

☒ Faculté des Sciences et Ingénierie**Department : UFR 925 – Physique****Partner organisms : CNRS/INSU et IN2P3****Location : Campus Pierre et Marie Curie, 4 place Jussieu, 75005 PARIS****Identification de l'emploi****Discipline : Astronomie multi-messagère****Corresponding CNU sections :****Section 34 - Astronomie, astrophysique / Section 29 - Constituants élémentaires****Nature de l'emploi : Tenure track****Quotity : ☒ 100%****Etat du poste : open****Profil****Astronomie multi-messagère (à haute énergie)****Job Profile****Multi-messenger astronomy****Teaching****Training courses**

The laureate is likely to teach in all types of Physics courses, from bachelor to doctorate levels.

Teaching objectives and supervision requirements

The volume of teaching is set to 42 hours of lectures or 64 hours of tutorials or lab teaching, or any equivalent combination, per year over the duration of the contract. An interest in teaching experimental physics or numerical methods in physics, in developing new pedagogical methods and more generally, a personal vision in teaching physics will be highly appreciated.

Most available courses are taught in French, except for the Paris Master physics and some Master 2 specialties which are taught in English.

The first year of License at the Faculty of Science and Engineering (L1) is organized in multidisciplinary portals while the second and third years (L2 and L3) of the physics License associate a physics major and a minor which can be taken in another discipline or one complementary to physics (major/minor system).

The first year of Master (M1) is general while the second year (M2) comprises more specialized courses. The NPAC (Nuclei, Particles, Astroparticles and Cosmology) and AAIS (Astronomy, Astrophysics and Space Engineering) propose courses directly related to this professorship.

Expected Profile

- Expertise in data analysis in high energy astrophysics (signal modeling, parameter reconstruction methods). Skills in the use of numerical simulations, collaborative data analysis software. Knowledge of radio detection of astroparticles will be appreciated.
- Strong knowledge of multi-messenger infrastructures for real-time transient source tracking with alert and response systems.
- Skills in physical and astrophysical interpretation (theoretical/phenomenological modeling).
- Teaching experience required

The professorship contract is signed for a duration of 3 to 5 years. At the end of the contract, the person may be granted tenure as a university professor, following the advice of the tenure committee. The resources allocated to the professor are as follows: a one-time funding (at the signature of the contract) of 200 k€ transferred to the host laboratory. A minimum of 120 k€ of this funding should be spent on salaries to build a team (doctoral student, post-doc, contract worker, IT), and the rest can be spent to support research expenses (travel, small equipment etc.).

Scientific themes

High energy multi-messenger astronomy, astroparticles, neutrinos, radio detection of cosmic particles.

Strategy of the university

The multi-messenger approach is the future of astronomy: progress will require to combine information from different messengers (photons, neutrinos and gravitational waves). Sorbonne University has an excellent positioning on this aspect, from experimental (Auger, CTA, LIGO-Virgo, SVOM, Euclid, LSST, LISA, GRAND) and theoretical points of views. In particular, the Sorbonne University teams at IAP and LPNHE have established a strong leadership on the GRAND (Giant Radio Array for Neutrino Detection) project which combines excellent technical assets to detect ultra-high energy neutrinos and thus open a new observation window on the Universe. The proposed professorship aims at developing multi-messenger analysis at Sorbonne University (SU) with a major contribution to GRAND.

Strategy of the host laboratories

The multi-messenger thematic is at the core of the scientific strategies of the two host laboratories: the Institut d'Astrophysique de Paris (IAP) and the Laboratoire de Physique Nucléaire et des Hautes Energies (LPNHE). Thanks to their different scientific priorities (astrophysics and particle physics), further illustrated by their two different umbrella institutes (INSU and IN2P3), these two laboratories offer complementary approaches and expertise in the field of astroparticles. The GRAND-SU team is a textbook case of a perfect synergy between two communities, two institutes, two laboratories, which is maturing since 2015 within Sorbonne University.

The GRAND-SU team is indeed at the origin of the GRAND project, a giant network of 200'000 antennas, distributed in various sites around the world and aiming at detecting very high energy cosmic particles via the electromagnetic emission they induce in the atmosphere. The GRAND concept was born within the walls of SU. Since then, the team has maintained a strong leadership on three topics vital to the advent of cosmic particle radio-detection: the development of algorithms for the analysis of cosmic particle-induced radio signals, the construction of the science program for ultra-high energy neutrinos, and the foresight on innovative online identification and autonomous trigger methods for giant antenna arrays.

Summary of the scientific project

The junior professor will play a leading role in the development of multi-messenger astronomy at Sorbonne University. In particular, he or she will use his or her expertise in high-energy astrophysics and astroparticles to lead the analysis of data in GRAND, aiming at the detection of ultra-high energy neutrinos, thus enlarging the panel of existing probes.

The work will take place within the framework of the GRAND experiment and will thus be partly dependent on various external factors and the achievements of the collaboration. Nevertheless, the following objectives are set:

- Prepare innovative tools and methods for conducting multi-messenger analyses at different time frames, corresponding to different stages of the project. From the GRANDProto300 demonstrator stage (2024): develop data analysis tools that allow to discriminate the nature of the messengers (cosmic rays, gamma rays, neutrinos), from the radio signal detected by the antennas.
- Before 2026: perform combined cosmic ray and gamma ray analyses with GRANDProto300 data, propose astrophysical interpretations to the results.
- Before 2026: define precisely the multi-messenger scientific objectives of the GRAND1k and GRAND10k stages, which will succeed GRANDProto300.
- From 2025, prepare alert and response systems to astrophysical signals and integrate the different phases of the GRAND detector into the alert networks for next-generation multi-messenger transient astronomy (with LISA, Einstein Telescope, CTA, LSST, KM3Net etc.).
- From the commissioning of the GRAND1k phase, analyze the data with the objective of physical interpretation of the results in the context of multi-messenger astronomy.

Scientific dissemination

As a fundamental science research project, the scientific dissemination will be carried out firstly by publications in high level peer-reviewed scientific journals, and by oral communications (international conferences, workshops, seminars).

The GRAND collaboration is involved in outreach actions. The GRAND-SU team is responsible for the "Education and outreach" aspects of the collaboration. It manages the GRAND website

[<https://grand.cnrs.fr/>] and documents the progress of the project through widely distributed films [<https://www.youtube.com/watch?v=8tDnwq8gAe4>]. To ensure the long-term sustainability of the detector, it is essential to have the support of the local community at the site where the detector will be deployed. The GRAND collaboration is conducting outreach activities such as lectures at local schools in China near the sites being evaluated for deployment of the prototypical arrays. The professor may be involved in these different actions.

Open Science

Sorbonne University has been an actor of Open Science for many years. Thus, all the publications of the GRAND collaboration are uploaded in the open archive arXiv, and all the works published on this project, and more widely in the laboratory, are also deposited in HAL. In addition, the data collected by the GRAND collaboration are processed in a FAIR approach. The collaboration plans to make the data public one or two years after their acquisition. All software developed in this project will be publicly available on Github and, if selected by the collaboration, will be implemented in the GRAND software, also publicly available.

Science and Society

Environmental awareness: The GRAND collaboration is committed to reducing its environmental impact. The GRAND-SU team chairs the GRAND Carbon Committee and has published pioneering studies on the evaluation of the carbon footprint of the GRAND project and on a life cycle analysis of its detectors, inspiring several large-scale experiments. The collaboration will strive to continuously improve its environmental impact as part of the development of the experiment. The "GRAND Green Policy" has been adopted by the collaboration with guidelines to follow regarding travel, digital, and equipment.

Intitulé du laboratoire	Sigle (UMR)	N°
IAP	UMR	7095
LPNE	UMR	7585

Application and recruitment procedures

Applications are open from March 16, 2023 10:00 am (Paris time) to April 17, 2023 4:00 pm (Paris time). Applications must be submitted on the [Galaxie](#) website. Candidates who do not have access to this Galaxie application (in particular non-French candidates) may exceptionally submit the complete application electronically according to the established schedule and procedures. Send the application files to sciences-drh-gestioncoEC@sorbonne-universite.fr with the subject "Candidature CPJ"

The documents to be attached to the application file are set by the [decree of February 6, 2023](#), as amended, concerning the general terms and conditions for the transfer, secondment and recruitment by competition of lecturers, university professors and junior professors (see in particular Title III - articles 24 to 27 and Title IV - articles 28 to 31).

Candidates who do not hold a doctorate must have their university diplomas, qualifications and titles recognized as equivalent to a doctorate, in accordance with one of the procedures provided for in article 5 of decree no. 2021-1710 of December 17, 2021 concerning the junior professorship contract provided for in article L. 952-6-2 of the Education Code and article L. 422-3 of the Research Code. Any incomplete application by the above-mentioned deadline will be declared inadmissible.

Only candidates who have been selected by the selection committee on the basis of their applications will be invited to an interview, according to a timetable and procedures that will be communicated shortly.

The aforementioned [decree n° 2021-1710 of December 17, 2021](#) determines the conditions of renewal of the contract, the modalities of assessment, before the tenure, of the scientific value and the aptitude to carry out the missions of each body, the modalities of appointment of the members of the selection and tenure commissions and the conditions of the commitment to serve.

Contacts

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