

Internship in ESA's Advanced Concepts Team on **Optimisation of orbits for Solar Power Satellites as an energy service provider for the Moon**

Topic description

Solar power satellites (SPS) have been proposed as an enabling technology for lunar exploration missions [1, 2]. Studies have considered the performance of small SPS constellations for the simple case where there is only a single lunar target. It has been shown that for the application of surviving the lunar night, there is significant potential for increasing the number of sites receiving power. This makes the design of the power system much more complex, as a single satellite transmitter can only power a single rover at any given time. The orbit of the SPS needs to be optimised such that all targets receive enough power to survive the lunar night.

The aim of this project is to model SPS constellations with multiple receivers at different locations on the Moon. Analysis will start by validating the simple constellations studied thus far, using satellites that are equally distributed in polar and equatorial orbits. The work will build towards considering a selection of lunar landing sites that are currently considered to be of interest [3].

Candidate's tasks

- Validate orbital simulation workflow by comparing against previous results.
- Model simple constellation geometries with multiple targets.
- Model and optimise constellations providing energy to a selection of landing sites.

The ideal candidate

Mandatory:

- Strong understanding of python.
- Strong understanding of orbital mechanics and constellation design.

Desirable:

- Knowledge of wireless power transmission components and design (lasers, monochromatic PV cells etc.).
- Experience using STK, GMAT or other orbital simulation tools.

References

- [1] Brandhorst W. H., Rodiek J. A., Crumpler M. S., O'Neill M. J. *A solar electric propulsion mission for lunar power beaming*. Acta Astronautica, 2009.

- [2] Ramasamy R., van Paridon D., Summerer L. *Solar power satellites for lunar rover exploration*. In proceedings of 69th International Astronautical Congress, 2018.
- [3] Gruener, J. E. *NASA Constellation Program Office Regions of Interest on the Moon*. Presented in the 2009 Annual Meeting of the Lunar Exploration and Analysis Group, 2009.