Junior Professorship
'Non-linear dynamics and research on intelligent UAV ensembles' (M/F)

What is a Junior Professorship?
Junior professorships are a new form of recruitment based on a research and teaching project, at the end of the pre-tenure contract, and after an assessment of the scientific value and professional aptitude of the successful candidate (M/F) for the chair by a committee, the candidate will have direct access without competition (subject to a favourable assessment) to a permanent post in the body of university professors (Decree no. 2021-1710 of 17 December 2021).

Reference Odyssée	252913
Recruitment article	L952-6-2 of the French Education Code
Job title	Junior Professorship 'Non-linear dynamics and research on intelligent UAV ensembles' (M/F)
Target academic staff	University professors
CNU section(s)	26 and 29
Faculty and department	Faculty of science and technology, Mathematics Department
Laboratory	Centre de Physique Théorique (CPT)
Workplace	Toulon University – La Garde campus
Starting date	1st October 2025
Contract duration	4 years
Gross monthly salary	Beetween 3726 et 4345 euros
Teaching profile	The professor will work within the Faculty of Science and Technology at the University of Toulon, teaching pure and applied mathematics from bachelor's to master's degrees. In particular, he/she will be able to propose new courses for the next habilitation, previously tested either as optional courses or in the international universities he/she will have visited in order to set up international agreements. He/she will be keen to develop teaching at Master's level related to dynamical systems, rigorous statistical physics and inverse problems or spectral theory, which could resonate with his/her research project and help attract students for internships or PhDs. He/she could also be a driving force behind the organization of thematic schools (such as summer schools).
Research profile	The scientific project revolves around the theme of controlling systems of many independent units, i.e. a school of underwater drones. These systems can be seen as active particles, breaking the action-reaction principle of mechanics and profoundly changing the nature of statistical physics approaches. How can such a school of drones be "piloted", formed, moved and dissolved to carry out individual or collective tasks? How can we generate "collective intelligence" to optimize its movement to a given location? How can communication between units be optimized, and what is the optimal shape of the school of drones to harness hydrodynamic "forces"? What happens if the flow becomes turbulent? The project

aims to formalize and find answers to these questions, using the tools of statistical physics, non-linear physics and control theory.

TEACHING

Faculty : Faculty of science and technology

Workplace : La Garde campus

Teaching staff : Mathematics Department

Name of faculty director : Christian Turquat

Faculty director contact details : directeur-fst@univ-tln.fr

Faculty URL : https://www.univ-tln.fr/-UFR-Sciences-et-Techniques-.html

Teaching profile:
The candidate will be based in the Faculty of Science and Technology at the University of Toulon, where he/she will teach pure and applied mathematics from bachelor's to master's level. Previous experience of teaching mathematics at various levels is desirable, and increasing integration within the mathematics department is expected. In particular, he/she will be able to propose new courses for the next habilitation (2029), previously tested either as optional courses or in the international universities he/she will have visited or in which he/she will have gained different experience, with the particular aim of setting up international agreements. He/she will be keen to develop teaching at Master's level related to dynamical systems, statistical physics, inverse problems or spectral theory. Its Masters courses should be linked to its research project and attract students for work placements or theses.

He/she could also be a driving force behind the organization of thematic schools (such as summer schools).
The candidate is therefore expected to propose a teaching and integration project within the Faculty of Science and Technology at the University of Toulon.

As far as language is concerned, fluency in French is essential for teaching, and fluency in English at a teaching level is expected.

RESEARCH

Laboratory name : Centre de Physique Théorique

Place : La Garde campus

Name of laboratory director : Alain Barrat

Laboratory director contact details : Tel : +33.4.91.26.95.40 E-mail : alain.barrat@cpt.univ-mrs.fr

Laboratory URL : https://www.cpt.univ-mrs.fr/

Description of the laboratory:
Theoretical Physics Centre is a joint research unit with three supervisory bodies, the University of Toulon, the CNRS and Aix-Marseille University. It is located on two sites, one on the Luminy campus in Marseille and the other on the Campus de la Garde in Toulon.

The laboratory is made up of researchers and teacher-researchers in theoretical physics and mathematics. It is made up of 8 research teams, with themes ranging from theoretical physics to physics-mathematics and mathematics. The CPT is a place for fruitful interdisciplinary exchanges and collaborations, particularly between mathematicians and theoretical physicists.
The teams are grouped into three main thematic clusters : fundamental interactions, statistical physics and condensed matter, and classical and quantum dynamical systems. The teams concerned by this recruitment are the statistical physics and complex systems team, the non-linear dynamics team and the quantum dynamics and spectral analysis team.

Research profile:
The candidate will develop a scientific project around the theme of controlling systems of many independent units, such as a school of underwater drones. These systems can be seen as active particles, which breaks the action-reaction principle of mechanics and profoundly changes the nature of statistical physics approaches. Numerous theoretical and practical questions arise, such as: how to “pilot” such a school of drones, its formation, displacement and dissolution for individual or collective tasks? How can we generate “collective intelligence” to optimize its movement to a given location? How can communication between units be optimized, and what is the optimal shape of the school of drones to harness hydrodynamic “forces”? What happens if the flow becomes turbulent?
The project developed will propose a research strategy and formalize fundamental approaches to these issues, working within one of the above-mentioned laboratory teams and using tools from statistical physics, non-linear physics and partial differential equations, and control theory.
As this is a multi-disciplinary project, the candidate will need to consider how he/she can make the most of the environment of the host laboratory and laboratories linked to the University of Toulon, as well as that of the Marseilles basin, and more generally think about the type of national or international collaborations he/she can envisage setting up. As the host laboratory develops fundamental theoretical research coupled with modeling and numerical simulation, notions of high-performance computing could be a plus, particularly for simulating 3D hydrodynamic flows with a view to targeted applications in the marine environment.

DESCRIPTION OF ADDITIONAL ACTIVITIES

- The development of the project will require the recruited person to invest in doctoral and post-doctoral supervision and supervision of Master's courses in mathematics and applications.
- It is also recommended that, during the course of this Chair, applications for project funding will be submitted (ANR, Région, etc.).
- The person recruited is expected to play an active role in the UFR's internationalisation strategy for its training courses.
- The person recruited will also be involved in scientific dissemination, at several levels, both to the general public and to specialists.
- As the theme of this Chair is one of the university's strategic priorities, the person recruited will be required to take account of the local context: activities of the university's other laboratories in the maritime field, meetings with local socio-economic players and, where appropriate, integration into the University of Toulon's institutes that have been set up or are in the process of being set up and whose activities will be related to the theme of this Chair.

OTHER INFORMATION

- The chair will run for four years.
- It benefits from specific funding (in addition to the laboratory's recurrent resources): 2 years of postdoc, 1 thesis (3 years), and €40k of operating costs for the duration of the chair.
- The volume of annual teaching hours envisaged during the contract is as follows:
    - 1st year: 64 hours of supervised work equivalent (HeTD)
    - 2nd year: 64 HeTD
    - 3rd year: 96 HeTD

- 4th year: 128 HeTD

WORK ENVIRONMENT

- Workplace: La Garde campus
- An office on the La Garde campus will be made available, as well as access to the digital environments and other facilities of the CPT laboratory and the University of Toulon.
- Health and safety: work on screen more than 4 hours/day

SKILLS REQUIRED

Specific skills required :

- Willingness to get involved in teaching teams and to monitor students to help them prepare for their professional future.
- Ability to lead collective projects at the level of the laboratory, the Science and Technology Department and/or the institution, and in particular to develop international partnerships at both teaching and research level and in setting up and managing contracts.

Desired skills :

- Teaching experience in the required speciality (mathematics)
- As part of the school's strategy, international experience and the ability to teach in English would be highly appreciated.
- Ability to communicate and work with theoretical physicists, willingness to collaborate with applied scientists and the private industrial sector
- Ability and willingness to work on multidisciplinary projects

PERSON TO CONTACT FOR FURTHER INFORMATION ABOUT THE POSITION

Laurent Raymond, Deputy Director (AMU) of the Centre for Theoretical Physics, University Professor:
laurent.raymond@univ-amu.fr, +33 (0)670 540 526