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INDIA SUCCESSFULLY LAUNCHES ASTROSAT: A MULTI WAVELENGTH SPACE OBSERVATORY

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Indian Space Research Organisation (ISRO) on September 28, 2015 successfully launched a dedicated scientific exploration space observatory 'Astrosat' from Satish Dhawan Space Centre (SDSC), SHAR, Sriharikota.[1] The 1513 kg satellite was launched aboard the PSLV-C30 rocket which also carried additional six satellites from international customers. The additional payloads successfully placed in orbit consisted of LAPAN-A2 (76 kg) of Indonesia, NLS-14 (14 kg) of Canada and four identical LEMUR satellites (7 kg each) of USA.[2] Astrosat is the first dedicated astronomy mission by ISRO and places India as the fourth nation in the world to have a scientific observatory in space after United States, Russia and Japan.[3]

A dedicated space observatory is a scientific satellite in outer space that is used for observation of distant planets and their satellites, comets, asteroids and other outer space objects as well as other galaxies. The other aim of these observatories is to study the birth of stars and their companion planets. The knowledge of the Universe requires the study of attributes of the light emitted by objects in space and this study is based on collation of information received on the radiation characteristics, the objects bulk density, temperature, brightness and surrounding atmospheric environment. Earth based observatories cannot access most of the radiations emitted from the objects in cosmos as the electromagnetic radiation is filtered and distorted due to earth's atmosphere. It is because of this reason that Space-based observatories are needed to provide with otherwise inaccessible information outside the optical and radio wavelengths.

Astrosat will help in exploration of universe by multi wavelength observations of astronomical objects in the optical, ultraviolet, low and high energy X-ray regions of the electromagnetic spectrum.[4] It is equipped with five scientific payloads that have been realised

with active participation of major astronomy institutions and Indian universities: -

- The Ultraviolet Imaging Telescope (UVIT) designed to achieve excellent resolution will provide with the capability of observing the sky in the Visible, Near Ultraviolet and Far Ultraviolet regions of the electromagnetic spectrum.[5] The payload has been jointly developed by the Indian Institute of Astrophysics (IIA) at Bangalore and Inter University Centre for Astronomy and Astrophysics (IUCAA) at Pune in collaboration with ISRO and Canadian space agency.
- Large Area X-ray Proportional Counter (LAXPC) has been developed by Tata Institute of Fundamental Research (TIFR) and Raman Research Institute to help study the variations in the emission of X-rays from cosmic sources.[6]
- Soft X-ray Telescope (SXT) has been designed by TIFR in collaboration with University of Leicister (United Kingdom) and ISRO. It will help study how the X-ray spectrum coming from distant celestial bodies varies with time.
- Cadmium Zinc Telluride Imager (CZTI), developed by TIFR and IUCAA in collaboration with ISRO will sense X-rays of high energy.[7]
- Scanning Sky Monitor (SSM), developed by ISRO Satellite Centre at Bangalore and IUCAA will be used for long term monitoring of bright X-ray sources in binary stars[8] and for the detection and location of sources that become bright in X-rays for a short duration of time.[9]

In addition, there will be a Charged Particle Monitor (CPM) to monitor the local charged particle environment and control the operation of the LAXPC, CZTI, SXT and SSM.[10] These payloads would provide the much sought data on deep field survey of the Universe and help assess the evolution, physical properties and orbital characteristics of distant stars, binary star systems, white dwarfs[11] and pulsars[12]. However, the mission's main goal is to study the massive black hole[13] believed to be existing at the core of the Milky Way. A black hole with a mass of million times more than Sun is considered to swallow matter from its surroundings and in the process radiate energy. The Astrosat will help learn about the Black holes by carrying out prolonged observations of the high energy processes and the governing forces involved.

The idea of ASTROSAT floated almost 20 years back has been conceived successfully after surmounting of a series of complex challenges.[14] While India does have the Astronomic Observatories with giant telescopes at Pune and Ladakh, these observatories are limited to studies based on radio and infrared radiations from cosmic bodies. As Astrosat becomes operational, the Indian Scientist and Astronomical Institutes now have an eye in the sky to capture information on neutron stars, newly born or exploding stars and data on creation and behaviour of black holes. Over the

operational life of five years, Astrosat will help the Astronomers across the globe to study the new phenomenon and events taking place in space and thus help India to garner International acclaim in the field of X-Ray Astronomy.

(Disclaimer: The views and opinions expressed in this article are those of the author and do not necessarily reflect the position of the Centre for Air Power Studies [CAPS])

Notes

[1]" Isro's PSLV carrying Astrosat launched successfully", at http://www.business-standard.com/article/current-affairs/isro-s-pslv-carrying-astrosat-launched-successfully-115092800136_1.html accessed on September 28, 2015

[2] " PSLV-C30/Astrosat Mission", at http://www.isro.org/launcher/pslv-c30-astrosat-mission accessed on September 24, 2015

[3] "India to launch first space observatory Astrosat on September 28" at http://zeenews.india.com/news/space/india-to-launch-first-space-observatory-astrosat-on-september-28_1800058.html accessed on September 21, 2015

[4] "Astrosat", at http://www.isro.org/Spacecraft/astrosat accessed on September 24, 2015

[5] "ISRO-PSLV C30/ Astrosat brochure", at http://www.isro.gov.in/sites/default/files/PSLV-C30Brochure.compressed.pdf accessed on September 21, 2015

[6] ibid

[7] ibid

[8] A binary star is a star system consisting of two stars orbiting around their common centre of mass.

[9] ibid

[10] "ASTROSAT Charged Particle Monitor (CPM)", IUCAA at http://astrosat.iucaa.in/?q=node/9 accessed on September 28, 2015

[11] A white dwarf, also called a degenerate dwarf, is a stellar remnant composed mostly of electron-degenerate matter. A white dwarf is very dense: its mass is comparable to that of the Sun, and its volume is comparable to that of Earth. A white dwarf's faint luminosity comes from the emission of stored thermal energy. (available at https://en.wikipedia.org/wiki/White_dwarf)

[12] A pulsar (short for pulsating radio star) is a highly magnetized, rotating neutron star that emits a beam of electromagnetic radiation (available at https://en.wikipedia.org/wiki/Pulsar)

[13] A black hole is a place in space where gravity pulls so much that even light cannot get out. The gravity is so strong because matter has been squeezed into a tiny space. This can happen when a star is dying. Because no light can get out, people can't see black holes. They are invisible. Space telescopes with special tools can help find black holes. The special tools can see how stars that are very close to black holes act differently than other stars. (available at http://www.nasa.gov/audience/forstudents/k-4/stories/nasa-knows/what-is-a-black-hole-k4.html)

[14] "Evolution of the Astrosat idea", *Frontline*, at http://www.frontline.in/science-and-technology/evolution-of-the-astrosat-idea/article7655287.ece accessed on September 28, 2015