

SPACE EXPLORATION SYMPOSIUM (A3)
Mars Exploration – Science, Instruments and Technologies (3B)

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LYMAN ALPHA ABSORPTION CELL PHOTOMETER ABOARD ISRO'S MOM SPACECRAFT:
DEVELOPMENT CHALLENGES, ONBOARD OPERATIONS AND PRELIMINARY RESULTS

Abstract

In continuation to the accomplished success of the maiden mission to Moon, Chandrayaan-1, India has witnessed a spectacular technical feat in late 2014 by insertion of a spacecraft orbiting the red planet, Mars. The mission named as MOM (Mars Orbiter Mission) was launched successfully in late 2013 and is the first of a series of missions planned by ISRO to explore and characterize the Mars in anticipation of future landing missions. The spacecraft has placed five scientific payloads with the objective of furthering the understanding of the Mars based on its morphology and mineralogy from an elliptical orbit of 400 km x 71,000 km. The 'Lyman Alpha Photometer (LAP)' is one of the payloads aboard MOM spacecraft that is essentially a compact far-ultraviolet instrument developed based on absorption gas cell technique. The instrument is capable of measuring in-situ Lyman alpha intensities and has the potential of generating global distribution Lyman- α maps of Martian exosphere in altitude range of +/- 3,000 km from periapsis. Instrument development choices were tightly constrained; principally by the technological aspects, spacecraft resources and time-schedule. Conceptualization and design aspects of the instrument realization were presented elsewhere. Further to that, this paper sheds the light on the other phases of the instrument realization in term of developmental challenges and qualification prospects. The LAP aboard

MOM is a 2- kg instrument occupying a footprint of 276 mm x 138 mm x 100.5 mm with the field-of-view of 3.5 degree(v) x 1.5 degree(h). Its development incorporates novel approaches and techniques, especially in metallic gas cells design, single-photon counting detection and processing electronics. LAP can function in two modes i.e., i) Photometer mode in which the incoming line-of-sight photon flux within the spectral bandwidth of the Lyman alpha filter is measured and ii) Absorption cell mode in which, filaments gas cells are activated in a cyclic manner to record the relative signal contribution. The first on-board operation in trans-Mars orbit phase was carried out on 6th February 2014 during the period 09:45:35 UT–10:03:02 UT. On-board performed functionality checks and health parameters attested the good health condition of the instrument. After the successful spacecraft's insertion into the desired orbit, the instrument has been flawlessly performing on-board investigations. Through this paper, authors would like to present development prospects of the LAP instrument at its different phases, challenges faced and executed types of on-board operations along with the preliminary data analytical results.