

Call for applications for a junior professorship in geosciences (Four year tenure track)

CY Cergy Paris Université
Laboratoire Géosciences et Environnement Cergy

Scientific profile: Numerical modeling of thermal, hydraulic, mechanical and chemical interactions in rocks.

Keywords: *fluid-rock interactions; numerical modeling ; energetic transition ; geothermal energy; underground reservoirs; building and heritage rocks.*

Target duration: 4 years (September 2023 - August 2027), then evaluation for tenure as a university professor.

Scientific subject of the chair:

Climate change and the energy transition increase the need to understand the interactions of fluids with rocks. Our experimental, analytical and field efforts on new uses of the subsoil lack a numerical approach. The chair is an opportunity to quickly reach the state of the art in numerical modeling of fluid-rock interactions on several themes: (i) changing properties of natural underground reservoirs (flows with dissolution and clogging, thermal and chemical exchanges, diagenesis, mechanical stability and durability, environmental hazards); (ii) reinforcement of the digital rock laboratory at the sample scale for the design, analysis and assistance in interpreting the results of experiments (already under development for acoustic measurements); (iii) relations between the scales of the laboratory and the natural site (including upscaling), (iv) damage and renovation of the rocks and mortars of the built heritage. Synergies are thus expected between the researchers of the laboratory around the chair. These deliberately broad issues, with their broad industrial applications (storage, geothermal energy, unconventional mining, monumental heritage), allow us to open up recruitment to various profiles, with criteria of scientific excellence.

Teaching project:

The Geosciences department recently opened the CMI GEOSSEN ("Master's Degree in Geoscience Engineering for Energy"), based on its research and dedicated to training geoscientists on industrial (80%) and academic (20%) new uses of the subsoil in the energy transition (Geostorage, Geothermal energy, Hydrogeology, etc.). The chair is also essential for the innovative training that is the CMI where it will provide an entire coursework (fluid-rock interactions, 20h) and will participate in the courseworks of geothermal energy (16h), geo-storage of fluids (10h) and numerical simulation practical work in hydrogeology. The chair will allow us to offer students from the CMI and the future engineering training course at CY Tech, research projects combining experimental and numerical approaches. Developing digital R&D and applications to real cases, these courses are essential for acquiring reservoir engineering skills, widely sought after in industry. The chair will increase the attractiveness of our training to companies and students, in particular our

partners (Karlsruhe Inst. of Tech. (Germany), Mines Paris PSL (Fontainebleau), University of Neuchâtel (Switzerland), Uni. Roma Tre (Italy), Erasmus exchanges).

The annual teaching load will be 64 hours of tutorials, or 42 hours of lectures or a any combination of these two. On the long term, the professor is expected to teach in french.

Financial overview for the four years:

- Chair salary: app. 3200 €/month before taxes.
- Salary: 120 k€ for hiring a PhD or a post-doc.
- Funding for research expenses over 4 years, including the PhD or post-doc's expenses: computer equipment (licenses and calculator), publications, conferences, visits, etc...: 80 k€

Terms and conditions of application:

The files are to be collected and deposited on the ministry's website: https://www.galaxie.enseignementsup-recherche.gouv.fr/ensup/cand_CPJ.htm before March 30, 2023, 4:00 p.m. Applicants must hold a Ph.D. Applications may be written in French or in English.

It is necessary to contact the GEC members of the selection committee Bertrand.maillot@cyu.fr; Beatrice.Ledesert@cyu.fr ; Franck.Bourdelle@cyu.fr to organise a visit and/or a seminar before the official hearing, and of course, for any additional information required.

Additional informations:

University policy

CY Cergy Paris University (www.cyu.fr) deploys a strategy of excellence and internationalization of its research, in particular through the ISITE CY Initiative, with ESSEC and CNRS. To do this, it has implemented an ambitious recruitment policy for long-term post-docs and academic chairs, particularly internationally, in order to increase its attractiveness in its key areas of research. These tools are already widely used by the university's research laboratories. In particular, CYU aims to become a leading player in the national and international landscape of global complexity and the design of sustainable solutions adapted to the challenges of society. This ambition is based in particular on the development of high-level expertise in the digital modeling of complex systems for applications in the environmental transition. This request for a chair is thus fully in line with the strategy of the university and the ISITE CY Initiative and will in particular strengthen the institutional links created with the EUtopia alliance (funded doctorate in fluid-rock interactions in geothermal systems with Vrije University of Brussels).

Strategy of the Geosciences and Environment laboratory

The GEC laboratory (gec.cyu.fr) develops its research on the "useful" properties of near-surface rocks, with a large analytical and experimental arsenal

(electron microscopy, Raman spectrometry, triaxial presses, climatic chambers, permeameter, porosimeter, etc.) allowing the measurement of mechanical, petrophysical, electrical, thermal, seismic and hydraulic properties. The laboratory supports the energy and environmental transition in two areas: (i) natural underground reservoirs and sites (evaluation and characterization for geothermal energy and storage (CO₂, radioactive waste, etc.); (ii) construction materials (impact of climate change on heritage rocks, and design of new thermally efficient materials). In these two directions, fundamental questions appear on the role of fluids. If the GEC is already at the state of the art on its experimental and analytical approaches, it wants to be at the best international level in numerical modeling to approach these questions in a global way, and carry out ambitious projects with ISITE CY, the National Research Agency (ANR) and Europe.

Scientific Dissemination: The laboratory has a policy of publishing fundamental research in scientific journals with a very high level reading committee and through communications at international conferences, workshops and invited seminars.

Open Science: This project, like the laboratory, will of course respect the principles laid down by the international academic research community: publications in open access journals, deposit of work on the national HAL archive and on ORCID, presentation of work in conferences and workshops. Possible publications of data on public institutional servers, with obtaining a DOI.

Science and society:

The issues of energy resources and underground storage are in the spotlight daily in the media and reveal important problems of public information and societal acceptability. Many of these questions relate to, or involve, fluids in rocks: production of polluted water in mining, induced seismicity, long-term storage of radioactive waste in a geological environment, or injection of CO₂ (fluid) into old reservoirs , etc... The fluid-rock interaction theme of the chair will very usefully increase our expertise on these questions to contribute to the precise information of the general public. The chair will benefit from the experience of the GEC laboratory, which interacts regularly with the public to support the university whenever possible in its scientific mediation actions with and for society.

Indicators for tenure at the end of four years:

Our laboratory, of medium size, allows an informal continuous follow-up of the activities of its members. The laboratory director will monitor research annually while a referent will support teaching. At the end of the four-year contract, the chairholder will submit a detailed report on the achievements of the project before evaluation by the laboratory council and then by the tenure committee.

This report will highlight the elements of academic scientific excellence: publications with high impact factor, invited seminars and communications, obtaining public contracts (ANR, Europe MSC Rise, etc.), organization of conference sessions, supervision of masters, doctorates,

and post-doctoral. It will also take into account informal criteria on the reputation acquired with other specialists in the discipline and with the co-authors of the articles. Finally, it will mention, where appropriate, industrial openings (contracts and collaborations). On the substance, we will seek a balance between personal research (for example, methodological in numerical simulation) and collaborations with the members of the laboratory on the main axes of application of the simulations.

To quantify the evaluation we expect a minimum of:

- four publications in journals with a high impact factor;
- three communications in international congresses;
- submission of at least one ANR project or European program (including ERC).

In addition to these priority criteria, the report will present the work done in teaching and the evaluations by the students (which we practice systematically by questionnaires and within an annual improvement council). Communication with the general public will also be detailed (open days, science festival, presentation at the open university of CY, etc.).