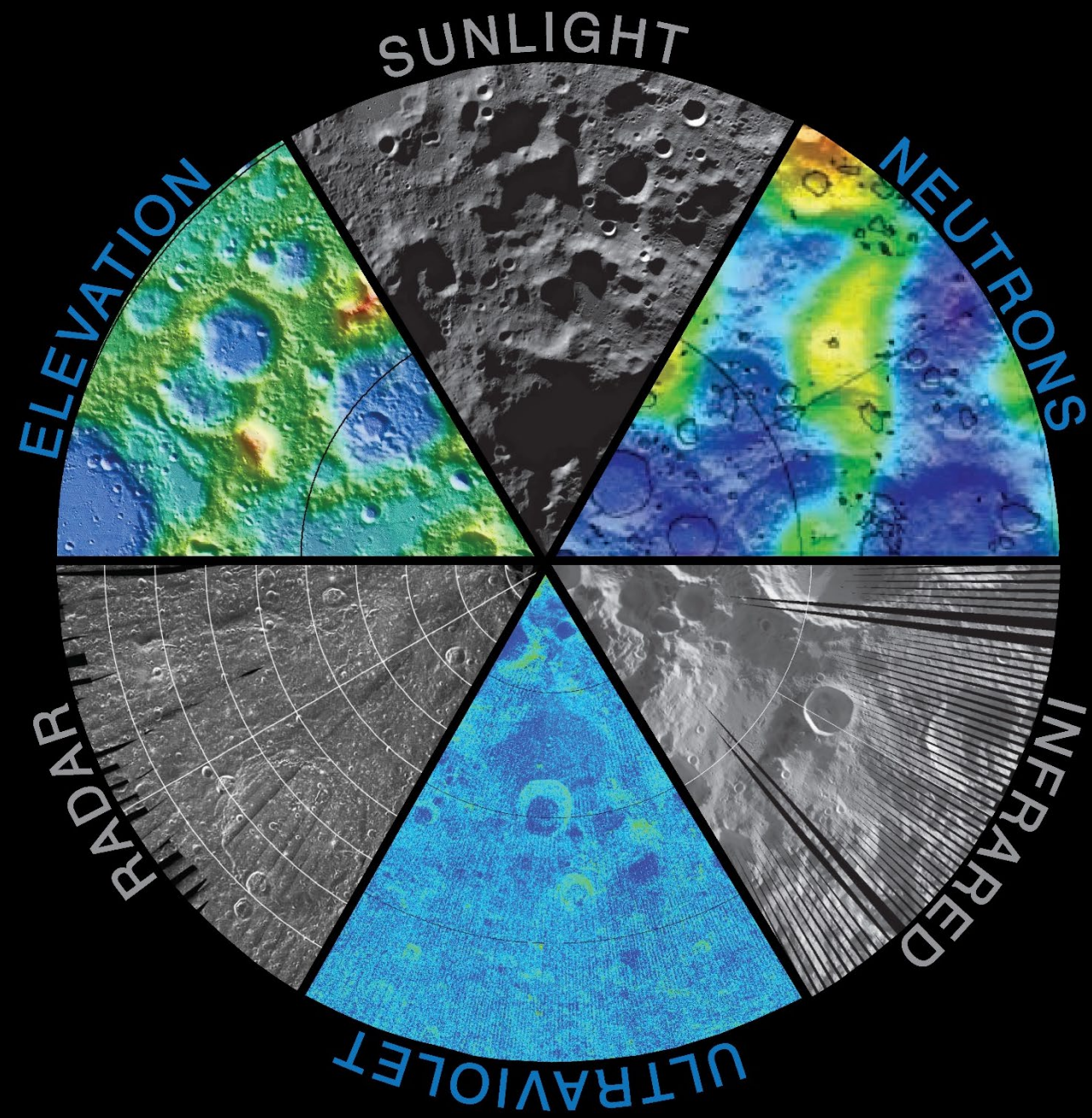
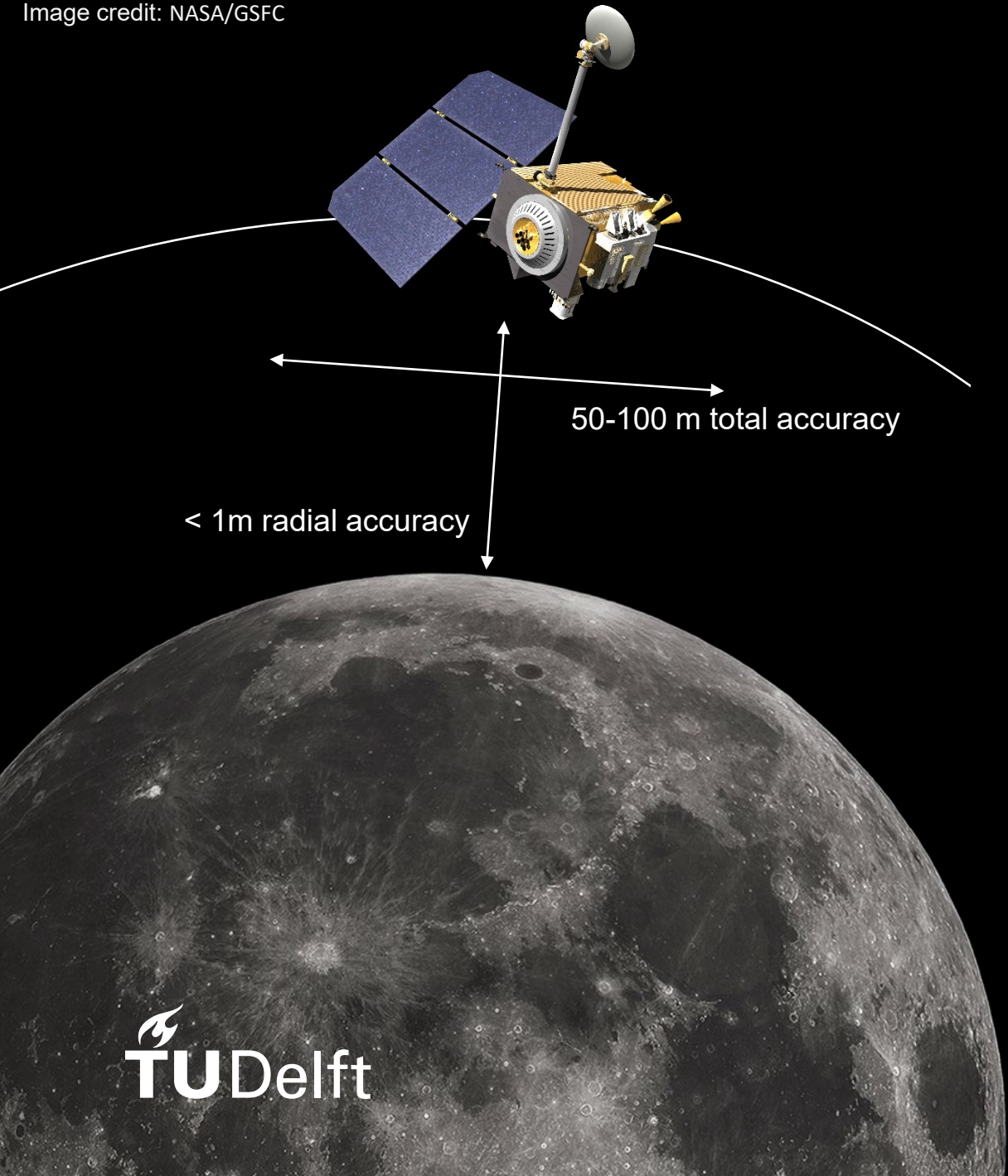




Image credit: NASA/GSFC

Short-term orbital effects of radiation pressure on the Lunar Reconnaissance Orbiter

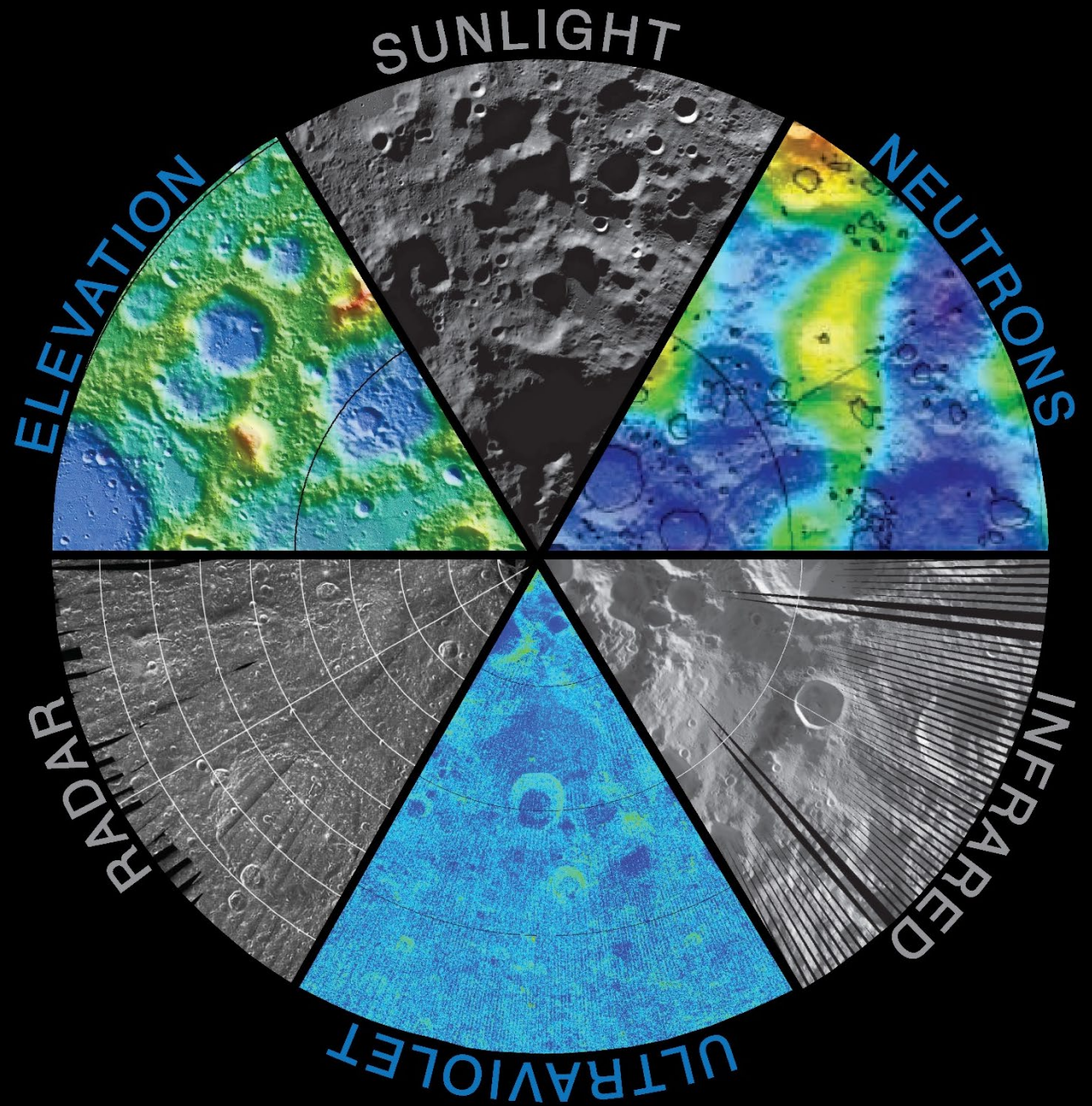
Dominik Stiller / HPB Project / 31 August 2023



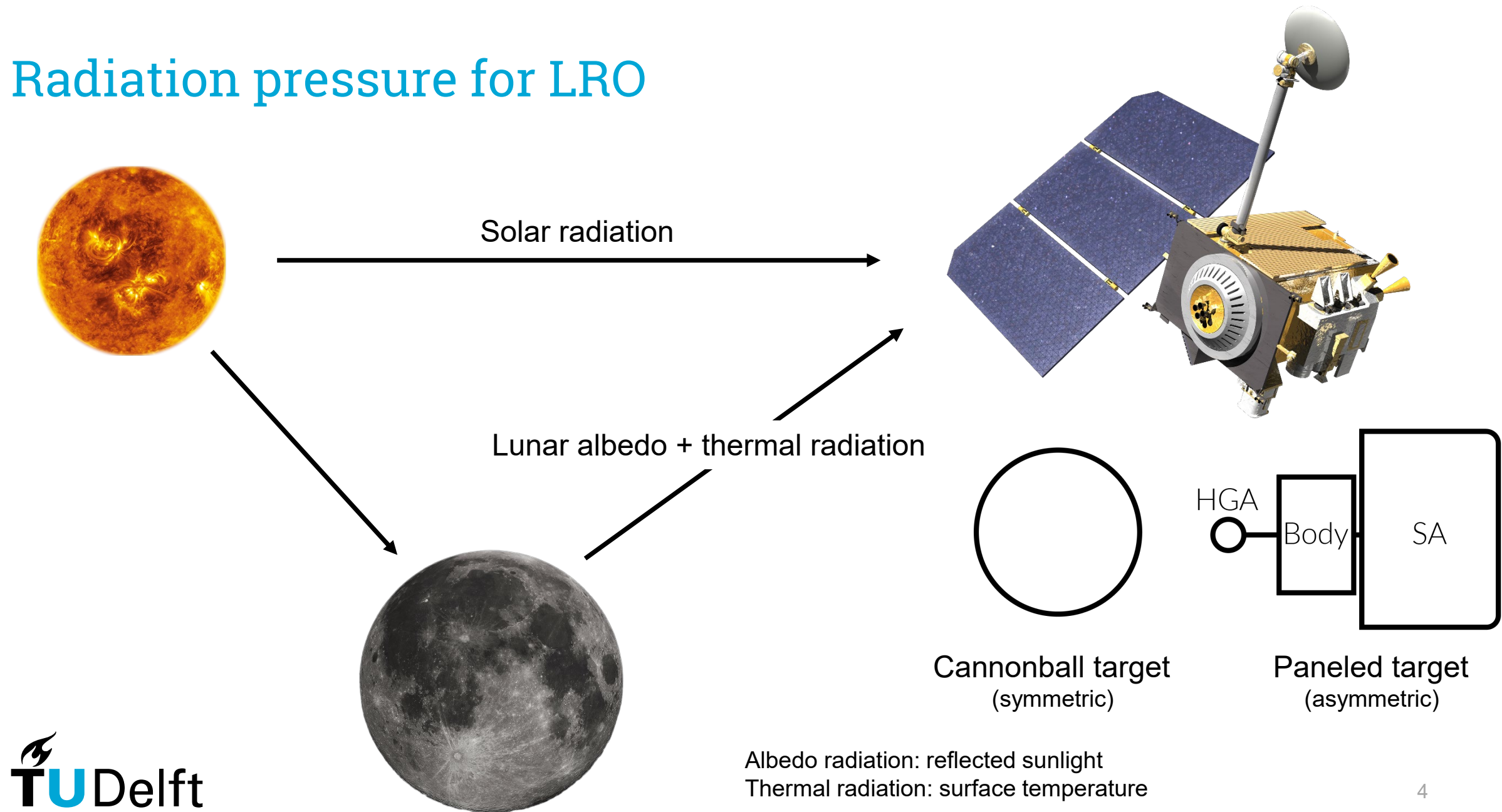


Accelerations

- Gravity: 1 m/s^2
- Radiation pressure: 100 nm/s^2

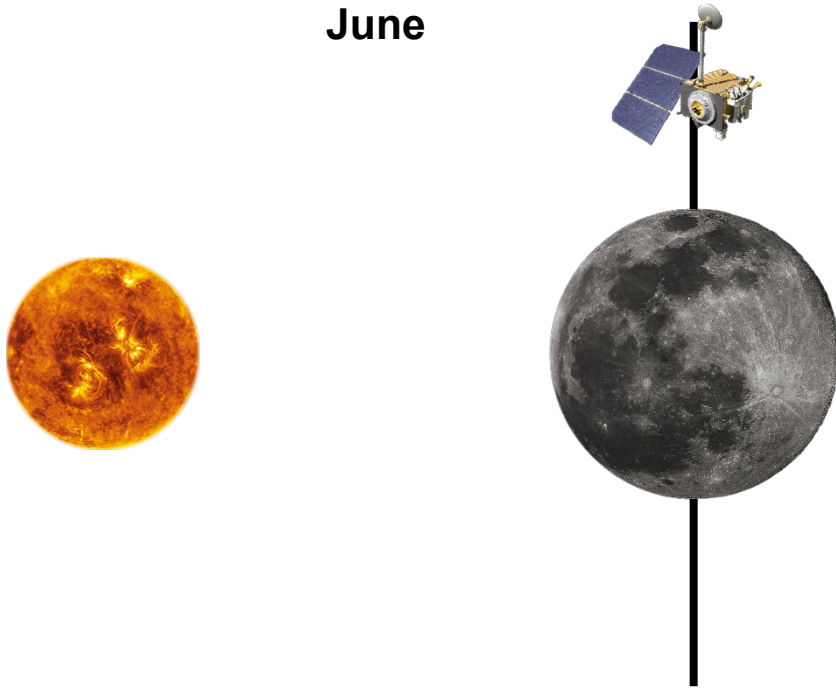


Radiation pressure for LRO



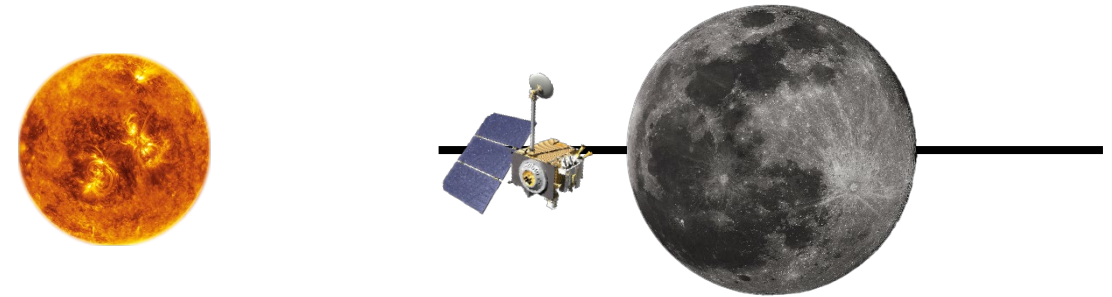
Orbit geometry for LRO

June



- Sun perpendicular to orbit plane
- Permanent sunlight
- LRO only passes above dark/cold regions

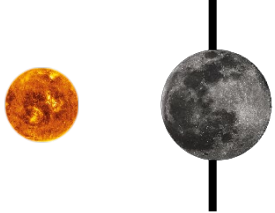
September



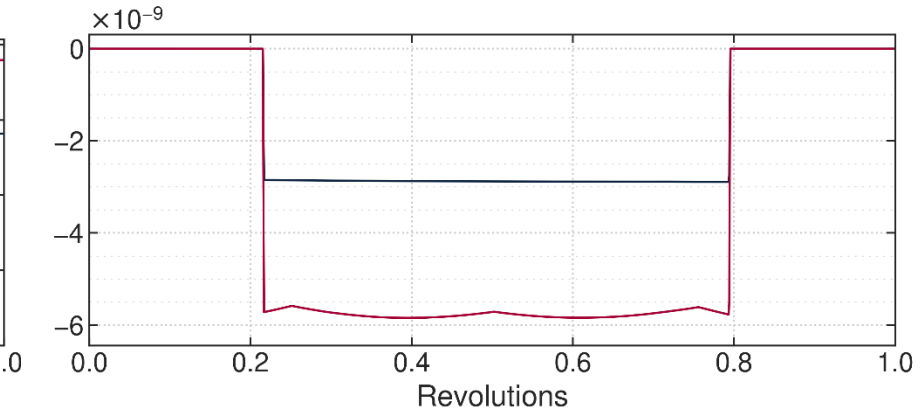
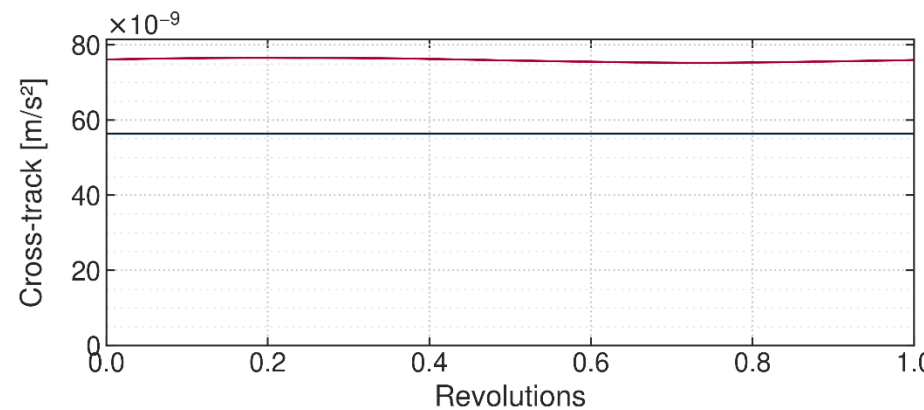
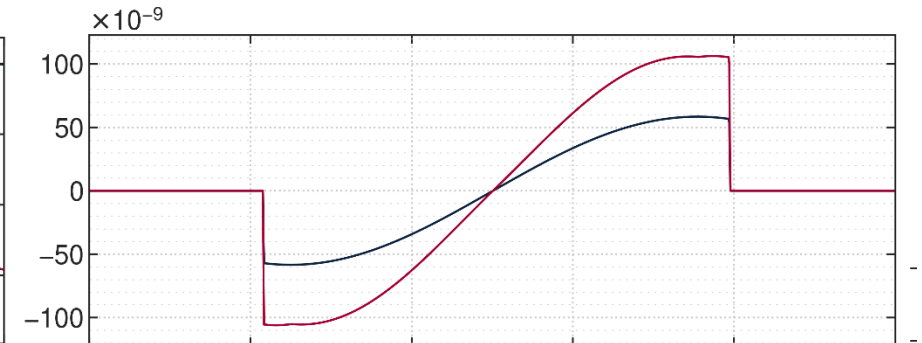
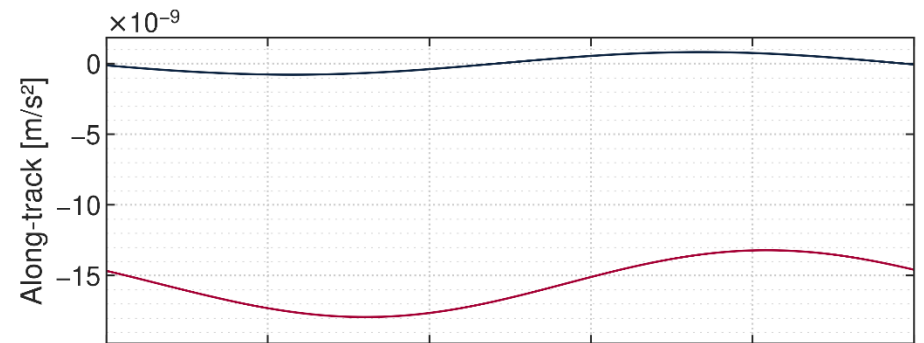
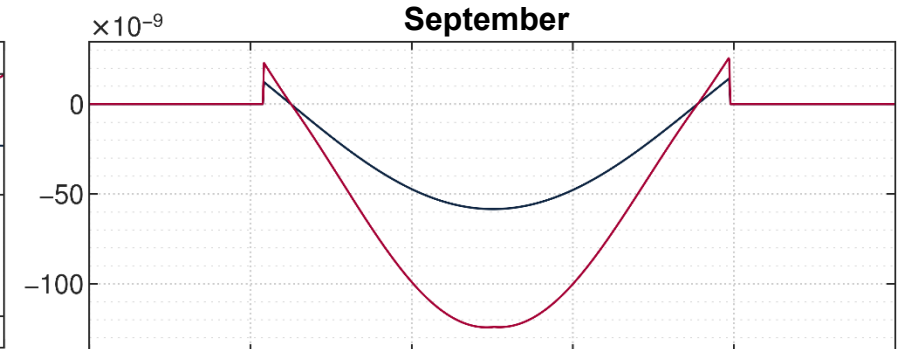
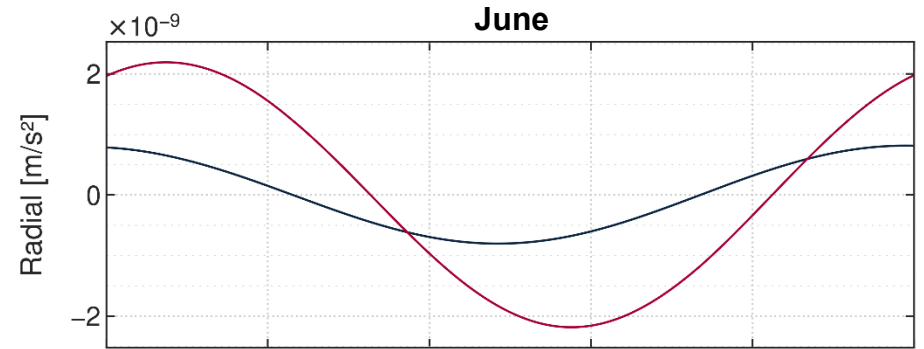
- Sun in orbit plane
- Longest eclipse duration
- LRO passes over subsolar point

Accelerations due to solar radiation

June

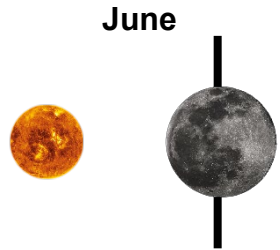


September

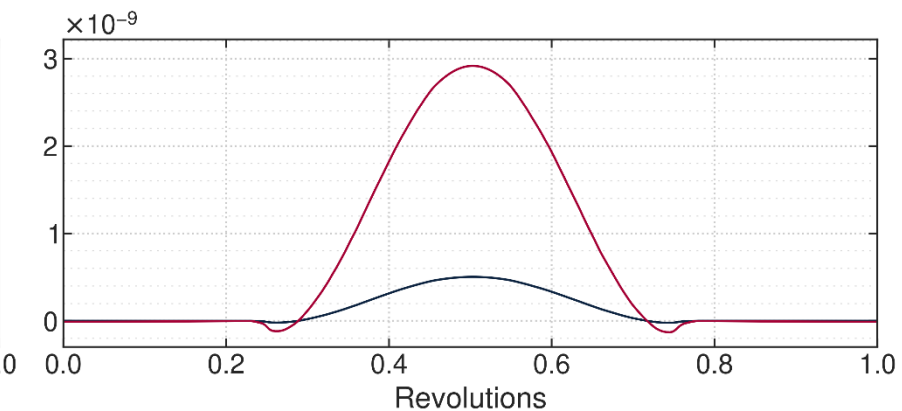
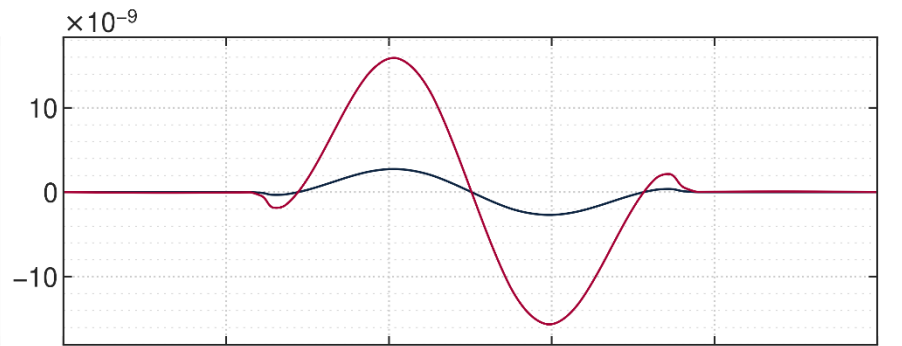
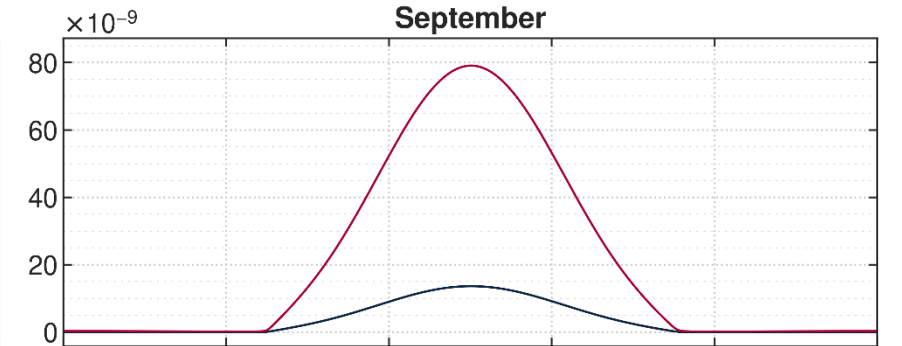
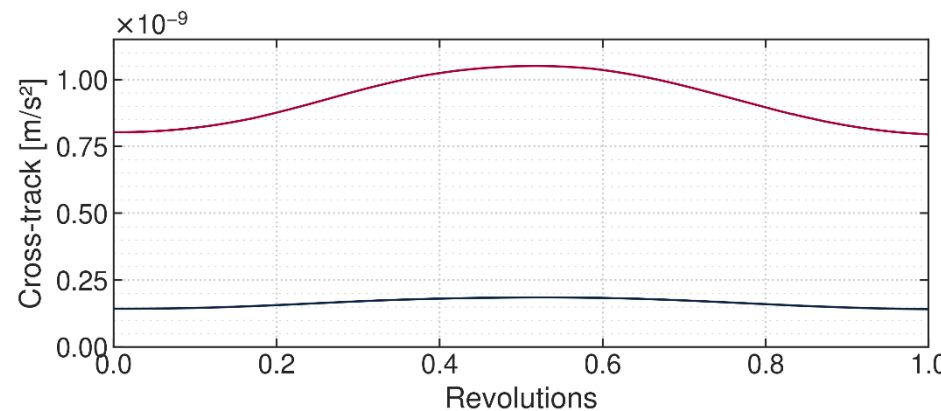
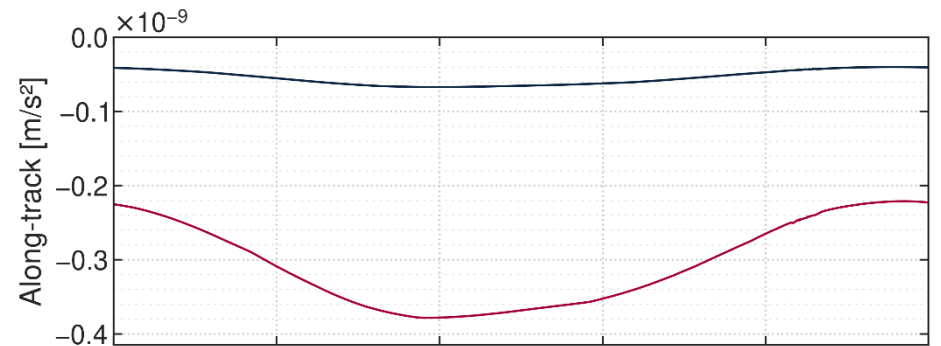
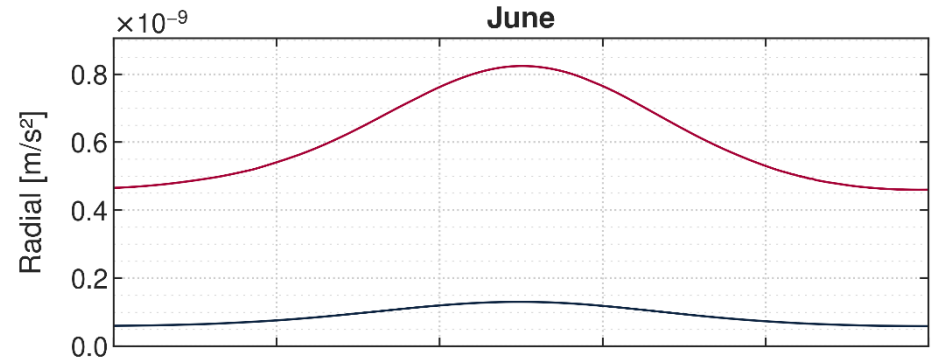


— Cannonball — Paneled

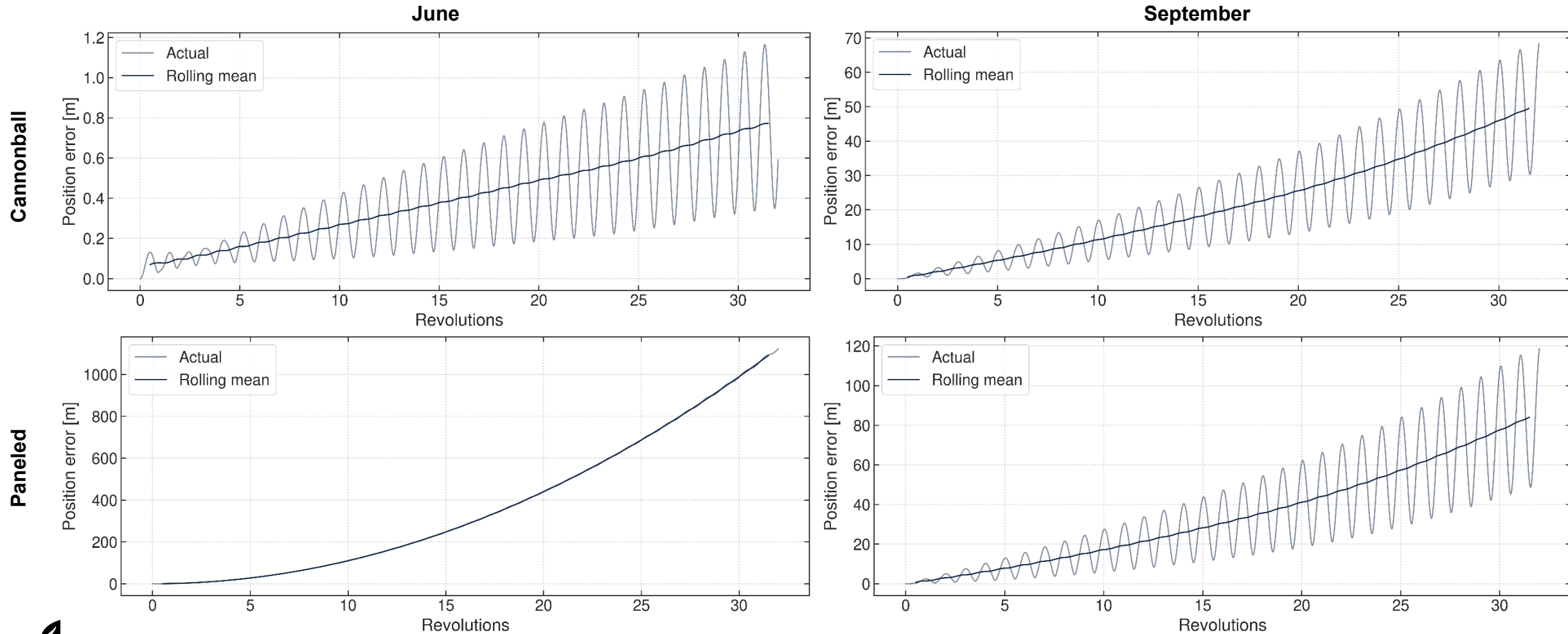
Accelerations due to lunar radiation



— Albedo — Thermal

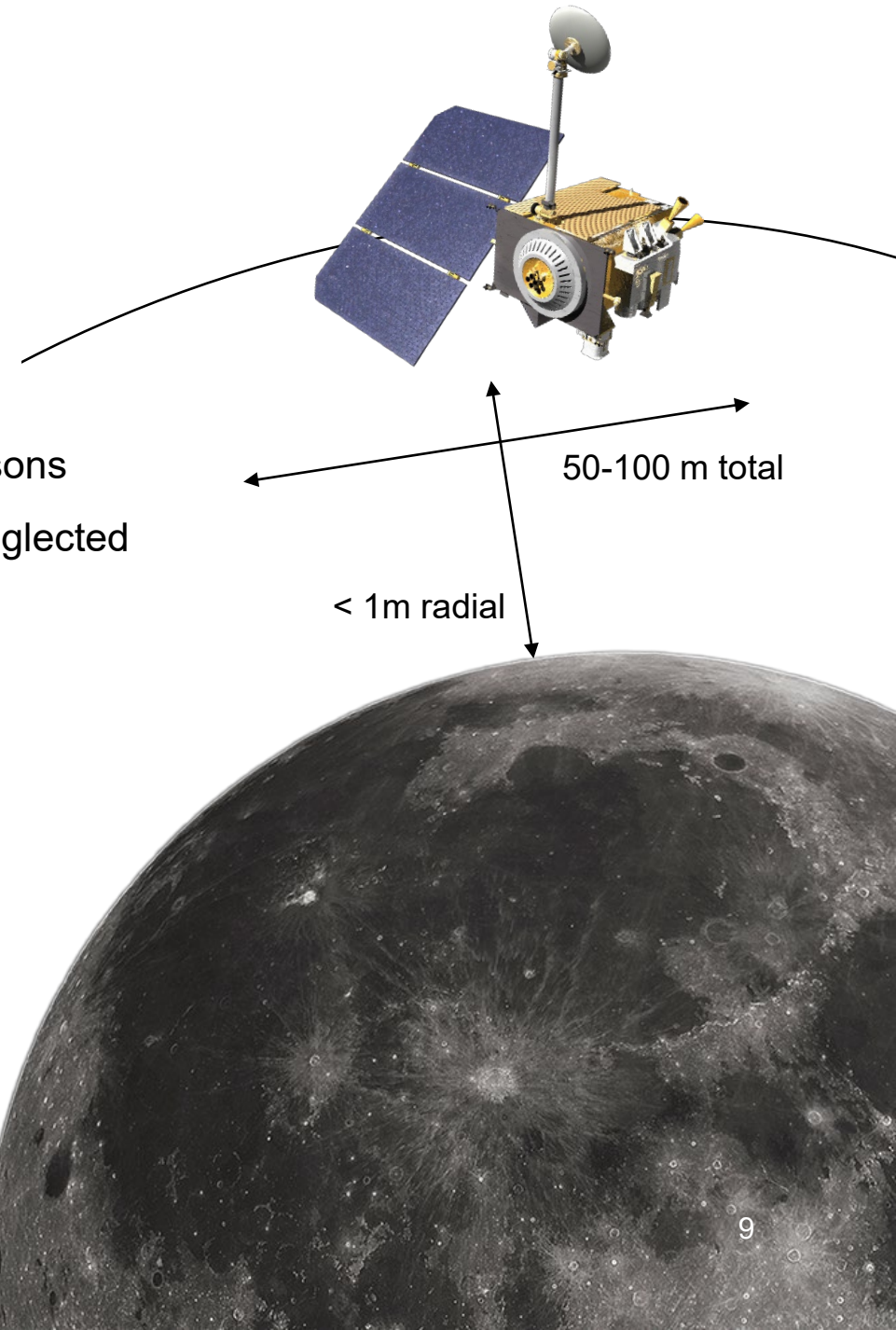


Difference in position due to radiation pressure



Conclusion

- Key findings:
 - Large variations in accelerations depending on Sun position
 - Only a paneled model can properly represent LRO throughout the seasons
 - Orbit determination requirements are not met if radiation pressure is neglected



Conclusion

- Key findings:
 - Large variations in accelerations depending on Sun position
 - Only a paneled model can properly represent LRO throughout the seasons
 - Orbit determination requirements are not met if radiation pressure is neglected
- Aspects I did not cover:
 - Mathematical modeling
 - Albedo distribution
 - Thermal reradiation
 - Sources of uncertainty
 - Performance impact

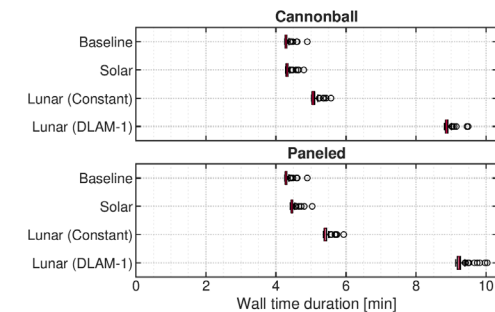
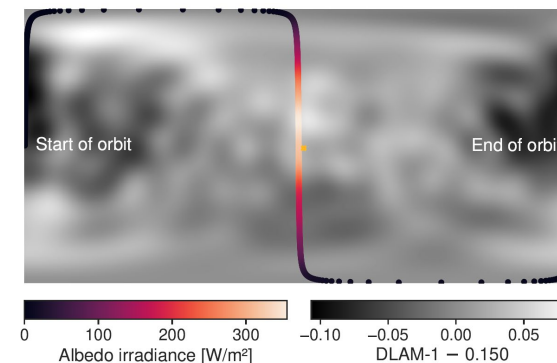
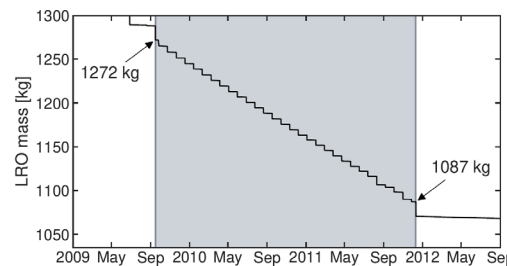
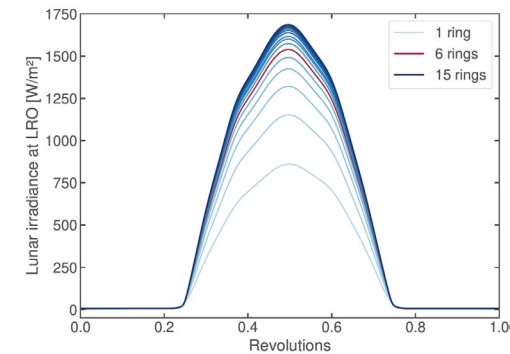
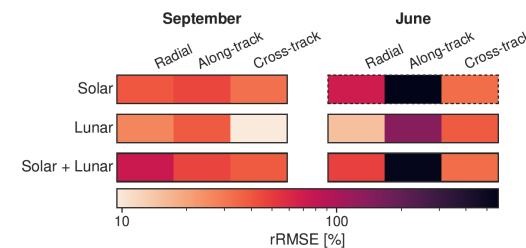
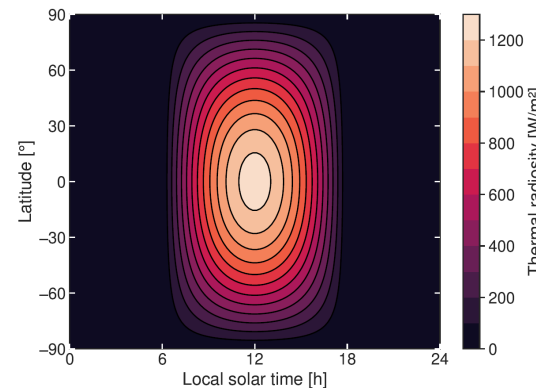
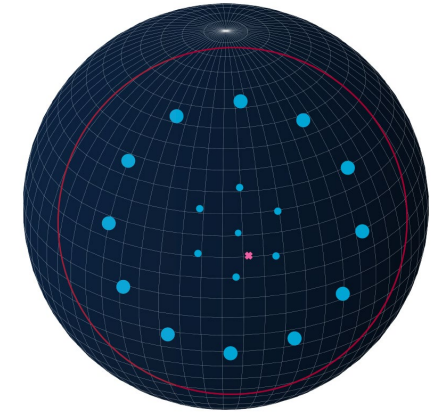
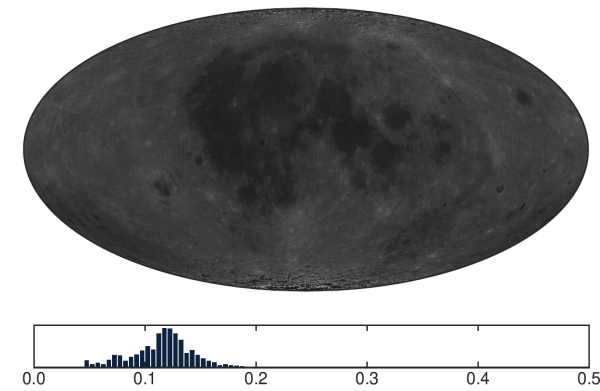




Image credit: NASA/GSFC

Questions?