

Leveraging the Moon and stable Libration point orbits around L4/L5 to observe the Solar corona

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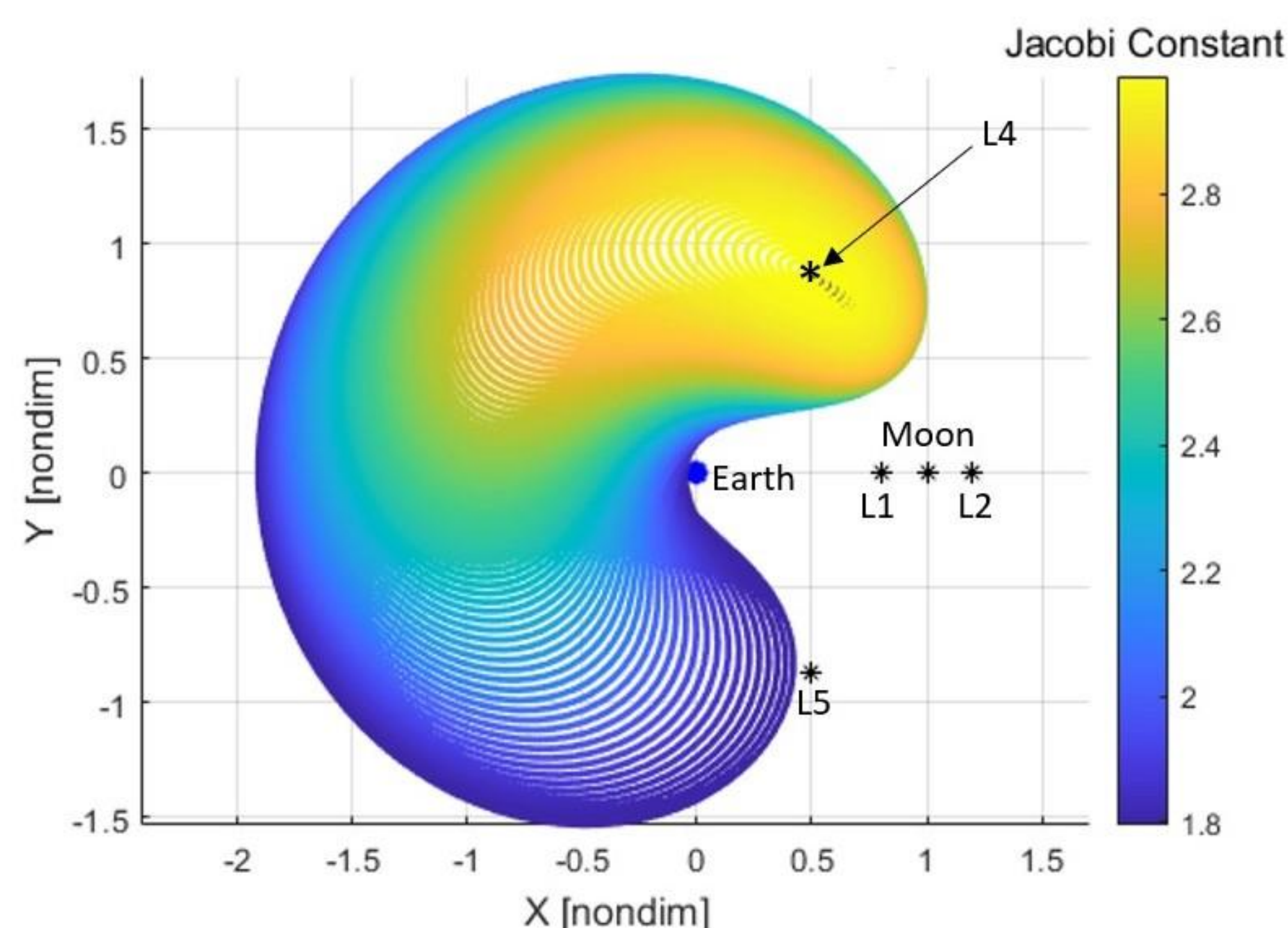


Abstract

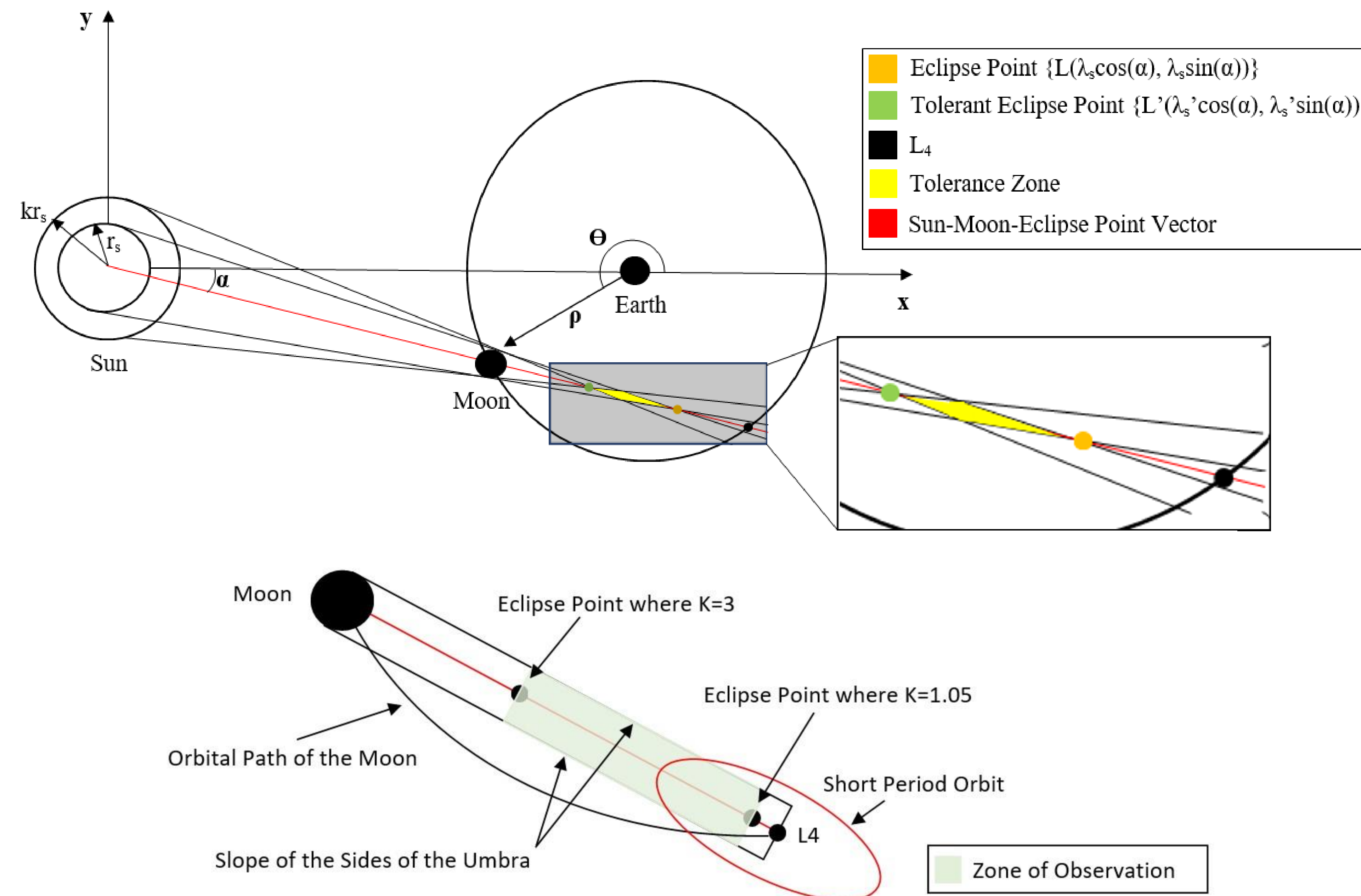
There is a significant interest in studying the Solar corona to gather information about the Sun. This investigation provides an efficient approach to observe the Solar corona by using the Moon as an occulter to suppress the blinding luminosity of the Sun's surface. Another objective is an analysis and comparison of diffraction patterns created by Lunar occultations (LO) from L4 and from Earth. By exploiting the Libration point L4 within the Cislunar region, a spacecraft (s/c) would be within proper position to observe the Solar corona every sidereal month.

Methodology

To observe the Solar corona by using the Moon as an occulter, the s/c must be within the Lunar Umbra. The study detects when the s/c falls within the Lunar Umbra such that Solar corona observation is possible. The s/c simulates the entire short period orbit family of L_4 over 36 months. By simulating both the s/c in each short period orbit and the motion of the Lunar Umbra within a non-rotating reference frame over the 36-month period, the observational times of the Solar corona is known. An additional science driver compares the Lunar occultations observed on Earth and within the Cislunar region to further justify observing the solar corona within the Cislunar region.

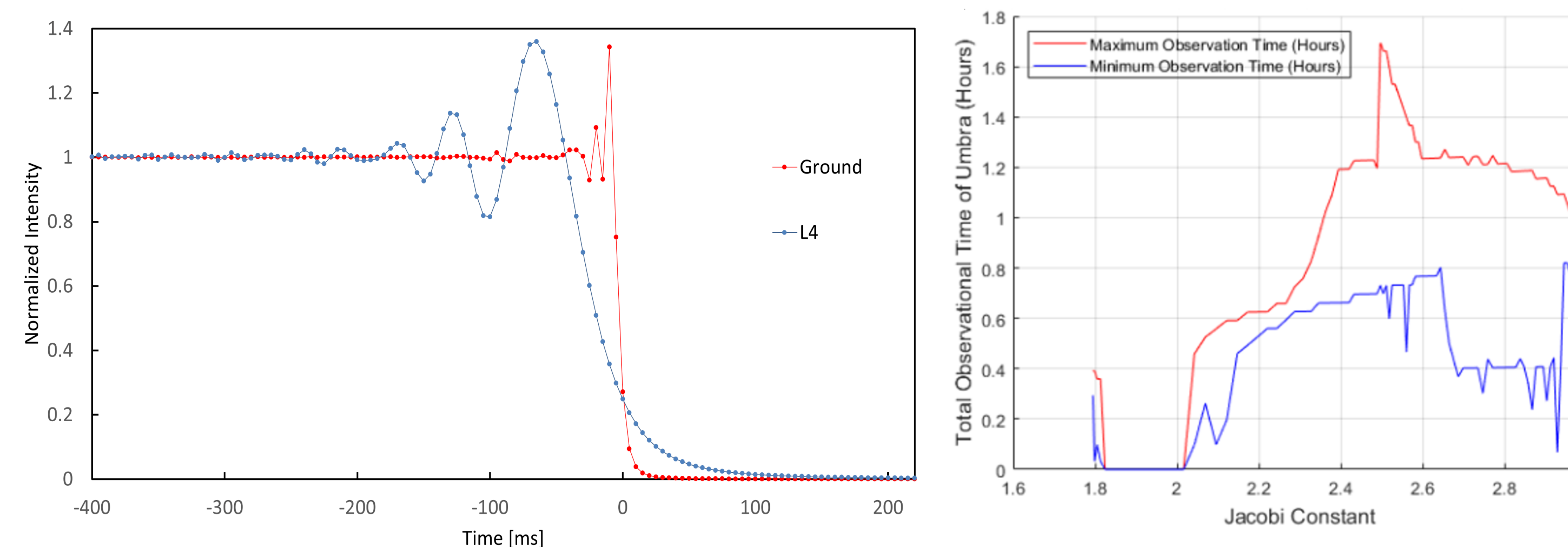


Spacecraft and Umbra Intersection



Results

Lunar Occultation Analysis and Observational Time of the Solar corona within the L_4 short period orbit family:



Future Goals

There is potential of increasing the Solar corona observation times by utilizing short period orbits about the Sun-Earth L_2 which is the next area of focus for the presented investigation. The method of detecting when the s/c can observe the Solar corona will be upheld. The stability and control of the s/c will be further improved to better the orbital maintenance cost of the s/c in each orbit. The results of the orbital maintenance cost within each orbit will also account for finding the optimal orbit to observe the Solar corona.

References

- [1] Doroba, S., Kale, R., Canales Garcia, D., Cho, H., Eikenberry, S., Fors, O., Gómez Cama, J. M., and Richichi, A., "Leveraging the Moon and stable Libration point orbits around L4/L5 to observe the Solar corona," 2023.

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