

IAF SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 1 (2A)

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LUMIO: CHARACTERIZING LUNAR METEOROID IMPACTS WITH A CUBESAT

Abstract

The Lunar Meteoroid Impact Observer (LUMIO) is a mission designed to observe, quantify, and characterize the meteoroid impacts by detecting their flashes on the lunar far side. Earth-based lunar observations are restricted by weather, geometric and illumination conditions, while a lunar orbiter can improve the detection rate of lunar meteoroid impact flashes, as it would allow for longer monitoring periods. This paper will present the scientific mission of LUMIO, designed for the ESA SysNova LUCE competition, that resulted as the ex-equo winner in the competition. LUMIO, a 12U CubeSat weighing approximately 20kg, will be brought to the Lunar orbit by a mother spacecraft, which also acts as communication relay. From a lunar high-inclination orbit, LUMIO will autonomously determine its trajectory to reach the Moon-Earth L2 point and perform the cruise phase. From the Lunar orbit, LUMIO will observe the Lunar far side continuously for half the Lunar orbit, when the illumination is less than 50%. LUMIO will have to autonomously perform its scientific task without direct coordination from Earth: fully autonomous operations will include science, communications and navigation and a similar concept can be re-used for a wide variety of future missions. This scientific mission will also be possible thanks to an innovative on-board data processing system, capable of drastically reduce the information to transmit to Earth. The camera, designed to capture the flashes and measure their intensity is, in fact, capable of generating 2.6TB/day while only approximately 1 MB/day will need to be transmitted to Earth: impact identification will be autonomous and only relevant information will be transmitted. All these innovative characteristics will make this mission feasible, as proved by a successful study at the ESA/ESTEC concurrent design facility, showing that a CubeSat orbiting almost 500 thousand kilometers away from Earth, will bring a strong contribution to science.