

# 2 PhD positions in interferometric exoplanet imaging: signal processing and instrumentation

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The Institute of Astronomy (IoA) of Leuven University in Belgium is a young and vibrant research group of some 50 scientists, engineers, and administrative staff ([fys.kuleuven.be/ster](https://fys.kuleuven.be/ster)), including 7 full-time and 3 part-time professors. The institute is an expertise center in stellar physics and is active in several international consortia and collaborations, involving telescopes at observatories worldwide and in space. Members of IoA have access to parallel computing facilities at Leuven University. The IoA is responsible for the organization of the 2-year Master in Astronomy & Astrophysics of the Faculty of Science and owns the 1.2m Mercator telescope at Roque de los Muchachos, La Palma Observatory, Canary Islands. The institute has a long tradition in instrumental, observational, and theoretical studies of stellar evolution.

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## Project

The spectral characterization and understanding of terrestrial exoplanets is currently one of the most ambitious and challenging long-term goals of astrophysics. All observing techniques with the potential to tackle this challenge face the same limitations: the overwhelmingly dominant flux of the host star and/or the lack of angular resolution. A very promising technical solution around these issues is nulling interferometry, which combines the advantages of stellar interferometry (high angular resolution) and coronagraphy (starlight rejection). With SCIFY (Self-Calibrated Interferometry For exoplanet spectroscopy), we aim at building Hi-5, a thermal near-infrared (3.8 microns) high-contrast nulling interferometric instrument for the visitor focus of the Very Large Telescope Interferometer. We also contribute to the ongoing major VLTI facility upgrade within the GRAVITY+ collaboration. By pushing VLTI high-contrast capabilities to smaller inner working angles, it will be possible to carry out several unique exoplanet programs to study young Jupiter-like exoplanets at the most relevant angular separations (i.e., close to the snow line), better understand how planets form and evolve, and characterize exozodiacal dust disks. In the long term, the SCIFY project will be a cornerstone in the roadmap leading to the characterization of terrestrial exoplanets and the search for life beyond Earth (see LIFE project page).

Through an ERC-CoG, the KU Leuven Institute of Astronomy is advertising 2 PhD positions. The selected candidates will join the SCIFY team (2 PhDs, 2 postdocs, 1 engineer) under the supervision of Prof. Denis Defrère and will work as part of an international network of collaborators. The advertised positions cover the following topics:

- PhD1: Development of advanced self-calibration data reduction techniques and scientific exploitation of current high-contrast interferometers. Current state-of-the-art nulling interferometers are operating one to two orders of magnitudes above the fundamental photon noise limit due to systematic errors caused by imperfect background subtraction and/or residual phase variation. The selected PhD candidate will tackle this problem by improving self-calibration data processing techniques. The goal is to provide a new and more robust general-purpose interferometric self-calibration data reduction tool while preparing the data processing tool of Hi-5. Our team participates in the scientific exploitation of the second-generation instruments on the VLTI (GRAVITY and MATISSE). In particular, we currently lead and/or are part of various observing programs to characterize exozodiacal dust around nearby main-sequence stars. Thanks to our collaborations with various observatories around the world, we also have access to data obtained with state-of-the-art nulling interferometers (LBTI, Keck). The selected PhD candidate will also contribute to their scientific exploitation and support their data analysis efforts.
- PhD2: development, characterization, and tests of the instrument in the lab. One of the main tasks of SCIFY is to build the Hi-5 interferometric instrument. With the support of the SCIFY team, the selected PhD candidate will characterize the performance of the instrument and support various laboratory tasks, including optical alignment, vibration characterization, and performance monitoring. In particular, (s)he will support the ongoing development of integrated optic components for the thermal near-infrared in collaboration with the SCIFY partners (University of Cologne, University of Grenoble, Australian National University, Macquarie University). (S)he will compare the different beam combination technologies and strategies and develop new OPD-control solutions to mitigate the effects of both precipitable water vapor and high-frequency vibration peaks.

## Profile

PhD applicants must hold a M.Sc. degree in physics, astrophysics or mathematics or else own an equivalent diploma. The degree must be dated at the latest one month before the position can be taken up. Expertise in signal processing, python programming, and astrophysics is an asset but not a requirement. Similarly, expertise in optical/infrared interferometry and/or exoplanet is an asset but not a requirement. Proficiency in English is required.

## Offer

The selected PhD students will be offered a 2-year contract, once renewable with 2 more years after positive evaluation. The salary will be commensurate to the standard scale for PhD students in Belgium; it includes social and medical insurance as well as pension rights. The foreseen starting date is October 1st 2021 but can be negotiated. The successful PhD applicant will have to register at, and comply with, the regulations of the Arenberg Doctoral School of the Leuven University. Good command of the English language is a requirement to be approved by the doctoral school. The successful PhD applicant will follow a doctoral program including personal training in management, science communication, and teaching. As part of the doctoral requirements, the students will have to take up a teaching task of at maximum 4 hours per week in one of the Bachelor (in Dutch) or Master (in English) programs. PhD students at IoA are also required to perform at least one Mercator observing run of 10 nights per year for the pooled IoA long-term monitoring programmes.

## Interested?

To apply for this position, please follow the application tool and enclose:

- 1) Full CV, with a publication list (if relevant) and contact details of two reference persons who would be prepared to send confidential recommendation letters;
- 2) A statement of interest (max. one page)
- 3) A summary of the research experience (max. 2 pages)
- 4) Full list of credits and grades of both BSc and MSc degrees (as well as their transcription to English if possible). If you haven't finished your degree yet, just provide us with the partial list of already available credits and grades

For more information please contact Mrs. Clio Gielen, tel.: +32 16 37 46 28, mail: [clio.gielen@kuleuven.be](mailto:clio.gielen@kuleuven.be).

You can apply for this job no later than April 12, 2021 via the online application tool :

<http://www.kuleuven.be/eapplyingforjobs/light/60005701>

KU Leuven seeks to foster an environment where all talents can flourish, regardless of gender, age, cultural background, nationality or impairments. If you have any questions relating to accessibility or support, please contact us at [diversiteit.HR@kuleuven.be](mailto:diversiteit.HR@kuleuven.be).