Satellite PHASES: a joint Mexican-Brazilian-Irish project

Opportunity for a PhD student (optical engineer) and a Postdoc (system engineer)

Brazil-Ireland education and research agreement

Programa Ciência sem Fronteiras

PHASES (Planet Hunting and AsteroSeismology Explorer Spectrophotometer) is a low-cost project to develop a **science payload** for use on board a **microsatellite**. The science payload consists of a compactly folded, quasi-baker type, off-axis three mirror telescope with an aperture stop of 20 cm, which feeds two instruments: a tracking system and a spectrophotometer. The main technological challenges are to minimize the stray light and achieve a high pointing stability.

The two camera **tracking system** comprises of, an external, auxiliary camera with a wide field-of-view to initially locate the target with a precision of about 100". The satellite is then re-pointed by means of the integrated 1 degree field-of-view camera, which is used to track the target with a pointing stability of 0.2" (goal: 0.1") for integration times of about 1 minute. The same target has to be observed for periods of up to several weeks with a duty cycle of 80%.

The **spectrophotometer** has a wavelength range of 370 nm to 960 nm, which includes the Balmer jump in the blue and the Calcium triplet in the red. The resolution is greater towards the blue part of the spectrum, with a resolving power of 900 at 370 nm and 200 at 960 nm.

PHASES will be used to obtain **flux calibrated spectra** and determine photometric variations with a precision of a few parts per million. In the field of characterization of bright sun-like stars (V<10), PHASES can be used for:

- The determination of fundamental properties of stars such as effective temperature and radius.
- The study of stellar activity in sun-like stars with/without planets.
- The study of transiting planets. This occurs when the inclination of the planet is approximately 90 degrees with respect to the sky plane, such that the planet periodically crosses the disk of the host star. When a transit takes place, a dip in the brightness of the star is detected as registered in the light curve (i.e., intensity versus time). The transit depth is related to the ratio between the areas of the planet and the star.

Os candidatos devem acessar o site http://www.cienciasemfronteiras.gov.br/web/csf/pos-graduacao-doutorado e seguir as instruções. Informações sobre os estágios na Irlanda podem ser obtidas em:

http://www.cienciasemfronteiras.gov.br/web/csf/apresentacao27 . INSCRIÇÕES ATE 20/12/2013 ou em abril/2014.

2. Description for the system engineer:

The Dublin Institute of Technology (DIT; http://www.dit.ie/about/) invites applications for a 2-years

position of system Engineer of the space-borne instrument PHASES. Located in Dublin, the Dublin Institute of Technology combined the academic excellence of a traditional university with career-focused learning stretching back over 125 years. The Systems engineer will closely work with Dr. Niall Murphy (optical engineer), Dr. Carlosdel Burgo (PI of the project; simulations) and a range of international partners.

The successful candidate will conduct and oversee the development of the engineering packages required to develop the instrument. A minimum of 4-years experience in space projects with a background in optics, mechanics and electronics and a general knowledge of space instrument development is required. The successful candidate will join a multidisciplinary, international team and will assist with the supervision of a PhD student. He/she will be based in Ireland, but may be required to travel to Brazil and Mexico as part of the project development. Further opportunities, based in Brazil, may exist on completion of the contract for involvement with the integration phase of the project depending on funding.

Candidates should apply by December 20th 2013 and include a curriculum vitae, publication lists and a brief statement of research interests. For further details, please contact: Dr. Niall Murphy (niall.murphy@dit.ie).

3. Description for the PhD student:

The Dublin Institute of Technology (DIT; http://www.dit.ie/about/) invites applications for a 4-years position of PhD student to work on the development of the space-borne instrument PHASES. Located in Dublin, the Dublin Institute of Technology combined the academic excellence of a traditional university with career-focused learning stretching back over 125 years.

The PhD student will be supervised by Dr. Niall Murphy (DIT), Dr. Carlos del Burgo (INAOE) and the system engineer of the project, with further advise from a range of international partners.

The successful candidate will work on the development of the optomechanics for PHASES, for which he/she will follow a methodology already developed by the team. The main drivers of the development are to minimize the stray light and achieve a very demanding pointing stability. The successful candidate will collaborate with a multidisciplinary group of experts aimed at proving the system through simulations and laboratory tests. The PhD student will work with the perspective of continuing his/her work during the first phases of the system integration.

Candidates should apply by December 20th 2013 including a curriculum vitae, publication lists and a brief statement of research interests. For further details, please contact: Dr. Niall Murphy (niall.murphy@dit.ie).

References:

• del Burgo C., Allende Prieto C., Peacocke T. 2010, JINST, 5, 1006: "PHASES: a concept for a satellite-borne ultra-precise spectrophotometer"
http://adsabs.harvard.edu/abs/2010JInst...5.1006D

• del Burgo C., Vather V., Allende Prieto C., Murphy N., 2013, ASPC, 472, 291: "PHASES: A Project

to perform Absolute Spectrophotometry from Space"

http://adsabs.harvard.edu/abs/2013ASPC..472..291D

• del Burgo C., Vather D., Murphy N., 2013, EPJWC, 47, 150006: "PHASES: opto-mechanical solutions to perform absolute spectrophotometry from space"

http://adsabs.harvard.edu/abs/2013EPJWC..4715006D

PhD thesis and Ms thesis related to the project:

PhD thesis:

• “Mechanical Support Structure for PHASES”, D. Vather (Dublin Institute of Technology, DIT, Ireland) (on going; to be end by early 2014)

Master thesis:

• “Preliminary Simulation of a Star Tracker Detector for PHASES”, P. McGillion (International Space University, France) (2010)

• “Laboratory characterisation of the Limitations Imposed by Satellite Jitter on the Detection of Transiting Exoplanets”, T. Brennan (U. Galway, Ireland) (2011)

• “The Kepler-9 system: An active spotted star with transiting planets”, C. Vilela (U.

Hertfordshire, UK) (2012)

• “Investigating exoplanet atmospheres by simulating transmission spectroscopy”, I. Fontaine (U. Hertfordshire, UK) (2013)

Joint Mexican-Brazilian-Irish collaboration
PHASES is a collaboration between INAOE (Mexico), USP and AEB (Brazil) and DIT (Ireland). The PI is Carlos del Burgo (INAOE) and the Co-PI Eduardo Janot-Pacheco (USP).