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Editorial

We view and learn about the objects in the Universe primarily from the electromagnetic radiation received by the measuring instruments. The optical and radio emissions can be studied extensively using ground-based and space-based observatories. The high-energy radiation like Ultraviolet (UV) and X-ray emission can be studied only by using space observatories because the Earth's atmosphere absorbs these radiations. In the last half century, the study of UV and X-ray emissions from a variety of celestial sources, using satellite-based astronomy instruments, have enhanced our understanding of the Universe.

India's first dedicated astronomy satellite – Astrosat, is designed and developed by the Indian Space Research Organisation (ISRO), with instruments covering a wide spectral band from optical to hard X-rays using a suite of 4 co-aligned instruments, along with a Scanning Sky Monitor, developed at various institutions, details of which are provided in the papers in this issue.

The Astrosat was launched on 28 September 2015 by PSLV-C30. It is aimed at simultaneous UV and X-ray observations of several celestial sources, and is operating as an astronomy observatory. It has successfully completed over a year and a half in orbit, and is providing opportunities to Indian astronomers to propose for and study different types of target sources of scientific interest like hot stars, X-ray binaries, white dwarfs, neutron stars, galaxies, Active Galactic Nuclei (AGN), and so on. This Special Section is meant to provide the readers a glimpse into the calibration and initial results from the instruments (payloads) on-board Astrosat.

The Astrosat project was approved in 2004, and has several indigenous developments to its credit. The development of UV optics, X-ray optics, high pressure counters, position sensitive proportional counters, and utilization of coded mask techniques are just a few. A new 'M.G.K. Menon Laboratory for Space Sciences' has also been set up for integration and testing of space-based optical/UV telescopes, with a capability of 100 class cleanliness. The first paper gives a brief outline of the inception of this project, lead institutions involved and details of some of the developments, many of which took place in several institutions within India.

There are totally six payloads on-board Astrosat, and the subsequent six papers by each of the instrument team leads, give a brief overview of the capabilities of these instruments, along with initial observations in space after launch.

Some of the important features of the instruments are:

- *Ultra Violet Imaging Telescope (UVIT)* images the sky simultaneously in three wavelengths, the payload is configured as a pair of telescopes, one covering the far-UV band (130–180 nm) and the second covering in the near-UV band (200–300 nm) and the visible (320–550 nm) band. The detector in each channel is a photon counting device. Multiple choices of filters are available in each channel. The optical channel is primarily used for tracking corrections and is therefore mostly used in integration mode.
- *Soft X-ray Telescope (SXT)* is a focusing X-ray telescope with an X-ray CCD imaging camera. This works primarily in photon counting mode, recording the position, time and energy of every detected photon in the energy range 0.3–8 keV.
- *Large Area X-ray Proportional Counters (LAXPC)* comprises of three identical non-imaging proportional counters with a large effective area. Its main purpose is to record variation of total intensity of sources within its 0.9 degree field-of-view, with high time resolution of 10 microseconds and moderate spectral resolution over a large spectral band from 3 to 100 keV.
- *Cadmium-Zinc-Telluride Imager (CZTI)* is a hard X-ray coded mask camera with CZT modules as detectors and can extend the X-ray energy range beyond 100 keV. It has a coarse imaging capability using the coded mask and can provide better spectral resolution than the LAXPC for sparse fields using weighted imaging.
- *Scanning Sky Monitor (SSM)* consists of 1D position sensitive proportional counters for detection

of new X-ray transients and monitoring of known X-ray sources in the 2.5–10 keV region.

- *Charged Particle Monitor (CPM)* is an ancillary payload aimed at detecting high-energy particles (primarily protons) in the satellite orbital path and provide alerts to the other payloads, through a ground-based model and/or by CPM.

These papers are followed by a brief description of the overall satellite configuration.

The Astrosat is now operating as an Observatory to point and observe specific target sources. A brief description of the nuances of the operation of this satellite after launch is provided in the last article.

In order to successfully accomplish all the above, a software called Astrosat Proposal Processing System (APPS) is set up. This was developed through the Inter-University Centre for Astronomy and Astrophysics (IUCAA), with Prof. G. C. Dewangan being the focal person. The APPS is made open for receiving proposals at the Indian Space Science Data Centre (ISSDC, http://www.issdc.gov.in) at specific times when AO is made open at ISRO website. The proposals received through APPS can be sent to reviewers across the world. The Astrosat Time Allocation Committee (ATAC) now chaired by Prof. R. Srianand, evaluates the proposals for their science merit and the Astrosat Technical Committee (ATC) chaired by Prof. Dipankar Bhattacharya, for the technical feasibility. The Chairman of ATAC finally provides a list of approved proposals. This list is then made available by the APPS administrator at ISSDC to the mission team. The mission team then schedules and provides commands for the individual operations.

Apart from these targets, proposals can also be submitted for any Targets of Opportunity (ToO) at any time through APPS. These are separately reviewed by a ToO committee chaired by Dr. P. Sreekumar.

For enabling the proposers to estimate whether an observation is feasible before submitting a proposal, and also to make available the calibration database and necessary information for analysing the data, an Astrosat Science support Cell (ASC) is set up and hosted at IUCAA (http://astrosat-ssc.iucaa.in/).

I thank all the authors of the papers in this Special Section, for their time and effort in providing the manuscripts. My profuse thanks to all the institution/agencies and their staff who contributed to the development of the instruments, the satellite, its launch and its operations. I also take this opportunity to thank the team members of ATAC, ToO Committee, ATC, ASC, APPS support team, and mission team at ISAC and ISTRAC, for all their contributions in making this mission as India's first Space Observatory.

I would also like to bring to the notice of the readers that many other articles on Astrosat and several other large projects will be published in the Special Issue of *Current Science* on "Large Astronomical Projects".

I look forward to many more scientific results from the Astrosat mission, paving the way for further strides in space science contributions from India.

S. SEETHA
Guest Editor