Long-term post-doctoral position in stellar spectroscopy of multiple systems

Project background and goal

In the framework of the FED-tWIN programme, the Belgian Science Policy Office (BELSPO) aims at promoting research cooperation between the Federal Research Institutes and Universities in Belgium. In this context, the *Astronomy and Astrophysics Department* of the Royal Observatory of Belgium (ROB) and the *Institut d'Astronomie et d'Astrophysique* of the Université Libre de Bruxelles (ULB) are recruiting a postdoctoral researcher. The candidate will implement the selected research project Prf-2020-033 "BISTRO": " The influence of binary stars on stellar and Galactic evolution, as revealed by current and large surveys " .

The long-term objective is to advance the understanding of single and binary star evolution in terms of chemistry and orbital parameters in order to gain insight in when and how binary components interact, and how the systems evolve across the Hertzsprung-Russell Diagram. This will have important repercussions on stellar evolution and population synthesis modelling. It is opportune to work towards this important goal, as current and future large spectroscopic surveys provide a homogeneous database with large samples of the various types of binary stars for which physical parameters, chemical abundances, and orbital parameters can be determined. Improved statistics of the properties of binaries in different stages of stellar evolution will allow us to gain new insights about how their components interact and how the systems evolve. However, traditional data-analysis methods are inadequate to cope with such vast data volumes. They are, on the other hand, ideal for data-mining applications using machine-learning techniques.

In the first two years the activities of the Fed-tWin Researcher (FTR) will be dedicated to develop an automated spectral fitting package using machine-learning techniques relying on artificial neural networks for the study of single stars and multiple systems in current and future large spectral surveys.

All planned tasks will be performed in close collaboration with the staff at the ROB and ULB. In parallel, we expect that the FTR will apply for external funding and establish collaborations with international teams. The FTR will be encouraged to supervise PhD students. The FTR will be proposed to devote a small fraction of his/her time to teaching assistant tasks at ULB.

Involved institutes:

The Royal Observatory of Belgium is one of ten Federal Scientific Institutions (FSIs) with about a hundred and eighty employees, where research is carried out in four departments: reference systems and planetology, seismology and gravimetry, astronomy and astrophysics, solar physics and space weather. More information on the

activities of the astronomy and astrophysics department can be found on the website
https://aa.oma.be/

The Université Libre de Bruxelles is a complete university maintaining 40 bachelor and 150 master programs, for 30 000 students of 140 nationalities, and hiring 9000 employees. More information on the Institut d'Astronomie et d'Astrophysique, belonging to the Physics Department of the Science Faculty, can be found on:
http://www.astro.ulb.ac.be

This FED-tWIN collaboration represents a fantastic opportunity to combine the expertise of two Belgian astronomical institutes in Brussels which have independently gained expertise on binary and multiple systems, albeit with different focuses and objectives. Whereas the expertise of the IAA-ULB team focuses on the orbital and chemical properties of binaries containing giants with peculiar spectra (Ba and related stars) and on their modelling (BINSTAR), the ROB team concentrates on binary and multiple systems found on the main sequence (OBAF stars) and/or evolved stars [planetary nebulae, (post-)AGB, Mira and Cepheid pulsating stars]. The development of a common machine-learning tool to deal with a large number of newly detected systems will provide a boost to these on-going research activities, and will allow the team members to grow and develop a centre of excellence in the field of the evolution of binary and multiple-star systems beyond this 10-year project.

Requirements and expertise:

The candidate will have a minimum of 3 years of post-doctoral experience. The candidate will hold a Ph.D. degree in astronomy and astrophysics obtained at the earliest 12 years prior to the submission date of the job application. The 12-year period is extended by one year for each long-term maternity, parental & adoption leave of the candidate & for each long-term sick leave of the candidate or his/her immediate family.

The ideal candidate will have demonstrated expertise in one or more of the following domains: analysis of high-resolution spectra, binary and multiples stars and their orbital characterization, spectral synthesis, stellar atmosphere models, data mining and machine learning techniques, involvement in current or future large spectroscopic surveys. Some experience as a teaching assistant is an asset.

The FTR candidate should have very good English communication skills, very good programming skills and be a real team player.

We offer:

Upon positive evaluation after 2 years the post-doctoral position will be extended according to the rules of FED-tWIN.
The researcher will be affiliated as scientific staff - SW2 Workleader at ROB (50%) and as post-doctoral researcher at ULB (50%) with two open-ended contracts. The FTR will

distribute his/her work time according to a bilateral agreement associated with the research profile.

Besides the salary the contract includes a research budget, free public transport, possibility of hospitalisation insurance, and flexible working hours. The FTR will be granted full access to computing facilities (high performance clusters at ROB, CECI http://www.ceci-hpc.be for ULB).

Workplaces:
- ROB: Department of Astronomy and Astrophysics, Royal Observatory of Belgium, Ringlaan/Avenue Circulaire, 3, B-1180 Brussels, Belgium
- ULB: Institut d' Astrophysique, Boulevard du triomphe, B-1050 Brussels, Belgium

More information on working for the federal government (in Dutch and French) can be found on the site of FedWeb (https://fedweb.belgium.be/). The starting date is negotiable, but ultimately 30th November 2022.

Practical information:

Applications should include:
- A cover letter motivating the application;
- A detailed CV in which the FTR demonstrates their most important publications and achievements, the FTR added value as an academic researcher for the core tasks of research, education, and services in their past career and for their future activities (maximum 5 pages);
- complete publication list.

A detailed research plan will be requested from short-listed candidates. Job interviews will be held.

Applications should be sent via e-mail to Dr. G. Van de Steene (g.vandesteene@oma.be) and Prof. Van Eck (svaneck@astro.ulb.ac.be)

using " POSITION ASTRONOMY " as subject before 15th December 2021 at 1 PM.

Contact persons:
- For info about the job content
  - ROB: Dr. G. Van de Steene (g.vandesteene@oma.be)
  - ULB: Prof. S. van Eck (svaneck@astro.ulb.ac.be)
- For administrative matters
  - ROB: hrrob@oma.be
  - ULB: angelique.greindl@ulb.be

The Royal Observatory of Belgium actively pursues a policy of diversity on the work floor and safeguards equal opportunities, equal treatment and equal access to the selection process for all applicants. ULB shows a constant concern for valorizing and supporting initiatives aimed at putting the issue of equality and diversity in the spotlight, while

simulating the implementation of solutions in order to achieve more equality, openness and efficiency.