

# Solar Array Drive Assembly for LUMIO

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Modeling and Simulation of Aerospace Systems  
AY 2020-2021



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# LUMIO Mission

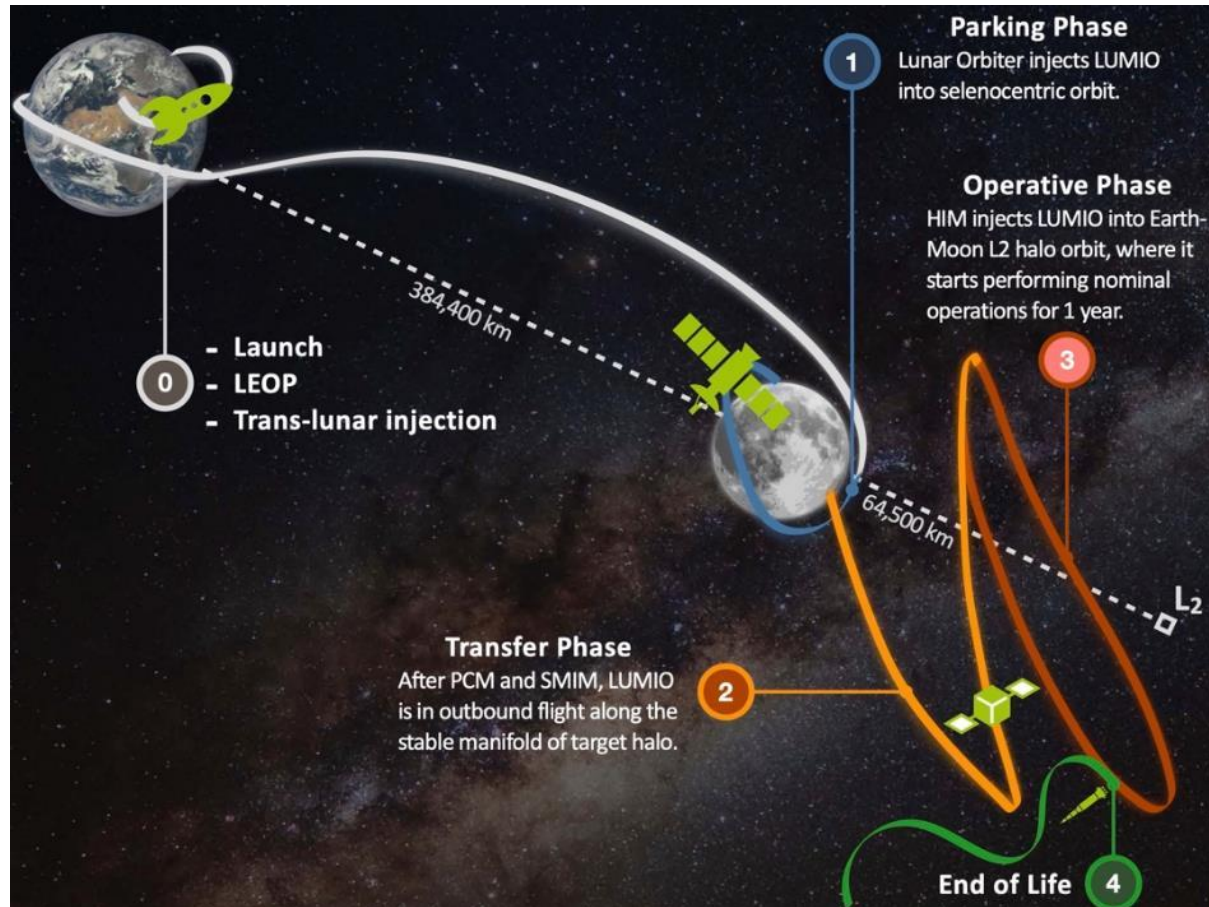
The **Lunar Meteoroid Impact Observer (LUMIO)** is a CubeSat mission to observe, quantify, and characterise the meteoroid impacts by detecting their flashes on the lunar far-side. LUMIO is one of the two **winners of ESA's LUCE** (Lunar CubeSat for Exploration) **SysNova competition**, and as such it is being considered by ESA for implementation in the near future.



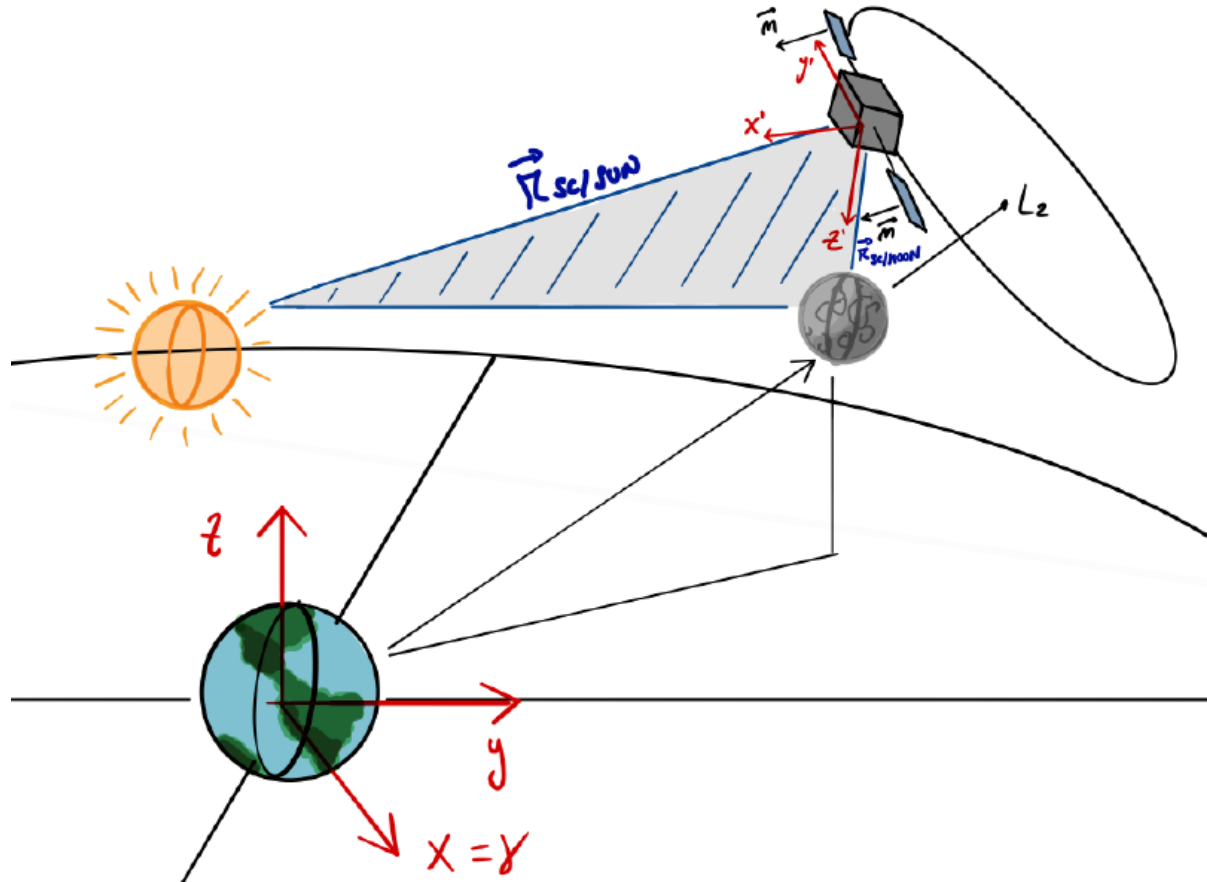
LUMIO Mission logo



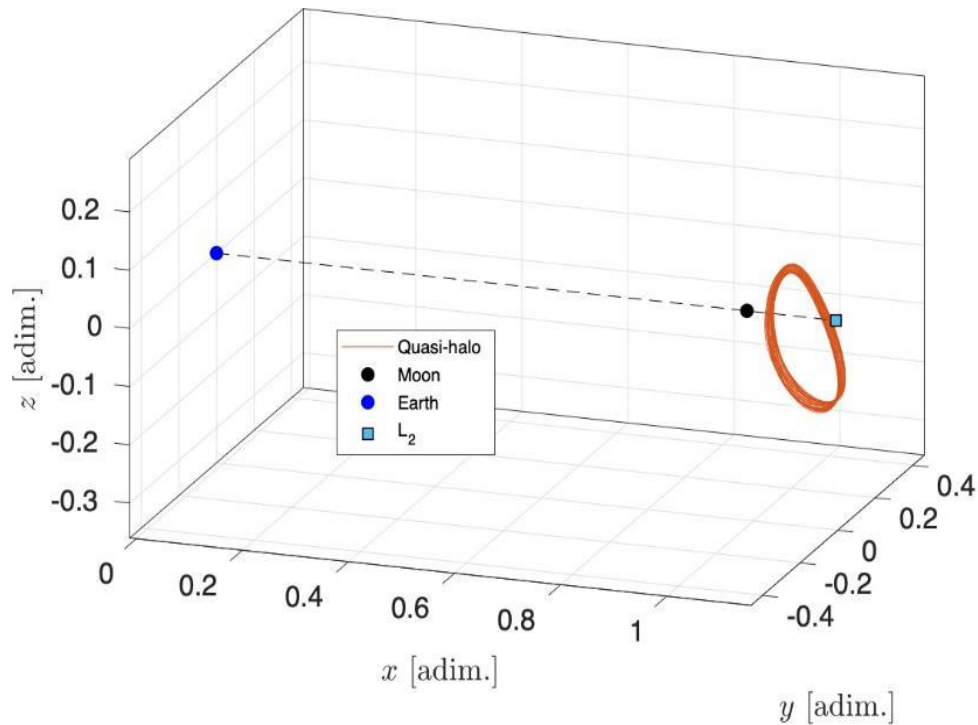
# LUMIO Mission Profile



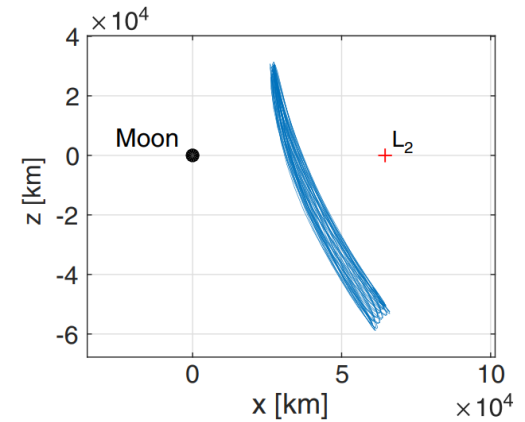
# LUMIO Operative Orbit Sketch



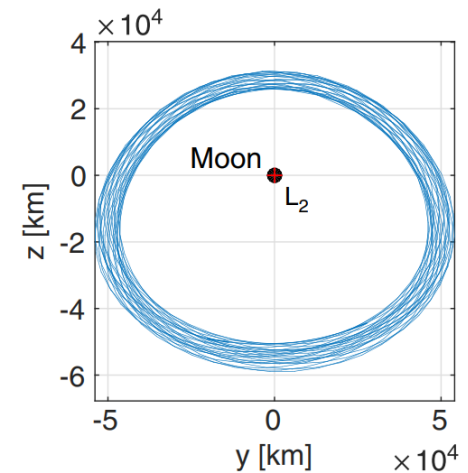
# LUMIO Operative Orbit



EM L<sub>2</sub> Halo orbit

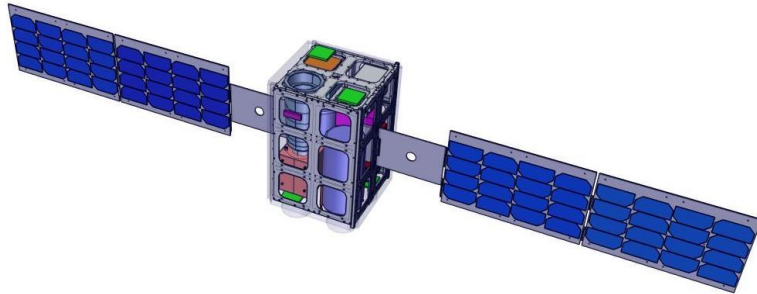


a) Lateral view (x,z)



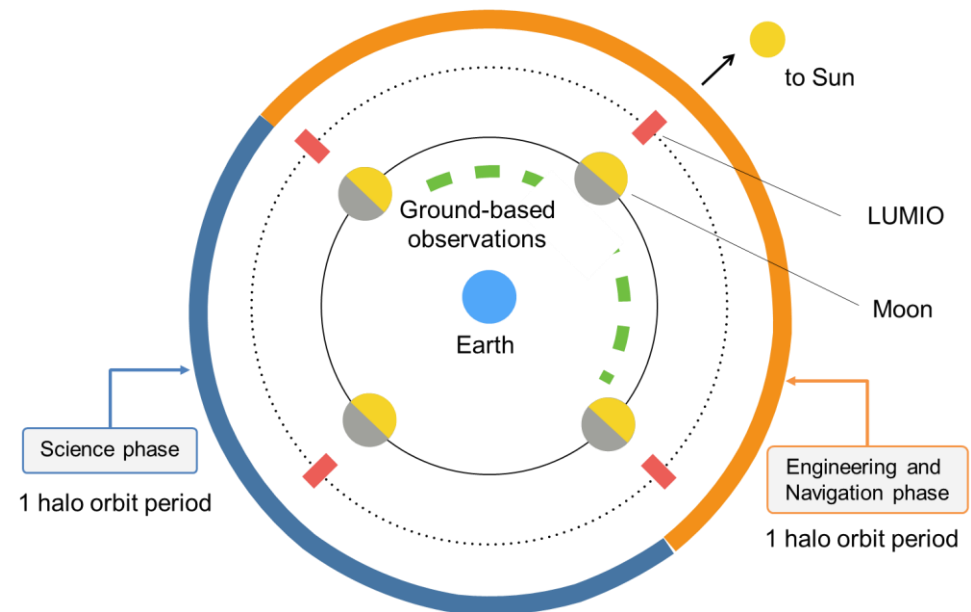
b) Front view (y,z)

# LUMIO Platform and ConOps

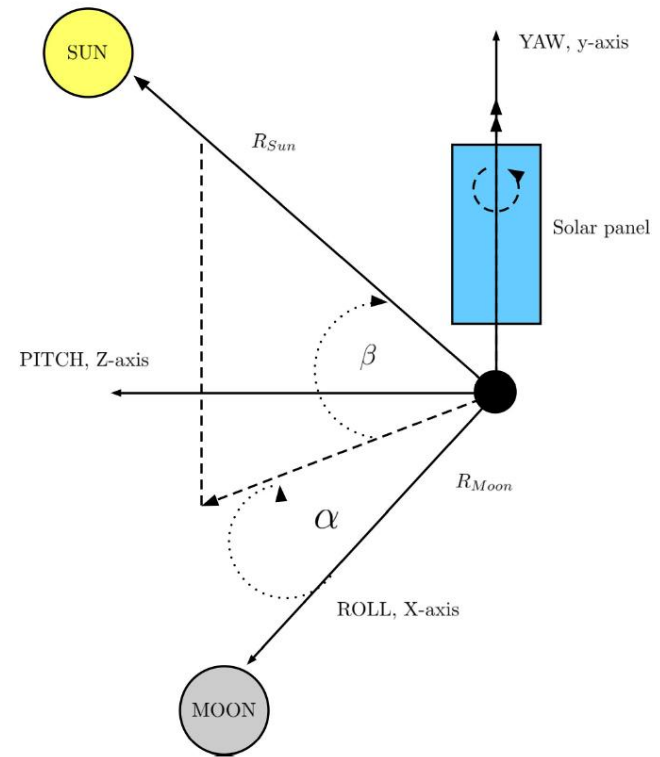
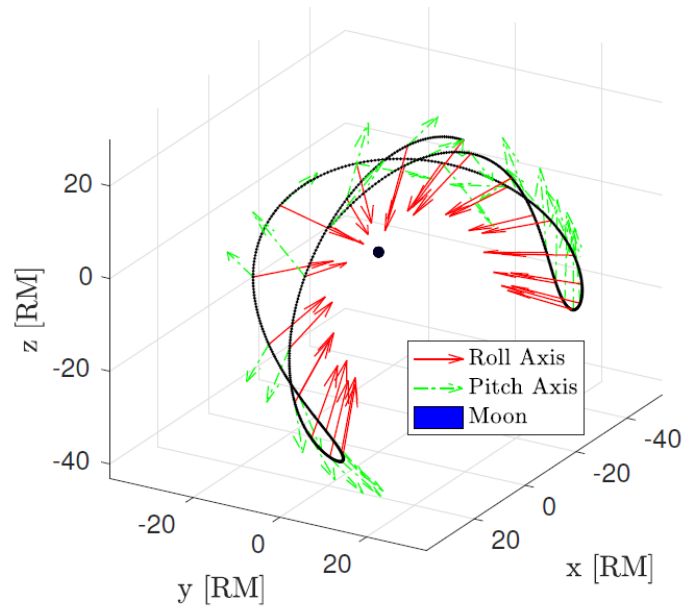


LUMIO CubeSat	
Dimension	12 U
Mass	< 28 kg
Launch Date	2023-2024
Mission Lifetime	1.5 years
Mission Objective	Lunar Meteoroid Impacts Detection

## E-M L2 Halo orbit ConOps

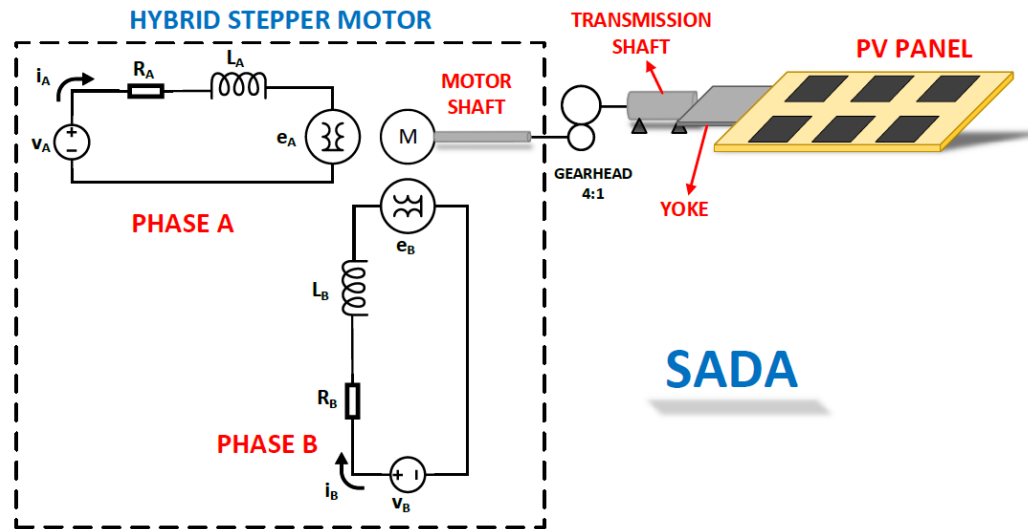


# LUMIO Pointing Profile



Max power generated when solar panels are orthogonal to the Sun direction

# Electro-mechanical system



- KVL for each phase

$$v_i - R_i i_i - L_i \frac{di_i}{dt} + e_i = 0$$

- Faraday's law:

$$e_i = - \frac{d\phi_i}{dt}$$

- Flux

$$\begin{aligned}\phi_A &= \Phi \cos(p\theta) \\ \phi_B &= \Phi \sin(p\theta)\end{aligned}$$

Note that:

- Total torque is given by the **sum of the torque** of each phase:

$$\tau = \tau_A + \tau_B$$

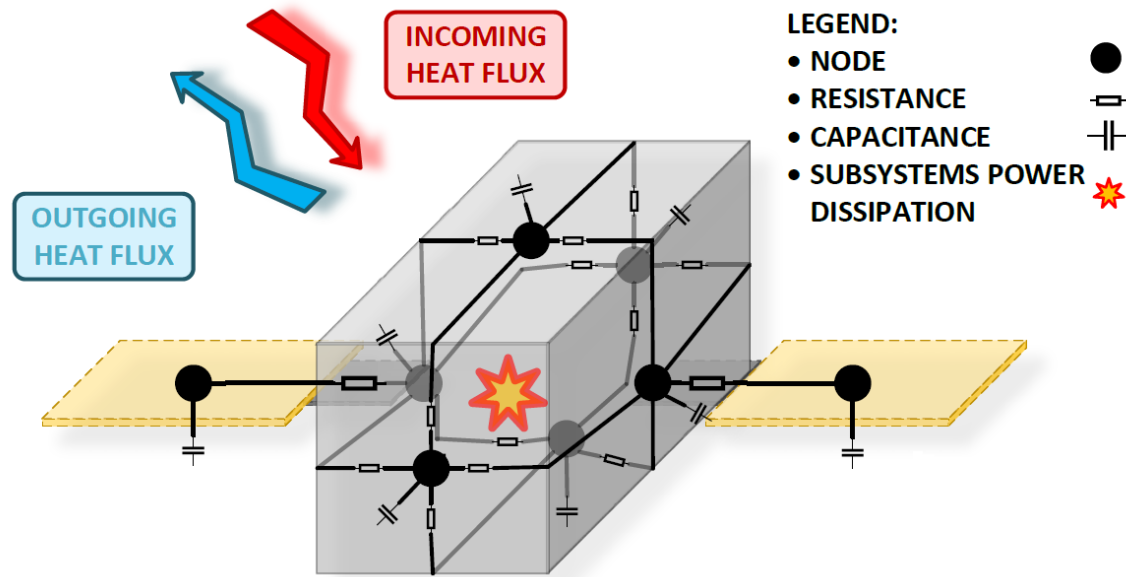
- There is a **reduction gear**:

$$\theta_{motor} = \frac{1}{r} \theta_{panel}$$

- Rotation **cannot be continuous** (It's a stepper motor!)
- **Solar panel** can be modeled as a **plate**



# Thermal system



- For each node

$$c_i \dot{T}_i = \sum_j \dot{Q}_j$$

Note that:

- You need to have at least **10 nodes**
- Thermal properties can be deduced from LUMIO data