

First Dayside Lunar Atmosphere Measurements: Results from Chandra's Altitudinal Composition Explorer (CHACE) aboard MIP/Chandrayaan-1

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The first of its kind of measurements of the tenuous lunar atmospheric composition on the sunlit side was carried out by the CHACE (Chandra's Altitudinal Composition Explorer) experiment on the Moon Impact Probe (MIP), which was an experiment to impact a stand alone micro-satellite at a designated area, as a part of the Indian mission to Moon Chandrayaan-1. As the MIP, after release from Chandrayaan-1 at 100-km, raced towards the lunar surface, systematic atmospheric pressure and composition measurements were made with a quadrupole mass spectrometer based payload CHACE, with an altitude resolution of ~250 m and a latitudinal resolution of ~0.1 degree. All the information is contained in 650 mass spectra obtained during 45 minutes of the MIP descent. The major new results from CHACE are: (i) higher pressures, of the order of 10^{-7} torr, on the dayside than anticipated earlier, (ii) unambiguous relative neutral composition determination in the mass range 1-100 amu, (iii) dominance of H₂O and CO₂ in the atmosphere, and (iv) presence of significant amount of heavier (>50 amu) species. While the other experiments on the Chandrayaan-1 (viz., M3 and Mini-SAR) have recently detected water in the form of ice on the lunar surface mostly at higher latitudes and in craters at the poles, CHACE has detected water in the vapour phase and showed that it is omni-present in the dayside lunar atmosphere. Further, the latitudinal temperature gradient on the lunar surface as one moved from the equator to the southern pole had been delineated from the composition measurements, in addition to vindicating the concept of a Surface Boundary Exosphere (SBE) on the sunlit side of the moon. These exciting results that have completely changed our present understanding of the lunar ambience would be discussed. We will also present our future plans to further study the lunar atmosphere in greater detail on the Chandrayaan-2 mission.