

# Open Internship in the ESA Advanced Concepts Team in 2014

## on

### **Moon Hopper: a web based crowdsourcing experiment**

#### **Topic Description**

Over the past few years crowdsourcing has become a popular way to process large amounts of scientific data or to solve computationally intractable problems [1]. Humans have the ability to recognize complex patterns and translate them into actionable steps, e.g. playing the game of GO. GO has a very high branching factor, which makes exhaustive search impossible and requires heuristic pattern recognition. The ACT has developed a web-based game called Moon Hopper [2] that allows users to design complex interplanetary spacecraft trajectories. The goal of Moon Hopper is to design a trajectory that maps all four Galilean moons of Jupiter, which requires more than a hundred flybys. Moon Hopper is collecting data on the players' problem solving behaviour and is exploiting this data to formulate a human inspired tree search algorithm [3] for this complex problem.

#### **Candidate's tasks**

The successful candidate will develop a system that collects and stores user interaction data in a central database. The system should allow players to create accounts, login, play the game, track their progress and display the current overall ranking. He/she will also perform a preliminary study to evaluate collected data and possibly devise a human inspired search heuristic.

#### **The ideal candidate**

- Strong programming skills (Java Script, HTML5, AJAX/Websockets)
- Interest in orbital mechanics

##### Desirable:

- Experience with Three.js and Websockets
- Experience with Monte Carlo Tree Search (MCTS)

#### **References**

- [1] Khatib, Firas, et al. "Algorithm discovery by protein folding game players." Proceedings of the National Academy of Sciences 108.47 (2011): 18949-18953.
- [2] Wiktor Piotrowski, Marcus Maertens, Dario Izzo and Daniel Hennes. "Moon Hopper: A Crowdsourcing Approach to Designing Interplanetary Trajectories". AI in Space Workshop, IJCAI, 2013.
- [3] Browne et al.: "A survey of Monte Carlo Tree Search methods", IEEE Transactions on Computational Intelligence and AI in Games, 2012.