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LUMIO CUBESAT: PHASE-A MISSION DESIGN AND ANALYSIS

Abstract

The Lunar Meteoroid Impacts Observer (LUMIO) is a CubeSat mission to observe, quantify, and characterise the meteoroid impacts by detecting their flashes on the lunar far-side. This complements the knowledge gathered by Earth-based observations of the lunar nearside, thus synthesising a global information on the lunar meteoroid environment. LUMIO envisages a 12U CubeSat form-factor placed in a halo orbit at Earth-Moon L2 to characterise the lunar meteoroid flux by detecting the impact flashes produced on the far-side of the Moon. The mission employs the LUMIO-Cam, an optical instrument capable of detecting light flashes in the visible spectrum.

LUMIO is one of the two winners of ESA's LUCE (Lunar CubeSat for Exploration) SysNova competition, and as such it is being considered for implementation in the near future. The Phase-A design has been conducted in 2020 under ESA GSTP contract, after a successful, independent mission assessment performed by ESA's CDF team.

In this work, the present-day mission design and analysis of LUMIO CubeSat will be presented. The trade-off carried out among the different lunar launch options will be shown. For what concerns the operative orbit, a sophisticated orbit design, concept of operations, and station-keeping strategy has been carried out. The current baseline foresees placing LUMIO on a quasi-halo orbit about Earth-Moon L2, where permanent full-disk observation of the lunar farside is made. This prevents background noise due to Earthshine, and thus permits obtaining high-quality scientific products. Repetitive operations are also foreseen, the orbit being in near 2:1 resonance with the Moon orbit. In this work we show a comprehensive orbit design for LUMIO and discuss possible improvements in view of the future mission implementation.