

# Internship in ESA's Advanced Concepts Team on **Modelling bio-inspired solar concentrators for spacecraft solar panels**

## **Topic description**

Solar cells provide the primary source of energy in spacecraft and constitute an enabling technology for space exploration. Consequently it is desirable to increase the efficiency of solar panels. Conventionally thin and flat solar concentrators, sometimes incorporating arrays of lenses, are used to redirect incident light towards the photovoltaic cell [1]. In a biomimetic approach, the compound eyes of insects inspired a novel solar concentrator design: The lens and rhabdom structure of the compound eye were abstracted to form a lens-waveguide apparatus redirecting the light to a photovoltaic cell [1]. The developed structure yielded enhanced performance in terms of angle of acceptance [2]. Yet, there is potential for improvement and optimization for space related application. In the framework of the internship within the Advanced Concepts Team, we seek to develop a simulation framework to investigate different concentrator geometries.

## **Candidate's tasks**

- Build simulation model inspired by different insects eyes geometries.
- Simulate model with material/transmission properties of materials commonly used in solar panels used in space.
- Explore possibilities for improvement of developed configuration.

## **The ideal candidate**

Mandatory:

- Strong understanding of geometric optics.

Desirable:

- Knowledge of LightTools or comparable ray tracing software.
- Interest in bio-inspired technology for space optics.
- Basic understanding of solar panel principles.

## **References**

- [1] J. Karp and J. Ford. Planar micro-optic solar concentration using multiple imaging lenses into a common slab waveguide. *Proc. of SPIE*, 7407, 2009.
- [2] R. Dhakal, J. Lee, and J. Kim. The principles of quantum mechanics. *Applied Optics*, 53(2), 2013.