या हैं

न्यूट्रॉन तारे अंतरिक्ष में पाए जाने वाले वे तारे हैं, जिनका भार सूर्य से 1.4 गुना ज्यादा है। इनका निर्माण तब होता है जब कोई बहुत भारी तारा नष्ट हो जाता है। सौर मंडल को मुकाबले इनका भार 10 से 29 गुना तक अधिक रहता है। अपरिचयमय घनत्व के कारण प्रोटोन और इलेक्ट्रॉन मिलकर न्यूट्रॉन में बदल जाते हैं, इसी कारण इन सितारों को न्यूट्रॉन स्टार का नाम दिया गया। इनका घनत्व बहुत ज्यादा होता है। इनकी खोज 1930 को दशक में हुई थी।

का न्यूट्रॉन तारा है जो कि एक सेकंड के दसवें हिस्से में, सूर्य द्वारा 1,00,000 वर्षों में उत्पादित ऊर्जा के बराबर ऊर्जा उत्सर्जित किया है। यह मैग्नेटार विस्फोट 15 अप्रैल 2020 (जीआरबी 200415) को हुआ।



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'Solar hamam' taking care of heating in cold Himalayan regions

The system is also helping conserve the forests as it is reducing the dependence on fuelwood

VIKAS VASUDEVA
CHANDIGARH

Aimed at providing clean energy solutions to households in the cold mountainous regions for heating purposes and also to achieve forest conservation, a solar water-heating system, 'solar hamam', is proving popular among the villagers in Himachal Pradesh, Ladakh and Uttarakhand.

In the higher Himalayan region, 50% of fuelwood is consumed for the purpose of heating and is one of the ma-

ior reasons for forests degradation and also the main cause of drudgery of women.

Scientists at the Himalayan Research Group, an NGO, which is a part of the Government of India's Department of Science and Technology Core Support Programme of Science for Equity Empowerment and Development (SEED) Division realised that technology interventions to conserve forests was required, and hence they devised a customized solar water and space



A 'solar hamam' at work.

heating system for the region.

"It was in 2004 that with an aim to reduce dependence on fuelwood and women drudgery that we start-

ed research and development for designing a simple and cost-effective solar water and space heating system for rural households. In 2008, we developed a prototype of the solar water-heating system, and it was put for evaluation. It was found to be cost-effective, providing 15 to 18 litres of hot water within the first solar illumination of 30-35 minutes in the morning. Successive batches of hot water are available in 15-20 minutes gap. After its encouraging re-

sults we started installing the system from 2014 onwards. We have so far installed over 1,200 such systems in Himachal Pradesh, Ladakh and Uttarakhand," said Dr. Lal Singh, Director at the Himalayan Research Group.

Harish Chander (49), a resident of village Oli in Mandi district installed the solar system in 2018 and is very happy with its results. "After I installed it (solar hamam) in my house I urged other people to use it. It is wonderful," he said.



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Air pollution in parts of India went up during lockdown

ARIES Scientists Used Nasa Satellites' Data For Study

TIMES NEWS NETWORK

Bengaluru: Reduction of economic activities during the pandemic-related lockdown had resulted in decrease of air pollution in most parts of India, but satellite observations show that parts of India showed an increase in pollution in contrast to the general trend.

Scientists from the Aryabhata Research Institute of Observational Sciences (ARIES) have identified that regions in the central-western part of India and north India are prone to higher air pollution exposure based on state-of-the-art satellite observations and hence are exposed to greater risk of respiratory problems.

ARIES is an autonomous institute of the Department of Science and Technology (DST), which said that while satellite-based observation of toxic trace gases — ozone, nitrogen-dioxide and carbon monoxide — near the surface and in the free troposphere mostly showed a reduction of



The study shows that ozone, carbon monoxide, and NO₂ showed an increase of about 15% over the central-western part of India

the pollutants over India, an increase of ozone and other toxic gases was observed in some regions like western-central India, some parts of Northern India, and remote Himalaya. "This could have aggravated respiratory health risks around those regions during the pandemic. We utilised the EUMETSAT and NASA satellite observations for the years 2018, 2019, and 2020, and investigated the influence of significant cutoff of anthropogenic activities on the changes in the ver-

tical and columnar distribution of ozone, CO, and NO₂ during the lockdown period," one of the scientists said.

The study published in 'Environmental Science and Pollution Research' led by Prajwal Rawat, a senior research fellow at ARIES along with his research supervisor Manish Naja, shows that ozone, carbon monoxide, and NO₂ showed an increase of about 15% over the central-western part of India.

According to the results, carbon monoxide showed a

consistent increase — as high as 31% — of concentration at higher heights during the lockdown. "The long-range transport and downward transport from the stratosphere significantly increased ozone concentrations over north India during the lockdown, and remote regions like the Himalayas and coastal cities showed the bare minimum influence of lockdown in air quality, with a tendency to increase in criteria air pollutants," one of the scientists added.

The scientists explain ozone production and loss are constrained through the complex photochemistry involving its precursor gases like Nitric Oxide and volatile organic compounds (VOCs) — emitted as gases from certain solids or liquids.

"...A decrease in its precursor gases could also lead to enhancement of ozone, depending upon the chemical environment. Moreover, ozone concentrations are also altered via ambient meteorology and dynamics," they said.



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In pandemic, foul air up in central-western India

TIMES NEWS NETWORK

Bengaluru: Reduction of economic activities during the lockdown had resulted in decrease of air pollution in most parts of India, but satellite observations show that some parts of India showed an increase in pollution.

Scientists from Aryabhatta Research Institute of Observational Sciences (ARIES), an autonomous institute of the department of science and technology, said while satellite-based observation of toxic trace gases—ozone, nitrogen dioxide and carbon monoxide—near the surface and in the free troposphere mostly showed a reduction of pollutants over India, an increase of ozone and other toxic gases

was observed in some regions like central-western India, some parts of northern India, and remote Himalayas.

According to the ARIES team, the study has helped identify the regions prone to higher air pollution exposure, and thereby identify areas at a greater health risk. "This (the rise in pollution) could have aggravated respiratory health risks around those regions during the pandemic," one of the scientists said.

The study, published in Environmental Science and Pollution Research, said ozone, CO and NO₂ showed an increase of about 15% over central-western India. CO showed a consistent increase—as high as 31%—of concentration at higher heights.



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UoH prof named WIHG member

Hyderabad: The central government nominated University of Hyderabad (UoH) professor M. Jayananda as member of the governing body of the Wadia Institute of Himalayan Geology (WIHG), Dehradun, for a period of three years on Tuesday. Jayananda, who works at Centre for Earth, Ocean and Atmospheric Sciences, is known for completing several major national and international science projects and highly cited research papers. The WIHG is a research institute for the department of science and technology, ministry of science and technology.



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‘Geospatial Mkt to Soar to ₹63k cr by ’25’

FUTUREWISE Govt’s policy moves will make India regional hardware hub, says Kant

Our Bureau

Mumbai: India’s geospatial economy has potential to touch ₹63,100 crore by the end of 2025, growing at 12.8%, according to a report. The market is currently valued at ₹38,972 crore. Speaking at the launch of the India Geospatial “Artha” Report, industry leaders and ministers said the recent policy updates across geospatial, remote sensing and drone technology will boost domestic industry and the innovation ecosystem.

Amitabh Kant, chief executive of premier policy think tank Niti Aayog, said the government’s recent move to update three critical policies related to geospatial technology will create a dynamic space not only

for the industry to flourish but also to make it easier to innovate and make India a regional hardware hub.

Policy implementation will not differ from guidelines announced by the government.

“It is truly a watershed moment where the government has taken several definitive steps to override overall three critical policies that have a direct impact on the geospatial ecosystem, namely the geospatial policy, the remote sensing policy and the drone rules,” Kant said.

The government is currently in the process of finalising policies for geospatial as well as satellite navigation. It has already implemented guidelines for geospatial data (guidelines for acquiring and producing geospatial data and geospatial

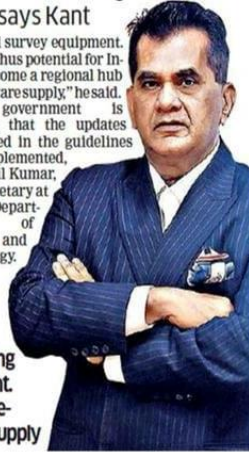
data services including maps).

As per projections by the Ministry of Science and Technology, the sector can now open up allowing geospatial data of the value of ₹1 lakh crore to be acquired and used by 2030.

India is already one of the leading exporters of geospatial services, Kant added. “However, with the recent reforms, it is expected that more companies might be getting involved in the manufacturing of GNSS

chips and survey equipment. There is thus potential for India to become a regional hub for hardware supply,” he said.

The government is ensuring that the updates announced in the guidelines are implemented, said Sunil Kumar, joint secretary at the Department of Science and Technology.



AMITABH KANT CEO, Niti Aayog

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Air pollution less in most parts during lockdown

PRESS TRUST OF INDIA
New Delhi, 27 December

Reduction in economic activities during the pandemic-related lockdown had resulted in decrease in air pollution in most parts of the country, but satellite observations show that parts of central-western and northern India recorded an increase in pollution in contrast to the general trend, the government said on Monday quoting a study.

Scientists at the Aryabhata Research Institute of Observational Sciences (ARIES), an autonomous institute under the Department of Science and Technology, utilised the EUMETSAT and Nasa satellite observations for 2018, 2019 and 2020, and investigated the influence of significant cutoff of activities on the changes in distribution of ozone, carbon monoxide and nitrogen dioxide during the lockdown period.

According to the study, published in the *Environmental Science and Pollution Research* journal, ozone, carbon monoxide and NO₂ showed an increase of about 15 per cent over the central-western part of India.

According to the results, carbon monoxide showed a consistent increase (as high as 31 per cent) of concentration at higher heights during the lockdown.



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लॉकडाउन में वायु प्रदूषण हुआ था कम

■ नई दिल्ली (भाषा)।

कोरोना वायरस के कारण लगाए गए लॉकडाउन के दौरान भारत के अधिकतर हिस्सों में वायु प्रदूषण कम हुआ था, लेकिन उपग्रह के अवलोकनों में दिख रहा है कि मध्यमपश्चिम और उत्तर भारत के कुछ हिस्सों में प्रदूषण बढ़ा है, जो आम प्रवृत्ति के विपरीत है। सरकार ने एक अध्ययन के

हवाले से सोमवार को यह जानकारी दी।

विज्ञान एवं प्रौद्योगिकी विभाग के तहत आने वाले स्वायत्त संस्थान आर्यभट्ट प्रेक्षण विज्ञान शोध संस्थान (एआरआईएस) ने 2018, 2019 और 2020 के लिए ईयूपमईटीएसएटी और नासा के उपग्रह अवलोकनों का इस्तेमाल किया और लॉकडाउन अवधि के दौरान ओजोन, कार्बन मोनोऑक्साइड और नाइट्रोजन डाइऑक्साइड के फैलाव में परिवर्तन पर गतिविधियों के बंद होने के प्रभाव की जांच की। अध्ययन के मुताबिक, भारत के मध्य-पश्चिमी भाग में ओजोन, कार्बन मोनोऑक्साइड और नाइट्रोजन डाइ-

ऑक्साइड में लगभग 15 प्रतिशत की वृद्धि हुई। यह अध्ययन एनवायरमेंटल साइंसेज एंड पॉल्यूशन रिसर्च में प्रकाशित हुआ है। परिणामों के मुताबिक, लॉकडाउन के दौरान ऊंचाई वाले इलाकों में कार्बन मोनोऑक्साइड में (अधिकतम 31 फीसदी तक) की बढ़ोतरी देखी गई। अध्ययन का नेतृत्व एआरआईएस नैनीताल के वरिष्ठ शोध फेलो प्रज्वल रावत ने अपने शोध पर्यवेक्षक

■ एक अध्ययन में हुआ खुलासा

डॉ. मनीष नाजा के साथ किया है। विज्ञान और प्रौद्योगिकी मंत्रालय ने एक बयान में कहा कि वैज्ञानिकों ने अत्याधुनिक उपग्रह अवलोकनों के आधार पर भारत के मध्यमपश्चिमी भाग और उत्तर भारत के उन क्षेत्रों की पहचान की है, जहां उच्च वायु प्रदूषण का जोखिम है और वहां रहने वाले लोगों को सांस संबंधी परेशानी होने का अधिक खतरा है। मंत्रालय ने कहा कि 2020 में कोरोना वायरस के प्रसार को रोकने के लिए पूरे देश में लॉकडाउन लगाया गया था, जिससे आर्थिक गतिविधियों में बाधा उत्पन्न हुई थी। बयान के मुताबिक, इससे सतह के पास कुछ अवधि के वायु गुणवत्ता में सुधार आया था।



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PRL scientist studies ocean's carbon sink potential

TIMES NEWS NETWORK

Bengaluru/Ahmedabad: Tropical rainforests are referred to as Earth's lungs, absorbing massive amounts of carbon dioxide from the atmosphere and releasing oxygen in return. However, it turns out that our oceans have far bigger potential to store carbon dioxide or act as a carbon sink. A scientist from the Physical Research Laboratory (PRL) is working on ways to store large amounts of carbon dioxide in the oceans as a way to tackle global climate change.

The Earth's oceans are the most important global carbon dioxide storage depot on the planet, absorbing more carbon dioxide than all of the rainforests combined, according to the Ocean Frontier Institute. They have taken in approximately a quarter of the CO₂ released since the Industrial Revolution. Most of this is absorbed by phytoplankton, algae and bacteria-based microorganisms that absorb more carbon than all the plants on land.

Arvind Singh, associate professor with PRL's ocean science geo-science division, is examining the impact on the delicate ocean ecology if one enhances ocean alkalinity by adding minerals artificially to sequester atmospheric CO₂ in the ocean. This is primarily done by adding widely available minerals like olivine, in a

STUDY HIGHLIGHTS

- The ocean has 38,000 gigatonnes of carbon and can definitely absorb the 250 gigatonnes of atmospheric carbon that industrial activities have produced in the last 150 years
- Scientists are working on ways to store large amounts of carbon dioxide in the oceans as a way to tackle climate change
- The PRL research will examine the impact of enhanced ocean alkalinity on delicately interdependent carbon, nitrogen and phosphorus nutrient cycles of the ocean



Associate professor Arvind Singh at the PRL lab

- PRL is examining the impact on the ocean ecology — phytoplankton, algae and bacteria — if one enhances ocean alkalinity by adding minerals artificially to sequester atmospheric CO₂
- PRL scientists will cruise to upwelling regions to collect nutrient-rich water samples from the Arabian Sea

sustained way so that the atmospheric CO₂ reacts and settles on ocean surfaces as bicarbonates and carbonates.

Singh said his research will examine the impact of enhanced ocean alkalinity on delicately interdependent carbon, nitrogen and phosphorus nutrient cycles of the ocean, which no one has investigated till date. "It will also study the effect of increased alkalinity on phytoplankton and other microorganisms," he said.

Singh, a physicist by training and biogeochemist by profession, won the Swarnajayanti fellowship instituted by

the department of science and technology (DST) recently. "Singh has highlighted that we will need reservoirs that can store up to trillions of tonnes of CO₂ emitted from industrial and other man-made emissions in the coming years," a DST statement reads.

Singh, according to DST, uses stable isotopes to understand elemental cycling in the ocean. His work blends stable isotopes, in-situ and satellite observations, microbiology and statistical modelling to make quantitative estimates of carbon and nitrogen fluxes in the ocean.



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	Preeti Mehra	Page No:	10



LIFE SCIENCES

Is there science in shirodhara ?

Ongoing research at IIT Madras is looking closely at this ayurvedic therapy

PREETI MEHRA

How effective are ayurvedic therapies? Is there any scientific basis to them?

Research at IIT Madras has been looking into the ayurvedic relaxation therapy shirodhara, which is recommended for patients with stress (depression or anxiety or hypertension), insomnia, headache and several kinds of psychosis. The treatment involves the low-velocity impact of a medicinal liquid dropping on the forehead from a specific height, at a controlled temperature, for 30-60 minutes, for a defined number of days.

An IIT team from the Department of Applied Mechanics and Department of Engineering Design attempts to scientifically characterise the shirodhara therapy along two lines – the fluid impact and the neuro feedback.

The broad conclusion from the first is that, when fluid impact force is applied on the forehead, a very small displacement is observed. And the electromechanical response indicated that it does produce a current that is measured in microvolts.

This is in keeping with the principles of ayurveda, which holds that a falling liquid on the forehead produces a vibration, which generates electromagnetic waves. These are transferred to the cerebral cortex and hypothalamus, which has an impact on the brain and the central nervous system. This could reduce stress and, hence, hypertension.

The study included characterisation of shirodhara using electroencephalogram (EEG, which records elec-

trical activity in the brain). Various physiological parameters like systolic and diastolic blood pressure and heart rate were studied. Psychological factors like depression, anxiety, and Stress Scale-21 index, Pittsburgh sleep quality index, WHO-5 wellbeing index and mood-scale index were evaluated.

The EEG tests on four healthy female student volunteers of Chennai's Sri Jayendra Saraswathi Ayurveda College and Hospital showed good results for alpha waves, which are mostly responsible for calmness and relaxation of the brain. Due to shirodhara, maximum EEG waves were produced between the alpha and theta band in the range of 6-10.5 Hz. This is considered to have a calming influence.

The physiological tests showed a decrease in heart rate by 6.75 BPM (beats per minute) and improved blood pressure (9.25 mmHg for systolic and 4 mmHg for diastolic). Psychological tests showed the respondents maintained quality sleep and depression levels were reduced.

Shirodhara is a non-invasive brain relaxation therapy, comparable to the effects produced by yoga and meditation. However, unlike the other two, it does not require any effort from the patient.

The IIT researchers plan to widen their research and have submitted proposals to the AYUSH Ministry and the Department of Science and Technology. They are hoping to receive funding for it.

The research team includes Swathika Meenraj, Lakshmana Rao Chebolu, Venkatesh Balasubramanian, Yogeshwar Dasari and Anita Teladevalapalli.





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Journalist:	Bureau	Page No:	4

Climate change hard on children, says study

PNS ■ NEW DELHI

Climate change is hard on children, making them vulnerable to infectious diseases too, a team of researchers has said in a study published in the journal "Science of the Total Environment".

For instance, during the study conducted in Varanasi city in Uttar Pradesh, the researchers from Banaras Hindu University (BHU) observed that a 1 degree Celsius rise in maximum temperature was associated with an increase in diarrhoea and skin-disease cases by 3.97 per cent and 3.94 per cent, respectively.

Overall, they found that climate parameters accounted for 9-18 per cent of the total infectious disease cases among kids. The study which was conducted among 461 children under 16-years-of-age in Varanasi had probed the association between climate parameters



and infectious diseases in children under 16-years-of-age in Varanasi.

The researchers concluded

that maximum temperature and humidity are important drivers leading to infectious disease among children. Driven

by human-made activities, climate change may challenge the gains in the public health sector made over the years. Globally, it is estimated that children bear most of the burden of disease due to climate change, with the poorest disproportionately affected.

Led by RK Mall along with Nidhi Singh, T Banerjee, (all from central Indo-Gangetic Plain region DST-Mahamana Center of Excellence in Climate Change Research, BHU) and Akhilesh Gupta from Department of Science and Technology under Union Science and Technology Ministry established that climate parameters like temperature, humidity, rainfall, solar radiation, and wind speed were associated with infectious diseases like gastrointestinal diseases, respiratory diseases, vector-borne diseases, and skin diseases among children in the holy city.



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Landslide warning system under trial, Parl told

Jayashree Nandi

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NEW DELHI: India is developing an early warning system for landslides that would help save lives and prevent damage to property, Parliament was told last week. The system, dubbed LEWS, is being tested by the Geological Survey of India in the two hilly districts of Darjeeling in West Bengal and Nilgiris in Tamil Nadu, and is likely to be operational by 2025, the earth sciences ministry informed the Rajya Sabha.

The prototype regional Landslide Early Warning System (LEWS), being developed by the Geological Survey of India in collaboration with its British counterpart under the aegis of the National Environmental Research Council's LANDSLIP project, is based on rainfall thresholds since 2017.

There has been increasing incidence of landslides in the country, particularly due to excessive rainfall during the monsoon season in Kerala, Uttarakhand and Maharashtra.

In response to a question on



Rescue workers push an overturned vehicle stuck in mud and debris at a site of a landslide in Kerala on October 17.

AFP

the number of people killed during the monsoon floods this year, the home ministry said: "This ministry does not maintain the centralised data regarding loss of human lives and crops due to any calamity. However, state-wise details of the human lives lost and loss of crops due to hydro-meteorological calamities, including floods, landslides, during the year 2021-22, as assessed/ reported by the state governments/ Union territories."

As per data shared by states

and UTs, 2002 persons were killed in cyclonic storms/ heavy rains/ floods/ landslides in 2021-22 and crop area of 50.40 lakh ha was damaged.

The LANDSLIP project developed a prototype last year based on terrain-specific rainfall thresholds in the two test areas. Since the 2020 southwest monsoon, the Geological Survey has started issuing daily landslide forecasts during the summer monsoon to district administrations in Darjeeling and Nilgiris,

the central government said.

GSI has also laid the groundwork to develop regional LEWS in other landslide-prone states like Uttarakhand, Kerala, Sikkim from this year and plans to add five more – Himachal Pradesh, Karnataka, Assam, Meghalaya and Mizoram – by 2022.

"The evaluation and calibration of the models will continue during the next few monsoon years and the regional LEWS will be made operational in phases in all such 10 states, the earth sciences ministry told Parliament.

India's National Disaster Management Authority has also constituted a group that includes the National Institute of Hydrology, Indian Space Research Organisation, Geological Survey of India and Wadia Institute of Himalayan Geology, among others, to develop a monitoring and early warning system for rock and snow avalanche events including glacier and landslide lake outburst floods to reduce cascading impacts like flash floods and landslides in downstream areas. The authority released guide-

lines on management of such floods and a summary for policy makers on October 13.

India currently does not have an early warning system for glacier-related disasters but has conducted studies on their melting by assessing mass balance studies and monitoring the recession of selected Himalayan glaciers, which have been receding due to global warming.

In a response to another question on increasing lightning deaths on December 1, the earth sciences ministry told the Lok Sabha that lightning activity has shown an increasing trend in the past two decades.

"Northeast, east and parts of peninsular India have registered a sharp increase of lightning over the past two decades, the ministry said in its response. As many as 2,357 persons died due to lightning strikes in 2018, it said. The number was 2,876 in 2019, and 2,862 in 2020.

"People should also respond to such a system, then it can be successful," Kalachand Sain, director, Wadia Institute of Himalayan Geology, said.

Study of distant magnetar reveals facets of the exotic star

The short-lived flare recorded by the ISS instruments spewed as much energy in a tenth of a second that our Sun will radiate in 100,000 years

SHUBASHREE DESIKAN

An international group of researchers has succeeded in measuring for the first time the characteristics of a flare on a distant magnetar. A magnetar is a rare compact type of neutron star teeming with energy and magnetism. The magnetar they have studied is about 13 million light years away, in the direction of the NGC 253, a prominent galaxy in the Sculptor group of galaxies.

The flare, which spewed within a few tenths of a second as much energy as the Sun would shed in 100,000 years, was captured accidentally on April 15, 2020, by the Atmosphere-Space Interactions Monitor Instrument (ASIM) of the International Space Station.

Rare and exotic

This data was then analysed by the researchers over the period of a year to throw light into the structure of the flare, and thereby, into the

nature of such magnetars. This is the first study to characterise such a flare from so distant a magnetar. The research was published in the journal, *Nature*.

Magnetars are relatively rare objects, with only about thirty having been spotted within the Milky Way so far. The present magnetar is only the second one to be studied which is located outside the galaxy and is also the furthest, at 13 million light years distance.

How magnetars form

During the course of their evolution, massive stars - with masses around 10-25 times the mass of the Sun - eventually collapse and shrink to form very compact objects called neutron stars. A subset of these neutron stars are the so-called magnetars which possess intense magnetic fields. These are highly dense and have breathtakingly high rotation speeds - they have rotational periods that can be just 0.3

Stellar fireworks

The study characterised a short-lived flare which briefly lit up this star

- Stars having around 10-25 times the solar mass eventually shrink to form neutron stars
- A small number of neutron stars become the so-called magnetars which possess intense magnetic fields
- Magnetars are relatively rare objects, with only about thirty having been spotted within the Milky Way so far
- Magnetars emit violent flares. It is only during a flare that they can be observed, and these flares are so short-lived that it presents a major challenge
- The observed giant flare lasted approximately 160 milliseconds and during this time the flare spewed as much energy that our Sun will radiate in 1,00,000 years



Distant star: An artist's illustration of the magnetar which is about 13 million light years away, in the direction of NGC 253, a prominent galaxy in the Sculptor group of galaxies.
• BIRKELAND CENTRE FOR SPACE SCIENCE, UNIVERSITY OF BERGEN AND MOUNT VISUAL

to 12.0 seconds. "We believe that size of the object was around 20 km in diameter with mass around 1.4 times the mass of the Sun," says Shashi Bhushan Pandey of the Aryabhata Research Institute of Observational Sciences, Nainital, who is

one of the authors of the paper.

High luminosity

Magnetars have high magnetic fields in the range of 10^{15} gauss and they emit energy in the range given by luminosities of 10^{37} - 10^{39} joules

per second. Compare this to the luminosity of the sun which is in the order of 10^{26} joules per second - a factor of at least 10^9 lower.

Further, these magnetars emit violent flares. "The observations revealed multiple pulses, with a first pulse ap-

pearing only for about tens of microseconds, much faster than other extreme astrophysical transients," said Alberto J. Castro-Tirado, from the Andalusian Institute for Astrophysics (IAA-CSIC), Spain, and lead author of the paper, in a release circulated by the Department of Science and Technology, Government of India.

The observed giant flare lasted approximately 160 milliseconds and during this time 10^{39} joules of energy was released. The flare spewed as much energy in a tenth of a second that our Sun will radiate in 100,000 years, according to the paper.

Eruptions in magnetars are believed to be due to instabilities in their magnetosphere, or "starquakes" produced in their crust - a rigid, elastic layer about one kilometre thick. This causes waves in the magnetosphere, and interaction between these waves causes dissipation of energy.

Magnetars are very difficult to observe when they are silent. It is only during a flare that they can be observed, and these flares are so short-lived that it presents a formidable problem. "They are mostly observed or seen in active transient phases which are very short in duration and are very faint in general for any available instruments or telescopes," says Dr Pandey.

Serendipitous finding

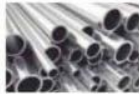
It was also a serendipitous find because, as Dr Pandey explains: "ASIM is mainly designed with its large effective area to observe terrestrial gamma ray flashes. It was a great coincidence that this bright transient flash was observed by ASIM instrument."

According to Dr Pandey, studying these flares will not only help us understand the physics of magnetars, it will also help in understanding fast radio bursts, which are among the most enigmatic phenomena in astronomy.



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Water-hating stainless steel



Indian researchers have developed superhydrophobic coatings that can improve stainless steel's corrosion resistance, making it usable in marine applications, pipelines, power generation, and nuclear sectors.

Superhydrophobic or ultralow wetting surfaces with self-cleaning properties have been intensely researched in recent decades due to their industrial relevance. When a drop of water is placed on a solid surface, it will spread on the surface based on the intermolecular interactions between the solid and the liquid. The wettability of a surface is measured by its water contact angle. Superhydrophobic surfaces have a water contact angle greater than 150 degrees and sliding angles less than 5 degrees. The conventional way of creating a superhydrophobic surface is by deposition of a polymer or sol-gel formulation in which nanoparticles are dispersed. This method enables a physical as well as chemical modification of the surface, to form superhydrophobic coatings in a single step. However, the coatings have shortcomings in durability, mechanical properties, and adhesion with the substrate.

Researchers at the International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI) investigated the durability of their superhydrophobic coatings on SS 304—the stainless steel used in marine devices, machinery, electronic parts, piping, power equipment and the nuclear sector, due to its excellent workability and cost-effectiveness.

The team explored shot blasting, a technique that improves the adhesion of coatings on a substrate surface, along with nanocomposite superhydrophobic sols for the generation of adherent and durable superhydrophobic surfaces on SS 304 substrates. With these surface modifications, the water contact angle increased from 84 to 160 degrees. The stability of the coatings was evaluated by the measurement of abrasion resistance, weather resistance, and corrosion resistance. It was observed that the developed coatings were able to withstand 100 cycles of abrasion testing. These coatings also exhibited superior corrosion resistance, which can help overcome the problems encountered by SS 304 in harsh and contaminated environments such as marine and gas pipelines, including surface ageing and corrosion.

Astronomers detect rare giant eruptions from magnetar located 13 million light years away

ANJALIMARAR
PUNE, DECEMBER 22

AN INTERNATIONAL group of astronomers has obtained the first clues about extremely rare giant eruptions lasting 3.5 milliseconds that emerged from a magnetar located 13 million light years away. The team includes astronomers from Norway, Spain and the Aryabhata Research Institute of Observational Sciences (ARIES), Nainital.

Magnetars are a type of isolated neutron stars that possess the most intense magnetic fields. They experience violent eruptions or intense bursts in the form of transient X-ray pulses which are several orders higher than that of the Sun. Even inactive magnetars can be thousands of times more luminous than the Sun.

So far, only 30 magnetars located within the Milky Way have been discovered.

The eruption that occurred on



(Left) The ASIM instrument onboard ISS; (Right) Artist impression of the starquakes on the distant magnetar.

April 15, 2020 — described in the latest study published in *Nature* — was from a magnetar named GRB2001415. Scientists involved in the research say that the single event released energy equivalent to what the Sun would radiate in one lakh years.

"The observations revealed multiple pulses, first of which lasted for about tens of microseconds — which is much faster than other extreme astrophysical transients," said Alberto J. Castro-

Tirado, lead author and scientist at the Instituto de Astrofísica de Andalucía (IAA-CSIC), Spain.

Found in the Sculptor group of galaxies (NGC 253), the detection of eruptions from GRB2001415 is significant as it is the farthest ever magnetar eruption detected by far.

"The detection of eruptions from a magnetar located outside our galaxy is rare," said Shashi Bhushan Pandey, senior scientist at ARIES, and one of the co-authors of the study.

Like earthquakes on Earth, magnetars suffer starquakes produced on their crust due to high instability prevailing in their magnetospheres. This instability triggers Alfvén waves that are also common in the Sun. The interactions between multiple Alfvén waves ultimately release massive energies, appearing as giant flares lasting for a few milliseconds.

The detection would have been nearly impossible without Atmosphere-Space Interactions Monitor (ASIM) on board the International Space Station and its wide effective area, coupled with complex data analysis performed by the scientists.

"ASIM was the only mission that detected the main burst phase in the entire energy range of photons without saturation," said second author Nikolai Østgaard, from the University of Bergen, Norway.

The study could further pave the way in linking how magnetic stresses are produced around neutron stars, said the researchers.



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ऋषिगंगा में मलबा आपदा की वजह बना

उत्तराखंड



देहरादून | शैलेंद्र सेनवाल

चमोली जिले की रैणी आपदा को लेकर वाडिया हिमालय भू-विज्ञान संस्थान के ताजा शोध में कई खुलासे हुए हैं।

मध्य हिमालय के नंदादेवी रिजर्व बायोस्फीयर क्षेत्र की ऋषिगंगा घाटी में सात फरवरी 2021 को आई भीषण बाढ़ का मुख्य कारण ऊपरी हिमालयी क्षेत्र में बड़ी मात्रा में पानी और मलबे का जमाव था। यह मलबा वहां पिछले चार-पांच साल से लगातार जमा हो रहा था। रौंगथी गंधेरे में 540 मीटर चौड़ी और 720 मीटर लंबी चट्टान टूटने और उस पर टिके हैमिंग ग्लेशियर

वैज्ञानिकों ने भविष्य के लिए किया आगाह

शोध में इस जोन में धीरे-धीरे लैंड स्लाइड, एवलांच और ग्लेशियर टूटने की घटनाएं बताई गई हैं। हिमालय में 4250 से लेकर 3800 मीटर की ऊंचाई पर इन घटनाओं से छोटी-छोटी झीलें बनीं और उनमें बहुत सारा पानी, चट्टानों के अवशेष एकत्रित होते रहे। 2016 की सैटेलाइट इमेज और आपदा के बाद खींची गई फोटोग्राफ में यह बदलाव और अवशेष दिखाई देते हैं। वैज्ञानिकों का मत है कि जब यह चट्टान और हैमिंग ग्लेशियर टूटकर नीचे गिरा होगा तो इसने छोटी-छोटी झीलों को तोड़ दिया। कई साल से जमा हो रहा पुराना मलबा 35 से 45 डिग्री की ढलान में अपने साथ सब-कुछ बहाकर ले गया।

के खिसकने से बाढ़ आई।

रौंगथी गंधेरे में ऋषिगंगा घाटी के तल में तेज प्रवाह ने रैणी, तपोवन और विष्णुप्रयाग में तबाही मचाई थी। यह आपदा फरवरी की सर्दियों में हुआ, जब अमूमन ग्लेशियर या बर्फ पिघलने की उम्मीद नहीं होती। ऋषिगंगा हादसे

को लेकर अभी तक जो शोध हुए, उनमें वैज्ञानिक दो सवालों के जवाब नहीं खोज पाए थे। पहला यह कि, घटना सर्दियों में क्यों हुई? और दूसरा, इतना मलबा और पानी कहां से आया? वाडिया के वैज्ञानिकों ने अपने शोध में इन सवालों के जवाब खोजे।



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'Solar hamam' taking care of heating in cold Himalayan regions

The system is also helping conserve the forests as it is reducing the dependence on fuelwood

VIKAS VASUDEVA
CHANDIGARH

Aimed at providing clean energy solutions to households in the cold mountainous regions for heating purposes and also to achieve forest conservation, a solar water-heating system, 'solar hamam', is proving popular among the villagers in Himachal Pradesh, Ladakh and Uttarakhand.

In the higher Himalayan region, 50% of fuelwood is consumed for the purpose of heating and is one of the ma-

ior reasons for forests degradation and also the main cause of drudgery of women.

Scientists at the Himalayan Research Group, an NGO, which is a part of the Government of India's Department of Science and Technology Core Support Programme of Science for Equity Empowerment and Development (SEED) Division realised that technology interventions to conserve forests was required, and hence they devised a customized solar water and space



A 'solar hamam' at work.

heating system for the region.

"It was in 2004 that with an aim to reduce dependence on fuelwood and women drudgery that we start-

ed research and development for designing a simple and cost-effective solar water and space heating system for rural households. In 2008, we developed a prototype of the solar water-heating system, and it was put for evaluation. It was found to be cost-effective, providing 15 to 18 litres of hot water within the first solar illumination of 30-35 minutes in the morning. Successive batches of hot water are available in 15-20 minutes gap. After its encouraging re-

sults we started installing the system from 2014 onwards. We have so far installed over 1,200 such systems in Himachal Pradesh, Ladakh and Uttarakhand," said Dr. Lal Singh, Director at the Himalayan Research Group.

Harish Chander (49), a resident of village Oli in Mandi district installed the solar system in 2018 and is very happy with its results. "After I installed it (solar hamam) in my house I urged other people to use it. It is wonderful," he said.