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Moon Exploration – Part 1 (2A)

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KEYNOTE: SCIENCE FINDINGS FROM CHANDRAYAAN-3 IN-SITU OBSERVATIONS

Abstract

The historic soft-landing of Chandrayaan-3 in the southern high latitudes on the Moon marked the beginning of in-situ investigations for the science payloads onboard the Vikram Lander and Pragyaan Rover. Salient results from the science payloads, which are deployed and operated in the unexplored terrain are as follows.

- Instrument for Lunar Seismic Activity (ILSA) recorded around 50 uncorrelated events, lasting for few seconds, and containing high frequency components in the order of few tens of Hz. The source could be micrometeorites impacts near to the lander or thermal effects on the terrain. Continuous measurements over one lunar day indicates that polar latitudes are not seismically quiet and hence provides crucial input for building lunar habitats in the polar region.
- Chandra's Surface Thermophysical Experiment (ChaSTE) probe was inserted in the lunar regolith to the depth of 141mm for studying the temperature profile. Active heating experiments were done at 80mm depth and the thermal conductivity is estimated. The numerical modelling and estimation of thermal conductivity using empirical model on ground, corroborate the in-situ measurements.
- The electron density electron temperature and their temporal evolution are derived from the RAMBHA- Langmuir Probe observations. The temporal variation of electron density is modelled using the Space Physics Laboratory's Lunar Ionospheric model (LIM). The findings unravel the role of solar/magnetospheric wind charge exchange process in the relation to the photo ionization process in modulating the temporal evolution of lunar ionosphere.
- The Alpha Particle X-ray Spectrometer (APXS) measured the elemental abundances at total 23 locations along the 100 m traverse of the Pragyaan rover. The measured APXS data do not show any statistically significant variation, which indicates a chemically uniform local lunar terrain composed primarily of ferroan anorthosite (FAN). Similar composition was derived from Apollo 16 and Luna 20, thus supporting the Lunar Magma Ocean hypothesis.
- Laser Induced Breakdown Spectroscope (LIBS) measurements indicate that the lunar polar terrain is dominated by the oxides of Fe, Ti, Al, Ca, Si followed by Cr, Mn. Hence the presence of minerals such as Ilmenite, Anorthosite and Triolite are anticipated.
- Spectro-polarimetry of HAbitable Planet Earth (SHAPE) observed the Earth from the lunar orbital platform, for two months. The spectra show the presence of Oxygen, water vapour and Carbon-di-oxide, indicating a planet which is habitable for the life as we know it.