PostDoc Offer - 1Year

Laboratoire des Fluides Complexes et leurs Réservoirs (LFCR)
Université de Pau et des Pays de l'Adour (UPPA)
1 Allée du Parc Montaury - 64600 Anglet – France

PostDoc SUBJECT

Non-equilibrium fluctuations upon convective dissolution of CO2 in Brine: microgravity experiments

ABSTRACT:
This PostDoc position is a part of the HUB project NewPores, an international hub project dedicated to the mechanics and physics of porous materials. This is a joint effort of the group on Geomechanics and Porous Materials (G2MP) of the LFCR at E2S UPPA and of the Centre for Sustainable Engineering of Geological and Infrastructure Materials (SEGIM) at Northwestern University. This hub project involves 12 (French-US) permanent researchers, 22 PhD students and 18 post-doctoral associates.
The goal of the present PostDoc position is to contribute to the enhancement of CO2 storage in deep brine aquifers. For this aim, the PostDoc will experimentally investigate the impact of non-equilibrium fluctuations on the triggering of convection of a layer of supercritical CO2 over a layer of brine (salted water). In this context, density fluctuations will be analysed by dynamic shadowgraphy while the layering will be achieved by means of a Flowing-Junction cell designed in our laboratory. Specifically, we envision to study the behaviour of non-equilibrium fluctuations in reduced gravity conditions, i.e. in the absence of the convective instability, in order to understand the origin of convection phenomena. A parabolic flight is scheduled for this purpose in 2020.

Keywords : convective dissolution, porous media, non-equilibrium thermodynamics, CO2 storage, microgravity experiments,

WORKING CONDITIONS

Hosting laboratory :	**Laboratoire des Fluides Complexes et leurs Réservoirs**
Site web :	**https://lfc.univ-pau.fr/fr/index.html**
Supervisor :	**Pr. Fabrizio Croccolo**
Place:	**LFCR - Anglet (FR)**
Provisional starting date:	**01 October 2019**
Duration :	**1 year**
Employer :	**Université de Pau et des Pays de l'Adour (UPPA)**
Monthly salary before taxes:	**2700 €**

HOST LABORATORY PROFILE

LFCR: From the nanometer to hundreds of kilometers, from the nanosecond to a million years, from the physics and chemistry of interfaces, through the thermodynamics of fluids under flow, to reservoir geology, geo-mechanics and geophysics, status as an "industrial" UMR (Joint Research Unit), supervised by TOTAL, the CNRS and the UPPA, the LFCR is an innovative and remarkable research unit in more than one way. Its specific focus, essentially based on the study of fossil geo-resources, and totally in phase with the local socio-economical context, sets it apart regarding applications and enables it to host internationally-recognized teams.

MISSION - ACTIVITÉS PRINCIPALES / MISSION – PRINCIPAL ACTIVITIES

I. *Scientific Context*

Thermophysical variables (density, composition temperature, pressure,...) fluctuate continuously in space and time. Fluctuations at equilibrium are essentially a white noise, but, in non-equilibrium (NE) conditions, the fluctuations of larger size are strongly enhanced and long range. When two fluids are superposed with the denser one on top of the lighter one, Taylor instability can occur. The latter is actually triggered by non-equilibrium fluctuations as most of convective phenomena. This is the case of supercritical CO2 layered on top of salted water as a consequence of injection of the former in a deep aquifer. In our laboratory, we aim to understand the impact of thermodynamic conditions on the convective dissolution of carbon-dioxide in the brine, such as how the pressure, the temperature, and other parameters may impact the convective dissolution of CO2 in a saline solution.

This subject is a part of the research goals of the CO2ES Industrial Chair project focused on the investigation of enhanced CO2 storage as a climate-change mitigation measure.

II. *Objectives*

In our laboratory in Anglet, we will design different experimental activities in order to prepare one or more measurement campaigns on a parabolic flight to investigate how non-equilibrium fluctuations behave in the absence of gravity, so without the presence of the convective instability, in order to get more information about the triggering process of convection. This can lead to a deeper understanding of how to enhance the CO2 dissolution in deep aquifers.

III. *Work plan*

This experimental project will include the design and build-up of a challenging research experiment in order to test the behaviour of non-equilibrium fluctuations in reduced gravity conditions. The main tasks will be setting-up of the Flowing-Junction cell and the optical apparatus in collaboration with a PhD student, finalising the flight hardware and performing ground based and flight experiments.

IV. *References*

- D. Brogioli, F. Croccolo, and A. Vailati, Cylindrical flowing-junction cell for investigating miscible fluids, submitted.
- F. Croccolo, J.M. Ortiz de Zárate and J.V. Sengers, Eur. Phys. J. E 39, 125 (2016)
- A. Vailati and M.Giglio, Nature 390, 262 (1997)

REQUIRED COMPETENCES

The candidate must hold a PhD or equivalent degree in physics or closely related subject with preferential background in fluid mechanics, experimental physics and laboratory software skills. Good communication in English and good writing skills are required.

CRITERIA USED TO SELECT CANDIDATE

Selection process steps:
- Establishment of the selection committee
- Evaluation of the applicants CV's
- Interview with the selected candidates and ranking

Criteria used in the selection of the candidate:
- The candidate's motivation, scientific maturity and curiosity
- Candidate knowledge in physics and experimental thermodynamics
- Subject of previous PhD or PostDoc research activities
- English level

REQUIRED DOCUMENTS

Send an e-mail with your candidature containing:
- CV
- Motivation letter
- Recommendation letters if available

closing date:	**15/09/2019**

CONTACTS

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