



**SORBONNE
UNIVERSITÉ**

CHINA SCHOLARSHIP COUNCIL

Appel à projets

Campagne 2022

<https://www.sorbonne-universite.fr>

Title of the research project :

Thesis supervisor (HDR) :

Name :

Surname :

Title :

email :

Professional address :

(site, dresse, bulding, office...)

Research Unit

Name :

Code *(ex. UMR xxxx)* :

Doctorate School

Thesis supervisor's doctorate school (candidate's futur doctoral school) :

PhD student currently supervised by the thesis supervisor (number, year of the first inscription) :



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Joint supervisor :

Name :

Surname :

Title :

email :

Professional adress :

(site, dresse, bulding, office...)

Research Unit

Name :

Code *(ex. UMR xxxx)* :

École doctorale

Joint supervisor's doctorate school :

Or, if non SU :

PhD student currently supervised by the joint supervisor (number, year of the first inscription) :

Joint supervisor :

Name :

Surname :

Title :

email :

Professional adress :

(site, dresse, bulding, office...)

Research Unit

Name :

Code *(ex. UMR xxxx)* :

École doctorale

Joint supervisor's doctorate school :

Or, if non SU :

PhD student currently supervised by the joint supervisor (number, year of the first inscription) :

Context:

The origin of the highest-energy cosmic rays has been judged one of eleven fundamental questions of the 21st century by the US National Research Council. To identify their sources, we will need to measure cosmic rays and neutrinos at the highest energies with event statistics significantly larger than present experiments. This will require detectors spanning gigantic areas of more than 100,000 km². Radio detection of extensive air showers could be applied on such scales, but only if we can operate it fully autonomously, i.e. without coupling it to other detection techniques.

The Giant Radio Array for Neutrino Detection (GRAND) is an ambitious proposal to meet this challenge in a decade from now. GRAND plans to build by then a network of 20 subarrays, each composed of 10'000 radio antennas working in the deployed over 10'000km² in mountainous, remote locations around the world. To achieve this ambitious objective, it is first needed to establish its principle of detection on a smaller scale. This is the main objective of GRANDProto300 (GP300), an experiment composed of 300 autonomous antennas about to be deployed over 200km² in a remote area in Western China. GP300 will have to demonstrate that very inclined air showers initiated by cosmic rays in the energy range $10^{16.5}$ - 10^{18} eV can be successfully detected and discriminated from background radio pulses with an autonomous array of radio antennas, and that the properties of the primary cosmic particles (direction of origin, energy and nature) can be successfully reconstructed from the radio data only. It is also foreseen that GP300 will be a very performing tool to study the transition between galactic and extragalactic origin of cosmic rays expected to take place in this energy range [1].

Subject:

The selected candidate will play a key role in the GP300 experiment. He will participate in the data taking, calibration and monitoring of the detector through several periods of stay on the experimental site of the experiment. He will also participate in the development of the software programs to perform these tasks. More over the candidate is expected to play an important role in the analysis of the radio data, which will consist in identifying the radio pulses associated with air showers, reconstructing of the properties of the primary cosmic particle which initiated it and hopefully deriving the reconstructed information an interpretation on the origin of cosmic rays.

Qualification:

Master students in their 2nd second year are welcome to apply. Some knowledge in computer programming is very welcome (python language in particular), but most important will be the candidate motivation to participate in an ambitious, pioneering effort in experimental physics.

Work environment:

This PhD will be prepared out under the co-supervision of Zhang Yi (Purple Mountain Observatory, Chinese Academy of Science) and Olivier Martineau (LPNHE, Sorbonne University). Zhang Yi is the head of the GRAND group at PMO, which plays a leading role in the management and operation of the GRAND project. Olivier Martineau is the initiator of GRAND and one of the 3 spokespersons of the project. He is very active in the Paris group (LPNHE + IAP), in particular in the developments of methods for data analysis. It is foreseen that the candidate will share his time equally between the two institutes. He will also have extensive interactions with the other members of the GRAND

project, a collaboration involving ~70 researchers from 8 countries, including world-level experts in the field of high energy astrophysics and experimental physics.