SMALL SATELLITE MISSIONS SYMPOSIUM (B4)
Small Space Science Missions (2)

Author: Dr. V. Koteswara Rao
Astronautical Society of India, India, vkrao@isro.gov.in

ADITYA – 1, INDIAN MINI SATELLITE SPACE CORONAGRAPH

Abstract

'ADITYA' in Sanskrit language means the 'Sun'. The 'ADITYA-1' mission envisages a space based Solar Coronagraph for Solar Astronomy. This project is approved by Space Commission, Government of India. The project shall be executed by Indian Space Research Organisation (ISRO), with the participation from number of Indian Institues.

The satellite bus is from the standard Indian Mini Satellite IMS-2 bus developed for SARAL mission. The IMS-2 is a 400 kg class satellite with an included capability to carry 200 kg payloads. This bus with minor modifications was studied and found suitable for Aditya-1. This would be the second mission of IMS-2 bus. The satellite is three axis stabilized, Sun pointing, polar orbiting with an altitude of 800 km. Out of the recent space missions, STEREO has a coronagraph to observe unvignetted corona from 1.64 R. STEREO may not be functional during the next solar maximum (2012-2013). The coronal loops which are visible only up to 2 R will be missed out by COR1 on STEREO due to the limit on its inner FOV.

The major scientific objectives of the 'ADITYA-1' are to achieve a fundamental understanding of the physical processes that Heat the solar corona (base to the extended), Accelerate the Solar Wind, and Produce Coronal Mass Ejections (CMEs). To achieve these objectives, the coronagraph should have the capabilities for observing high frequency intensity oscillations (1Hz), dynamics of coronal loops with high cadence, magnetic field topology and CMEs close to the solar disk.

Keeping in view the above scientific objectives we have planned the science instrument on 'ADITYA-1' to be a 20 cm internally occult coronagraph using an off-axis parabolic mirror capable of taking images of the solar corona simultaneously in the visible emission lines at 5303 Å [Fe xiv] and at 6374 Å [Fe x]. These emission lines are the brightest in the visible coronal spectrum and the field-of-view (FOV) will be from 1.05 R to 3.0 R in the solar corona. The fast cadence of the proposed imaging instrument will allow us to study the high frequency waves and its association with the coronal heating. Linear polarization measurements will also be made to map the magnetic topology of the solar corona. The inner FOV capability of this instrument will permit to study of origin and acceleration of CME's.