

## ESR 2: **Low-temperature chemistry for DRIFT-MARCS**

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### **Project Description**

Temperatures in planetary atmospheres stretches from those of cool stars to far below the freezing point of water. The MARCS stellar atmosphere code is thoroughly tested against observations for temperatures down to the coolest stars, and therefore forms a reliably starting point for the warmest exoplanets. To model medium and lower temperature exoplanets require inclusion of a lower temperature gas- and dust/cloud/rock chemistry. This project aims at combining the experience from cool star modelling by the MARCS code (e.g. Gustafsson et al 2008, A&A 486, 951) with the low-temperature gas- and cloud chemistry from the DRIFT code (Helling et al 2016, MNRAS 460, 855; Juncher et al 2017, A&A 508, 70, Woitke et al 2018, A&A 614, A1) and the atmosphere to surface interaction (Herbort et al. 2019), in order to be able to compare 1-D equilibrium model computations with existing and coming observations of a wide range of exoplanets.

### **Innovative Training Network (ITN)**

This project is part of the Marie Skłodowska-Curie Innovative Training Network (ITN) *CHAMELEON* -- “*Virtual Laboratories for Exoplanets and Planet Forming Disks*” (<http://chameleon.wp.st-andrews.ac.uk/>). The ITN combines the expertise of eight European research institutes (Universities of St Andrews, Groningen, Copenhagen, Edinburgh, Leuven and Antwerp, the Max-Planck Institute in Heidelberg and the Netherlands Institute for Space Research) to cover all relevant aspects for this complex modelling task, joining the expertise in planetary atmospheres and protoplanetary disks, including observation and interpretation. The network will consist of 15 Early Stage Researchers (PhD students) and the respective supervisors and local research groups. A description of all the 15 announced PhD fellowships of the network is listed at (<http://chameleon.wp.st-andrews.ac.uk/recruitment/>).

### **The Host Institutes**

In Copenhagen, the student will be part of the active environment in the Niels Bohr Institute's section for Astrophysics and Planetary Science, which covers aspects of exoplanet research, proto-planetary disk formation, formation of our solar system, meteorites and exploration of Mars. In St Andrews, the student will be part of the School of Physics and Astronomy's Centre for Exoplanet Science, which leads an interdisciplinary agenda on exoplanet research ranging from exoplanet discovery and characterisation, atmosphere chemistry and thermo-chemical disk modelling, to the impact of the host star on the exoplanet system.

### **The position**

The selected PhD student for this project will be offered a fully funded 4 years PhD study, expected to start with 3 years at the University of Copenhagen followed by 1 year of training secondment at the University of St Andrews. The funding will be commensurate to the standard scale for PhD students in according to the Marie-Curie funding rules. The successful PhD applicant for this position will have to register at, and comply with the regulations of, the University of Copenhagen and the University of St Andrews, and will obtain a double degree

from the two universities after 4 years. The successful PhD applicants will follow a doctoral programme including personal training in management, science communication, and teaching.

### **Requirements**

We seek an excellent student with a strong background in physics or astrophysics. Successful candidates must hold a Masters degree or equivalent by the starting date of the position. Previous research experience on aspects of exoplanet- or stellar atmospheres, cloud formation, analysis of astronomical spectra, and/or astro-chemistry and astro-biology, and a track record of team work/mobility will be important criteria for the selection, as will experience in computational coding (including Fortran). Note that the general eligibility and mobility rules of Marie Skłodowska-Curie Actions apply, e.g. that applicants must not have resided or carried out their main activity (work, studies, etc.) in the country of the main host institution (in this case Denmark) for more than 12 months during the 3 years immediately before the recruitment date.

### **Application documents**

Your application package should contain (i) a CV including publication list if applicable, (ii) a statement of interest (max. one page, including a brief description of research interests and relevant experience), (iii) copies of university grades, certificates and/or diplomas, (iv) two letters of reference to be sent by the application deadline, (v) a statement that confirms that you understood the requirements of the joint degree and the Marie Skłodowska-Curie mobility criteria as outlined at <https://chameleon.wp.st-andrews.ac.uk/recruitment/>.

Use the portal of the Niels Bohr Institute (<https://www.nbi.ku.dk> and follow the links under vacancies) at the University of Copenhagen to upload your application documents.

**Application deadline:** 3<sup>rd</sup> of February 2020. Applications potentially arriving after this date may be considered until the position is filled. The foreseen start is during September 2020 or soon thereafter.