Training Opportunity for Luxembourgish Trainees

Reference	Title	Duty Station
LU-2023-TEC-EFA	**Antenna Analysis and Design**	**ESTEC, Noordwijk, the Netherlands**

Overview of the mission:

The section covers space antenna systems, space vehicle TT&C antennas, user segment terminal antennas, and submillimetre wave instruments and associated technologies. More specifically, it deals with:

- the analysis and characterisation of antenna systems, as well as the interference effects of antennas with the spacecraft structure or other platforms (such as aircraft, trains or vehicles);
- the design, analysis and engineering of all antenna subsystems, including standalone radiators, arrays, reflector and lens optics and their associated focal plane;
- submillimetre instrument architecture, engineering and testing activities, as well as antenna front-end technology (e.g. quasi-optic multifrequency, heterodyne receivers) and component (e.g. mixers, multipliers) developments;
- coordination on all aspects of antenna and submillimetre wave devices;
- RF modelling and design tool developments for all kinds of standalone antennas and antenna interactions (e.g. parasitic effect on the radiation performance, coupling among antenna ports) for spacecraft or other platforms (such as aircraft, trains and vehicles);
- the testing of the radiative performance of antennas, payloads and instruments, both in standalone mode and in relevant environments;
- the characterisation of the RF properties of materials.

Overview of the field of activity proposed:

Conical scanning is required for various Earth observation missions based on radar and radiometric instruments. Typically, this specific beam scanning is achieved by spinning the entire antenna system around the nadir axis. Though effective, this solution presents several problems. Specifically, vibrations can cause de-pointing, which may impact the instrument's performance. Moreover, mass is an issue since the rotation of the full antenna system requires counterweights of similar mass.

An annular-focusing quasi-optical system can be used to simplify the mechanical beam steering solution. This particular configuration provides an annular focus region that matches the conical scanning requirement. Annular-focusing reflectors have been shown to provide good performance in one scanning plane. However, an offset configuration will limit the performance in the rest of the field of view.
As a LuxYGT, you will focus on the definition of annular-focusing planar lens solutions that are symmetric and will thus achieve similar performance over all the scanning planes. NASA's Jet Propulsion Laboratory recently conducted a preliminary study of a similar configuration.

In particular, you will conduct research activities to:

- define the phase profile of the lens to achieve the required annular-focusing behaviour as a function of the observation angle;
- research and trade-off technologies for the implementation of the lens, such as planar-printed single and dual lenses, constrained lenses, etc.;
- define and trade-off several feeding solutions, such as fully sampled focal plane arrays, mechanically spinning feeds, reconfigurable arrays, etc.;
- study the possibility of extending the solution to generate multiple beams allowing simultaneous observations at different angles;
- define design guidelines for this type of antenna system for different requirements;
- design, manufacture and test a proof-of-concept breadboard to demonstrate the potential of the technology.

Required education and skills:

- You should have just completed or be in the final year of your Master' s degree in electrical engineering.
- Good interpersonal and communication skills
- Ability to work in a multi-cultural environment, both independently and as part of a team
- Fluency in English and/or French, the working languages of the Agency