Optimizing Adaptive Optics systems for long baseline interferometry at visible wavelengths

Job offer: AO-ISSP for H2020_AdG 2020 Project 101019953 ISSP

Level: AO Scientist / PhD / AO Engineer

Salary: Depending on experience (research engineer / postdoctoral level)

Type of position: Science of engineering and scientific instrumentation; expert in the development of instruments.

Situation Université Côte d'Azur – Observatoire de la Côte d'Azur - Laboratoire LAGRANGE – Bâtiment Fizeau du Campus Valrose (Nice, Calern - France) – CHARA Array, Mount Wilson, CA (USA)

Description of Observatoire de la Côte d'Azur

Observatoire de la Côte d'Azur is a French public Center for research in earth sciences and astronomy. With more than 450 people working at four different locations (Nice Observatory, Université de Nice, Sophia Antipolis, Plateau de Calern), its role is to explore, understand and transfer knowledge about Earth sciences and astronomy, whether in astrophysics, geosciences, or related sciences such as mechanics, signal processing, or optics. OCA is composed of 3 research units (ARTEMIS, GEOAZUR, and LAGRANGE) and 1 support structure (GALILEE). This program will be developed in the Lagrange Laboratory.

The Interferometric Survey of Stellar Parameters (ISSP) ERC-Adv grant (PI Denis Mourard), started on 1 Sep 2021 for 5 years, aims at realizing and exploiting an ambitious and homogenous survey of the angular diameters of a thousand stars in the visible and as small as 0.2 milliseconds of arc. It benefits from the recently commissioned CHARA/SPICA instrument installed on the CHARA Array, Mount Wilson Observatory (USA, CA). The survey is built to address key questions about the relation between planets and stars and to offer to the broader community a unique and primary source of direct information on a representative and large sample of stars all over the HR diagram. The ISSP team is opening this position to support the scientific programs of the survey through a dedicated effort on the adaptive optics systems for reaching higher sensitivity.

Description of the CHARA Array

The flagship project of Georgia State University's Center for High Angular Resolution Astronomy (CHARA) is its optical interferometric array of six telescopes located on Mount Wilson, California. Each telescope of the CHARA Array (Director: Gail Schaefer) has a light-collecting mirror 1-meter in diameter. The telescopes are dispersed over the mountain to provide a two-dimensional layout that provides the resolving capability of a single telescope with a diameter of 330 meters! Light from the individual telescopes is transported through vacuum tubes to a central Beam Synthesis Facility in which the six beams are combined together. When the

paths of the individual beams are matched to an accuracy of less than one micron, after the light traverses distances of hundreds of meters, the Array then acts like a single coherent telescope for the purposes of achieving exceptionally high angular resolution. The Array can resolve details as small as 200 micro-arcseconds. In terms of the number and size of its individual telescopes, its ability to operate at visible and near infrared wavelengths, and its longest baselines of 330 meters, the CHARA Array is arguably the most powerful instrument of its kind in the world.

Description of the position and main activities

The Côte d'Azur Observatory, Lagrange Laboratory, ERC ISSP Project is recruiting in instrumentation within the framework of the CHARA/SPICA instrument project. The project consists of the optimization of the performance of the adaptive optics devices of the CHARA telescopes to reach the ultimate performance of the SPICA visible interferometric instrument. Each telescope is equipped with a fast AO for the atmospheric corrections (TelAO installed in the telescope itself) and a low frequency AO for the compensation of the static aberrations (LabAO installed at the exit of the delay lines, in the lab).

The person will have the responsibility, along with the project and CHARA team, of optimizing the operations of the adaptive optics systems to achieve the full performance and a level of automation compatible with the ambition of the large observational survey.

The main technical activities considered for this position are to:

- provide night-time assistance for AO, especially during SPICA runs. This would involve someone being onsite to work alongside the operators to optimize AO performance. This optimization is linked to alignment issues as well as parameters of the AO loops (LabAO and TelAO).
- Establish the correct strategy for computing new on-sky reconstructors, flats, and evaluating performance.
- participate in the development of an optimized version of the software displaying, for remote operations, the critical information on AO for remote observers.
- tabulate the settings (gains, exposure time, thresholds, etc) to optimize performance for different target magnitudes and seeing conditions. This information can then be used by the operators to optimize AO settings in the future.
- create software tools that can be used on the guiding devices (STST images for the infrared and SPICA FTT images for the visible) to provide concrete metrics (Strehl, encircled flux, etc) to monitor AO performance over time. The monitoring of AO performance over time should also include the seeing conditions provided by the new seeing monitor.
- developing a better way of using the IR+VIS information (STST and SPICA FTT) for complete VIS+IR guiding, using the possibility of moving the infrared fibers blindly while keeping the alignment in the visible.

The position also offers access to the unique observing capabilities of CHARA with SPICA/MIRCX/MYSTIC instruments, and it is expected that the person will contribute to one of the scientific programs of the ISSP project.

Skills

Experience in astronomical instrumentation is required, ideally in the field of high angular resolution and adaptive optics. Necessary skills in physical measurements and data analysis are required. C and python languages will be used for the position. Fluency in English is mandatory.

Conditions

The position assumes regular mobility and long stays in the United States at Mount Wilson in California for the various phases of sky tests and instrumentation optimization. The observations could also be done remotely from the Plateau de Calern site at Observatoire de la Côte d'Azur.

The starting date could be as early as 1 March 2025. Independently of the starting date, the end of contract is fixed to 31 Aug 2026.

The application should be sent by email to Denis Mourard and Gail Schaefer. It should include a detailed CV and a letter of motivation describing the interest in the position and the skills for the activities that are described. The deadline for applying is fixed to 31 Jan 2025.

We welcome applicants with diverse backgrounds and experiences. We regard gender equality and diversity as a strength and an asset.

Contact

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https://lagrange.oca.eu/fr/welcome-erc-issp