IAF SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 2 (2B)

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LUMIO MISSION: OBSERVATION AND CHARACTERIZATION OF LUNAR METEOROID IMPACTS

Abstract

Meteoroids continuously enter the Earth–Moon system, representing a potential threat to our planet and to spacecrafts operating around it. The characterization of the impact rate of the high-mass flux instead, has important implications for future human and robotic assets that will inhabit the Moon for significant periods, since high flux is also responsible for the deterioration of space equipment. Accurate models of the spatial and temporal distribution of this flux of meteoroids are therefore needed. Understanding meteoroids and associated phenomena can be also valuable for the study of asteroids and comets dynamical paths, as well as for understanding of the spatial distribution of near-Earth objects in the Solar System.

The LUnar Meteoroid Impacts Observer (LUMIO) is a 12U CubeSat mission designed to observe, quantify, and characterize Lunar meteoroid impacts by detecting their flashes on the far side of the Moon. LUMIO spacecraft, will operate in a halo orbit at Earth–Moon L2. Meteoroid detection is operated by the LUMIO-Cam, an optical instrument capable of detecting light flashes in the visible spectrum. Phase B activities of the mission are developed under ESA's General Support Technology Programme Fly Element (GSTP).

LUMIO is planned to be launched in the framework of the NASA Commercial Lunar Payload Service (CLPS) program. After release and commissioning, the satellite will perform several manoeuvres to achieve its final operative orbit around the Earth-Moon L2 point.

During nominal Operations, LUMIO will perform meteoroid detection for half period of the Lunar month,

when the Lunar surface will be only partially illuminated by the Sun. The remaining half period will be dedicated to station keeping manoeuvres, orbit determination and optical navigation exploiting the LUMIO-Cam to detect the Lunar terminator.
The mission will face technological challenges such as embarking a bulky payload in a limited volume and generating enough power to support scientific acquisitions, data processing and communication link.
Also, high reliability novel technologies, usually lacking in CubeSats, must be implemented due to stringent mass, volume, power and costs constraints, maximizing the reliability and survivability of the spacecraft during the whole mission.
This work presents the mission description and the technical challenges for the platform itself, and the innovative solutions that have been investigated.