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VOL. XCIX NO. 223 PRICE ₹6.00/WITH HINDUSTAN ₹10.50 (₹ 9.50 IN FARIDABAD)/WITH MINT ₹15.50 24 PAGES + 4 PAGES OF HT CITY.
AREA SPECIFIC PAGES EXTRA.

Hindustan Times
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{ RAISING THE SPACE BAR }

After its successful sun, moon expeditions, Isro starts work on dedicated polarimetry mission

A rocket carrying India's solar mission Aditya-L1 lifts off. ISRO

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NEW DELHI: After the success of India's Moon and Sun missions, the Indian Space Research Organisation (Isro) is now preparing for the country's first (and world's second) dedicated polarimetry mission to study various dynamics of bright astronomical X-ray sources in extreme conditions, providing vital information on the nature and behaviour of celestial objects. This mission is expected to be launched by the end of the year, scientists said.

"The dates for the XPoSat (X-ray Polarimeter Satellite) mission are yet to be finalised but the work around it is progressing at a fast pace," Isro chairman S Somanath said.

XPoSat is India's first and the world's second space mission to measure the polarisation of light. Polarimetry is a powerful tool that allows astronomers to infer information about celestial objects, from passing comets to distant galaxies. Isro scientists explained that the mission is unique and crucial because it will help them understand and measure emissions from various astronomical sources — black holes, neutron stars, active galactic nuclei, pulsar wind nebulae — that are otherwise challenging to study.

Such emissions are mostly tracked by studying the chemical make up (using a spectroscope) and the time it takes them to travel a distance.

"While the spectroscopic and timing information by various space-based observatories provide a wealth of information, the exact nature of the emission

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to our understanding, the degree of polarization and the angle of polarization and thus is an excellent diagnostic tool to understand the emission processes from astronomical sources," the space agency said.

The degree of polarization is the proportion of an electromagnetic wave that is polarized while the angle of polarization is the angle at which light of a certain polarization is perfectly transmitted through a transparent surface. Together, they can provide more information about the bodies that emit these waves.

Isro added: "The polarimetric observations along with spectroscopic measurements are expected to break the degeneracy of various theoretical models of astronomical emission processes. This would be the major direction of research from XPoSat by Indian science community."

The mission will carry two payloads — POLIX (Polarimeter Instrument in X-rays) which will measure the polarimetry parameters including the degree and angle of polarization, in medium X-ray energy range of 8-30 keV photons of astronomical origin, and XSPECT (X-ray Spectroscopy and Timing) payload which will give spectroscopic information in the energy range of 0.8-15 keV.

The primary payload, POLIX, developed by the Bengaluru's Raman Research Institute in collaboration with the UR Rao Satellite Centre (URSC) is made of a collimator, a device for producing a parallel beam of rays or radiation, a scatterer and four X-ray proportional counter detectors that surrounds the scatterer.

POLIX is expected to observe about 40 bright astronomical sources of different categories during its lifetime of about five years. This is the first payload in the medium X-ray energy band dedicated for polarimetry measurements.

XSPECT has been designed to provide fast timing and good spectroscopic resolution in soft x-rays. Taking advantage of the long duration observations required by POLIX to measure X-ray polarization, XSPECT will conduct long-term monitoring of spectral state changes in continuum emission, changes in their line flux and profile, simultaneous long term temporal monitoring of soft X-ray emission in the X-ray energy range 0.8-15 keV.

This will be the second such mission in the world, after the National Aeronautics and Space Administration's (NASA's) Imaging X-ray Polarimetry Explorer, or IXPE, which was built to "discover the secrets of some of the most extreme objects in the universe, the remnants of supernova explosions, powerful particle streams spit out by feeding black holes, and more."

POLARIMETRY MISSION

from such sources still poses deeper challenges to astronomers. The polarimetry measurements add two more dimension

Satellite images show farm fires in Punjab, Haryana

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EVERY YEAR, FARM FIRES LEADS TO A THICK JACKET OF SMOG ENVELOPING THE CITIES IN THE NATIONAL CAPITAL REGION, CAUSING A HEALTH CRISIS

NEW DELHI: Farm fires have begun to appear on NASA's satellite imagery of northern India's plains, with six fire events recorded in Punjab and two each in Haryana and Uttar Pradesh since September 15, data compiled by the Indian Agricultural Research Institute (IARI) shows.

Every year, crop residue burning is monitored from September 15 till November 30, and data compiled by the Consortium for Research on Agroecosystem Monitoring and Modelling from Space (CREAMS) — a centre under IARI — reveals that between September 15 and 18, Punjab recorded six fires. This figure is lower than previous years — in the same period last year, Punjab recorded 22 fires, while the count was 11 in 2021.

Haryana meanwhile has recorded a farm fire each on September 15 and 16, with no fire recorded on September 17 or 18. In comparison, Haryana recorded only one farm fire in all of September last year – on September 18. Uttar Pradesh's count of two fires came on September 16 this year. In comparison, the state recorded its first farm fire count last year on September 30.

VK Sehgal, professor and principal scientist at IARI, who is a part of CREAMS, said a clear trend will begin to emerge from October, when the monsoon has withdrawn and harvesting generally begins. "What we tend to observe in September are isolated fires, generally occurring in Amritsar or Tarn Taran in Punjab, since they primarily grow potato and that has a different harvesting cycle in comparison to paddy. Despite lack of rains in August, Punjab is still likely to see a bumper crop this year, which again means more efforts are required on the ground to control fires," he said.

Every year, Delhi faces a public health crisis with the emanation of farm fires in Punjab, Haryana, and Uttar Pradesh. This causes a smog jacket to form over northern India, particularly Delhi. This year, however, sowing has been impacted by an abnormal monsoon pattern.

Stubble burning generally starts impacting Delhi's air quality from October onwards, when the wind direction becomes northwesterly, following the withdrawal of the southwest monsoon in late September.

This year, sowing has also been impacted by an abnormal monsoon pattern, which saw a rain deficit of 10% across the country. This was followed by above normal rainfall in July, which saw northwest India record an excess of 59% and flooding in parts of Punjab, Haryana and even Uttar Pradesh. Over the last week, northwest India is also recording rain, which can push residue burning to October, experts say.

Anumita Roychowdhury, executive director, research and advocacy at the Centre for Science and Environment (CSE) says September is generally the ideal period for state governments to identify problems on the ground and intervene. "We generally start to see sporadic fires from September 15 onwards...With rains, we can generally see no farm fires and as soon as the rains stop, there can be a spike. Last year was similar, as rains in September pushed residue burning to October," she added.