

Position Description

Group of research topics: Fluid mechanics, Transport processes, Chaotic Mixing

Position is funded by	<ul style="list-style-type: none"> - COFUND, Marie Skłodowska-Curie Actions (MSCA), Horizon 2020, European Union - National Centre for Scientific Research (CNRS) - RMIT University (RMIT), Australia
Research Host	National Centre for Scientific Research (CNRS)
PhD awarding institution/s:	Université Rennes 1, France and RMIT University, Australia
Locations	<ul style="list-style-type: none"> - Primary: Rennes, France - Secondary: Melbourne, Australia - Annual workshops in Barcelona, Spain
Contract	Full time, fixed term (48 months)
Gross annual salary	21292,56 EUR (gross amount before employee's taxes and contributions)
Preferred start date	05/09/2022
Deadline for applications	30/04/2022 (Reference CNRS-DC1)

Your choice of research topics (only one of these projects will be funded):

Project 1: Mixing through porous-turbulent interfaces	Project 2: Chaotic mixing in porous structures	Project 3: Chaotic mixing at the Darcy scale
<p>Mixing by fluid flows over porous interfaces is frequent in nature and industry (riverbeds, canopy, fractures, porous membranes) and sets key processes, such as nutrient delivery or heat uptake. The general laws governing mixing in these rapidly changing environments are still poorly constrained. The PhD thesis will explore experimentally, numerically and theoretically turbulent-porous interfaces to uncover the physics governing fluid mixing in this context. <i>Further information may be obtained from the Supervisors.</i></p>	<p>Recent observations have shown that fluid flows through porous matter spontaneously generate chaotic advection, e.g., the exponential divergence of nearby fluid trajectories. The PhD thesis will uncover the key role of the porous architecture to produce these trajectories via numerical simulations. <i>Further information may be obtained from the Supervisors.</i></p>	<p>Recent observations have shown that fluid flows through porous matter spontaneously generate chaotic advection at pore scale, e.g., the exponential divergence of nearby fluid trajectories. Still, it is unknown if these dynamics also dominate at larger scales, such as the Darcy scale. The PhD thesis will uncover, through numerical simulations, the key role of large-scale heterogeneities in producing stretching-enhanced mixing. <i>Further information may be obtained from the Supervisors.</i></p>
Supervisors: Dr. Joris Heyman (CNRS) and Daniel Lester (RMIT)		
Research Fields: Environment and environmental science, Mathematics, statistics and analytics		

REDI

The REDI (RMIT European Doctoral Innovators) program is a unique opportunity offering excellent PhD conditions including enviable international experience, top-class research discipline and transversal skills training as well as networking with-academic and industry leaders across 60+ supporting partners and 12 countries.

As a REDI researcher you will be:

- enrolled by two entities, with the chance to be awarded dual doctorates and gain alumni status from multiple institutions, including the Marie Curie Alumni Association.
- seeing the world and spending a year at RMIT University in Melbourne, Australia (ranked in the top 20 of universities under 50 years old in the world).
- part of a rich multidisciplinary network of researchers and supervisors who come together in annual, week-long training events in Barcelona.
- working closely with industry and gaining experience with the 40+ leading companies supporting the program.
- earning a salary above national standards for doctoral positions with full social security benefits (with further support available for eligible researchers with additional needs).
- receiving support and guidance from two highest-calibre, experienced supervisors with high PhD completion rates.
- enhancing your career prospects through comprehensive technical and transversal skills training from leading institutions, intersectoral and international experience and mentoring.
- working on innovative and exciting projects of high commercial and societal value with up to four years to complete your research.

For more information visit: rediprogram.eu

Are you REDI? (Expected Profile)

Project 1

Your background and skills: The candidate should have an undergraduate in physics, engineering or environmental sciences. He should demonstrate a solid knowledge in fluid mechanics. Knowledge of scientific programming is mandatory. Experimental skills are welcome. The candidate should be fluent in English (oral and written)

Your work experience: Professional experience is not required.

Your research experience: Yes, an internship of 3 month minimum in a research lab (with a written report).

Project 2

Your background and skills: The candidate should have an undergraduate in physics, engineering or environmental sciences. He should demonstrate a solid knowledge in fluid mechanics. Knowledge of numerical computing methods is mandatory. The candidate should be fluent in English (oral and written).

Your work experience: Professional experience is not required.

Your research experience: Yes, an internship of 3 month minimum in a research lab (with a written report).

Project 3

Your background and skills: The candidate should have an undergraduate in physics, engineering or environmental sciences. He should demonstrate a solid knowledge in fluid mechanics. Knowledge of numerical computing methods is mandatory. The candidate should be fluent in English (oral and written)



Your work experience: Professional experience is not required.

Your research experience: Yes, an internship of 3 month minimum in a research lab (with a written report).

Employment Benefits and Conditions

CNRS offers a 36-months full-time work contract (extendable up to 48 months in duly justified cases), indicatively starting on 05/09/2022. The position will be based in Rennes - Bretagne (France). International travel is foreseen, including to Australia (up to 12 months) and Spain (one week per year). At CNRS, there is a probation period of 3 months and there are 35 working hours per week.

The remuneration, in line with the European Commission rules for Marie Skłodowska-Curie grant holders, will consist of a gross annual salary of 21292,56 EUR gross per year (gross amount before employee's taxes and contributions). Of this amount, the estimated net salary* to be perceived by the Researcher is 1785 euros net. However, the definite amount to be received by the Researcher is subject to national tax legislation. For more information on the estimated net monthly salary, please use the net salary calculator.

**Net salaries can fluctuate in accordance with an individual's personal circumstances (marital status, age, disability, family and dependents, etc. The above indicative net salaries offer an approximation of what a single person in their early 20s could expect to receive in their bank account after taxes.*

Benefits include:

- 1,000€ yearly travel allowance to cover flights and accommodation to participate in the annual workshop at RMIT Europe in Barcelona (Spain)
- 10,000€ allowance to cover flights and living expenses for up to 12 months in Australia
- 5 weeks paid holiday leave per year
- Sick and parental leave covered by public health insurance

For more details, please see: <https://cmi.univ-rennes.fr/en/international-student>

REDI to apply? First a little more about us...

CNRS

Centre National de la Recherche Scientifique is a government-funded research organisation under the responsibility of the French Ministry of research. With 33000 persons, 1144 research units spread throughout the country, CNRS carries out research in all scientific fields of knowledge and conducts interdisciplinary programmes, one major objective being to improve knowledge, promote interdisciplinarity, ensure economic and technological development or solve complex societal needs. CNRS is the French largest research organization, and the largest European one in terms of publications. CNRS has been awarded in 2017 [HR Excellence in Research](#) (HRS4R).

For more information visit: <https://www.cnrs.fr/>

The research laboratory, Géosciences Rennes (UMR 6118), gathers about 150 persons, among which 50 permanent researchers, 20 engineer and technicians and around 80 non-permanent staff (Ph.D. students and post-doc). It is located in the campus of University Rennes 1 (Beaulieu), in a green and open environment beside the city center. Research cover a large range of topics linked to earth sciences, including environmental fluid mechanics, hydrology, hydrogeology, geomorphology, geochemistry, tectonics...

For more information, visit : <https://geosciences.univ-rennes1.fr/en>

UNIVERSITE RENNES 1

Université de Rennes 1 is the degree awarding university. Université de Rennes 1 (UR1) is internationally acknowledged as one of the top scientific universities in France. Research at UR1 is organized along four major domains, corresponding to four graduate schools: Mathematics & ICT, Life Sciences, Materials Science, and Humanities & Social Sciences. Université Rennes 1 is linked to the beneficiary by delivering the doctoral degrees. UR1 is currently involved in more than 30 H2020 projects, has been involved in 43 FP7 projects, and in numerous other European initiatives such as the EIT Digital and Erasmus Mundus Master Courses. UR1 therefore has extensive experience in project management with support for IPR and finance.

UR1 takes part in the EDUC project, joint initiative of the University of Potsdam (Germany), Université de Rennes 1, Université Paris-Nanterre (France), Masaryk University (Czech Republic), University of Cagliari (Italy), University of Pécs (Hungary), which was selected by the European Commission in 2019, to be one of the first European Universities. It has obtained the HR excellence in Research label (HRS4R), in July 2020, acknowledging its contribution to the construction of the European Research Area, as well as the quality of its HR policy towards researchers.

For more information, visit: <https://international.univ-rennes1.fr/en/joint-phd-degree>

The doctoral school EGAAL offers to their Doctoral Students a wide range of training, mentoring and support activities, including:

- **Mentoring program:** The mentoring program includes frequent meeting and advising.
- **Courses and training opportunities:** Individual training program.
- **Language courses:** Yes, free language courses at the Rennes University.
- **Relocation support:** Yes, See the link below.
- **Cultural and social activities:** Yes, via Géoccontact, association of Ph.D. students of Géosciences Rennes.
- **Engagement with industry:** The candidate will be working closely with ITASCA. Non-academic partner engagement benefits per project: Exchange between solid matrix and fracture networks, Computation of fluid flow through fracture networks, Computation of fluid flow through planar fractures.

For more information, visit: https://ed-egaal.doctorat-bretagne.fr/en/5_ formations
https://ed-egaal.doctorat-bretagne.fr/en/5_ international-phd-students

RMIT

RMIT is a global university of technology, design and enterprise, ranked in the top 20 of universities under 50 years old in the world. World-class people, leading edge resources, collaboration with industry partners and multi-disciplinary approaches are just a few of the trademarks of research at RMIT, which boasts almost 90,000 students and campuses in Australia, Vietnam, a centre in Barcelona, Spain and research and industry partners on every continent.

As a Doctoral Student at RMIT you will be able to benefit from a wide range of training and mentoring opportunities including:

- **The PhD Up** program offering a huge range of workshops, seminars and short courses to build research knowledge and skills, including research writing, publishing, research methods, ethics, project management and careers (see more at: <https://www.rmit.edu.au/students/student-essentials/information-for/research-candidates/enriching-your-candidature/phd-up-program>)
- **RMIT PhD Online Modules**, designed specifically for PhD students, including *Researching your literature review*, *Writing a research proposal*, *Choosing where to publish*, *Writing for Publication*, *Research Integrity*, etc.
- **RMIT Creds**, RMIT's Digital Credentials Platform, which includes over 80 credentials covering a wide range of topics such as *Understanding Responsible Research and Innovation*, *Academic Integrity Awareness*,

Emotional Intelligence, Diversity Matters, Agile Ways of Working, Why Gender Matters, Cross Cultural Communications, etc. (see more at: <https://www.rmit.edu.au/study-with-us/levels-of-study/short-courses>);

- **The e-Grad School**, the online learning modules of the Australian Technology Network (ATN) of Universities' covering a multitude of transferrable skills such as *Critical and Creative Thinking, Leadership and Communication, Entrepreneurship, Research Commercialisation, Public Policy, etc.*
- **The RMIT Mentoring platform** also gives you access to mentoring from trained professionals and experts, including:
 - o *Career Mentoring* - career guidance from industry professionals from all disciplines and global locations.
 - o *Women@RMIT Mentoring* - career guidance from industry professionals who are committed to gender diversity and equality in the workplace (especially for female students in male dominated industries)
 - o *Pride Mentoring* - a chance for students who identify as LGBTIQ+ to receive professional and social guidance from industry professionals who also identify as LGBTIQ+ or are familiar with the additional challenges these groups face in the workforce.

Find out more: rmit.edu.au

A little more about you...

Eligibility

You need to fulfil criteria of the REDI program and both universities to be recruited.

To apply for REDI, you must comply with the MSCA-COFUND eligibility criteria by the application deadline:

- **Be in the first four years Full-Time Equivalent (FTE) research experience** of your research career and not yet have been awarded a doctoral degree. FTE Research Experience is measured from the date when a researcher obtained the degree entitling him/her to embark on a doctorate, **AND**
- **Not have resided or carried out your main activity (work, studies, etc.)** in the country of your research host for more than 12 months in the 3 years immediately before this call's deadline. Time spent as part of a procedure for obtaining refugee status under the Geneva Convention (1951 Refugee Convention and 1967 Protocol), compulsory national service and/or short stays such as holidays is not taken into account.

AND the following criteria:

- **Hold a bachelor's degree requiring at least 4 years of full-time study** in a relevant discipline awarded with honours and including a research component; **OR**
- **Hold a master's degree that includes a research component** or a master's degree without a research component with at least a high distinction average; **OR**
- **Have evidence of appropriate academic qualifications and/or professional experience** demonstrating that the applicant has developed knowledge of the field of study or cognate field and the potential for research sufficient to undertake the chosen project.

AND

- **Have English level C1 language proficiency.**



In addition to the above, if your application is successful, you will be required to:

- Apply for a working visa in France (More information): <https://cmi.univ-rennes.fr/en/international-student>
<https://france-visas.gouv.fr/en/web/france-visas/welcome-page>
- Apply for a student visa in Australia (More information: <https://www.rmit.edu.au/study-with-us/international-students/apply-to-rmit-international-students/student-visas/apply-for-a-visa>)

In addition to meeting the eligibility criteria for the REDI Program, you will also need to meet the admission criteria of all the institutions:

Admission at CNRS (Host Partner)

You will be enrolled as Doctoral Student at CNRS for the entire duration of the assignment. At admission, you will need to supply:

- Student visa
- Master's degree or equivalent
- Academic records of Master's (year 1 & 2), academic records of Bachelor's, Master thesis record and jury.
- English language level C1, no certificates of language proficiency required.
- Motivation letter

More information: https://ed-egaal.doctorat-bretagne.fr/en/5_pursuing-doctorate-degree

Admission at UNIVERSITY OF RENNES1 (Degree Awarding University)

You will be enrolled as Doctoral Student at CNRS for the entire duration of the assignment. At admission, you will need to supply:

- Application form composed of the thesis description, a motivation letter
- Master diploma
- Photo ID
- Course transcript of Master 1 and 2 – if not, a letter from the training director
- A CV

More information: <https://international.univ-rennes1.fr/en>

Admission at RMIT

You will also be enrolled as Doctoral Student at RMIT for the entire duration of the assignment. At admission, you will need to supply:

- CV
- Complete transcripts for all academic qualifications
- Research proposal or statement of interest in an available research project
- Language certificates
- List of referees

More information: <https://www.rmit.edu.au/research/research-degrees/how-to-apply>

Apply now (<https://www.rediprogram.eu/>)