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Isro begins new year with XPoSat success

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NEW DELHI: The Indian Space Research Organisation (Isro) on Monday successfully launched the Polar Satellite Launch Vehicle-C58 carrying X-ray Polarimeter Satellite or XPoSat and 10 other payloads in a mission that aims to study the dynamics of bright astronomical X-ray sources, including Black Holes, which could provide vital information on the nature and behaviour of celestial objects.

Isro chairman S Somanath said that XPoSat is a unique mission that will test India's capabilities of X-ray Polarimetry with locally built instruments.

"On January 1, 2024, yet another successful mission has been achieved with PSLV. PSLV-C58 has placed XPoSat in the desired orbit of 650km, six-degree inclination... We are looking forward to an exciting year ahead," Somanath said after the launch.

Isro launched XPoSat on board the PSLV from Sriharikota. AFP

XPoSat is India's first polarimetry mission and only the second such mission in the world. The US's National Aeronautics and Space Administration (Nasa) first launched its Imaging X-ray Polarimetry Explorer (IXPE) mission in 2021 on-board a SpaceX Falcon 9 rocket from Kennedy Space Center.

A joint effort with the Italian Space Agency, IXPE was dedicated to measuring the polarization of X-rays from the "most extreme and mysterious objects in the universe", including

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supernova remnants, supermassive black holes, and dozens of other high-energy objects.

At 9.10am on Monday, Isro's trusted launch vehicle PSLV-C58 lifted off from the Satish Dhwan Space Centre in Sriharikota.

Isro officials said that in the course of its five-year mission, XPoSat will investigate the polarization of intense X-ray sources. While India currently has a well-established space-based X-ray astronomy programme, this mission will predominantly focus on imaging, time-domain studies, and spectroscopy.

"The emission mechanism from various astronomical sources such as Black Holes, neutron stars, active galactic nuclei, pulsar wind nebulae etc, originates from complex physical processes and are challenging to understand. While the spectroscopic and timing information by various space-based observatories provide a wealth of information, the exact nature of the emission from such sources still poses deeper challenges to astronomers," Isro said in its mission statement.

It added, "The polarimetry measurements add two more dimension 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 polarimetric observations along with spectroscopic measurements are expected to break the degeneracy of various theoretical models of astronomical emission processes."

Polarimetry is a powerful tool that allows astronomers to infer information about celestial objects, from passing comets to distant galaxies.Such emissions are mostly tracked by studying the chemical make-up (using a spectroscope) and the time it takes them to travel a distance.

XPoSat will carry out its studies from a low Earth orbit — a non-Sun synchronous orbit of ~650 km altitude, low inclination of ~six degree — using two payloads. The primary payload is Polarimeter Instrument in X-rays or, POLIX, designed to measure polarimetry parameters, specifically the degree and angle of polarization, in the medium x-ray energy range of 8-30 keV photons originating from astronomical sources. The mission also carries X-ray Spectroscopy and Timing or XSPECT, which will provide spectroscopic information within the energy range of 0.8-15 keV.

POLIX is developed by the Raman Research Institute (RRI), Bangalore, with support from Isro labs, while XSPECT has been developed by Isro's UR Rao Satellite Centre.

Somanath said that depending on the findings of XPoSat over the next five years, the space agency will plan a follow-up mission to explore the astronomical origins of celestial bodies in the coming year.

Along with XPoSat, the PSLV orbital platform module carried 10 other payloads including Radiation Shield Experiment Module (RSEM) by TakeMe2Space, Women Engineered Satellite (WESAT) by LBS Institute of Technology for Women, BeliefSat by KJ Somaiya Institute of Technology, Green Impulse Transmitter (GIT) by Inspecity Space Labs Private Limited, Launching Expeditions for Aspiring Technologies Technology Demonstrator by Dhruva Space, RUDRA0.3 HPGP by Bellatrix Aerospace, Dust Experiment (DEX) by Physical Research Laboratory, Fuel cell Power System (FCPS) and SI-based High Energy cell by Vikram Sarabhai Space Centre.

Plan to launch at least 12 missions this year: Isro

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NEW DELHI: After a spectacular 2023 that saw the country land a spacecraft on the Moon and launch another to study the Sun, the Indian Space Research Organisation will carry out at least 12 launches this year, surpassing previous records, chairman S Somanath said on Monday.

"We are planning at least 12 missions for 2024. It may also go up depending on our ability to produce the hardware and complete testing," Somanath said at a media briefing after the successful launch of India's first polarimetry mission, the X-ray Polarimeter Satellite, a space observatory that will study black holes and other celestial objects.

In 2023, the space agency conducted a record seven missions, including the landing of Chandrayaan-3 close to the lunar south pole, and the launch of India's first sun observatory, the Aditya-L1, which is expected to reach its destination, Lagrange Point 1, on January 6. Besides the launches, the space agency also conducted key technology demonstrations that pave the way for future missions for the Gaganyaan spacecraft and a reusable launch vehicle.

This year will be the "year for Gaganyaan", Somanath said. "2024 is going to be a year to prepare for Gaganyaan. We are targeting the launch for 2025, but this year we will be conducting at least two more rounds of tests before gearing up for the final mission," he said.

The Gaganyaan, India's first human space flight mission, will carry a crew of three astronauts to an orbit 400km above the earth's surface for a three-day mission and bring them back safely. After a TV-D1 test flight demonstration in October, the agency will carry out a test flight with a humanoid robot, dubbed Vyomitra, and an unmanned flight before manned Gaganyaan mission, possibly scheduled for 2025.

The prerequisites for Gaganyaan mission include development of many critical technologies, including a human-rated launch vehicle for carrying crew safely to space and back, life support systems to provide an Earth-like environment, and an emergency escape system.

On February 7 last year, Isro with the Indian Navy carried out recovery trials of the crew module in Kochi. The trials were part of preparations for crew module recovery operations for the Gaganyaan mission. Isro also tested the Gaganyaan service module propulsion system on July 19 at its propulsion complex in Odisha. On October 21, Isro also conducted the first developmental flight of test vehicle (TV-D1) with the in-flight abort demonstration of the crew escape system (CES).