



– Postdoctoral Position at LAM –

## **Coupling SPHERE and CRIRES+ at the VLT: preparation, acquisition and interpretation of the observations**

**Location:** Laboratoire d'Astrophysique de Marseille (LAM; <https://www.lam.fr/>)  
**Funding:** ERC HiRISE (PI Arthur Vigan, grant agreement #757561)  
**Duration:** 2 years (1+1)  
**Starting date:** September – November 2021  
**Deadline:** 15 May 2021  
**Responsible:** Arthur Vigan (CNRS/LAM)  
**E-mail:** [arthur.vigan@lam.fr](mailto:arthur.vigan@lam.fr)

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### **Summary**

A 2-year postdoctoral position supported by the ERC HiRISE (High-Resolution Imaging and Spectroscopy of Exoplanets) is offered at Laboratoire d'Astrophysique de Marseille (LAM, France) to work with Dr. Arthur Vigan and his team on the coupling between SPHERE and CRIRES+ at the VLT. This coupling enables the characterization of the atmospheres of directly-imaged exoplanets at very high spectral resolution. The successful applicant has the opportunity to work on the scientific validation of the instrument, on the preparation of the observing program, and on the interpretation and analysis of first HiRISE on-sky data.

We are looking for a highly motivated researcher with experience starting from right after the PhD or more. The proposed salary will be adjusted to take into account the experience.

LAM and CNRS are strongly committed to equal employment opportunity.

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### **Context**

High-dispersion spectroscopy at resolutions up to  $10^5$  is one of the most promising pathways for the detailed characterization of exoplanets. The power of high-dispersion spectroscopy lies in the ability to disentangle the stellar and planetary signals based on the spectral features of the planet and on its distinct radial velocity component. Self-luminous, young giant planets are ideal science targets because of their intrinsic brightness in the near-infrared, but the performance of most current high-resolution near-infrared spectrographs are limited by the lack of extreme adaptive optics (ExAO), which corrects for atmospheric turbulence at high-cadence, and the lack of coronagraphs, which attenuates the brightness of the host star. These limitations can be partially alleviated by using a broad wavelength coverage, for example like the newly offered CRIRES+ upgrade, but ultimately the performance remains limited by the luminosity difference of the order of  $10^6$  between the star and the planet.

The goal of the ERC project HiRISE is to combine ExAO-assisted high-contrast imaging and high spectral resolution at the Very Large Telescope (VLT) in Chile. It will bring high-spectral



resolution to the SPHERE exoplanet imager by implementing a prototype fibre coupling with CRIRES+, the high-dispersion near-infrared spectrograph for the VLT that is currently being recommissioned. The HiRISE project will soon start its integration and testing phase in Europe before its installation at the VLT in 2022, and the start of science observations shortly afterwards.

More information on HiRISE: <http://astro.vigan.fr/hirise.html>

### ***Postdoctoral work***

The successful applicant will be working with the HiRISE team on the scientific validation of the instrument, on the preparation of the observing program, and on the analysis and interpretation of first HiRISE on-sky data.

The first objective of the postdoc is to prepare the analysis of the commissioning data that will be acquired during the installation and on-sky validation of the instrument at the Very Large Telescope. This commissioning data will be used to assess the final on-sky performance of HiRISE, which will be a key input for the preparation of the science observations with HiRISE. The postdoc will have a leading role in the selection of the targets for the commissioning, in the definition of the observations and in the analysis and interpretation of the data.

The second objective of the postdoc is to prepare a large observing program targeting a sample of directly imaged companions accessible to HiRISE. The definition of the observing program and of its astrophysical objectives will be performed in collaboration with an extended science team, including the current HiRISE team and external partners with detailed expertise (high-contrast imaging, astrometry, atmospheric modelling, etc). To reach this objective, the successful applicant, in coordination with the science team, will work on (1) the selection of the targets based on the commissioning performance, (2) the definition of the science objectives, (3) the estimation of the required observing time, and (4) the writing of the proposal.

The third objective is to work on the development of dedicated analysis tools for HiRISE data, and on the astrophysical interpretation of the first HiRISE science data. The extent of this part of the work will be defined with the applicant based on her/his expertise and areas of interest. Analysis of data sets already obtained by the HiRISE team on existing instruments (SPIRou, SINFONI, MUSE, GRAVITY) is also a possibility, and the applicant will be strongly encouraged to submit her/his own proposals to obtain new data that fit within the scope of the HiRISE project.

### ***Work environment***

The project will be carried out at *Laboratoire d'Astrophysique de Marseille* (LAM, France), one of the major public research institutes in France in the area of astrophysics. Most of the work will be done at LAM, but with one or several visits to the Paranal observatory for the commissioning of the system and subsequent science observations. The applicant will be at the interface between the planetary system group (*GSP*) and the instrumental R&D group (*GRD*). He/she will benefit from the local expertise in exoplanet science, data analysis, adaptive optics, high-contrast instrumentation, machine learning.



The work will be done in a highly collaborative environment with the HiRISE team, which currently includes the PI, 1 HiRISE PhD student, and 1 HiRISE AIT engineer, plus other closely related participants from the SPHERE and CRIRES+ consortia and from ESO.

### ***Requirements / Profile***

Minimum qualifications include a PhD degree in astrophysics, astronomical instrumentation or a closely related field. Whatever her/his background, the applicant must be highly motivated to work on the direct characterization of exoplanets using an innovative prototype system, in close collaboration with a small team. Skills in astronomical observations, high-resolution spectroscopy, data analysis and interpretation will be extremely useful. Proficiency in Python or similar data analysis software is necessary.

The applicants must have demonstrated their capacity for independent work and for conducting their own research.

### ***Application***

To apply to the position, please send to Arthur Vigan ([arthur.vigan@lam.fr](mailto:arthur.vigan@lam.fr)):

- A presentation letter including a research statement (no longer than 3 pages);
- A curriculum vitae, including a list of publications;
- Up to 2 letters of reference, which should be e-mailed directly to Dr. Vigan.

Applications sent before **Friday 14 May 2021** will receive full consideration. Past this date applications will be considered upon availability of the position. Junior and senior applications will be evaluated at the same level. LAM and CNRS are actively committed to equal opportunity in employment.

### ***Benefits***

Gross salaries range between 30k€ and 35k€ per year depending on experience and are subject to income tax. The position comes with full social benefits covered by the French social security system.

**If the sanitary situation improves:** the position also comes with generous funding for travels, missions and conferences (both national and international).