PhD position (4 years): Understanding and predicting nonlinear flows in confined disordered media

Job Description

We invite applications for a PhD in the University of Barcelona (Physics) jointly with the Institute of Environmental Assessment and Water Research (IDAEA-CSIC). We seek a highly-talented, motivated, and open-minded candidate, for a coordinated project (PID2025; Spanish Research Agency) between IDAEA-CSIC, UB-Physics, and Universidad Politécnica de Madrid, with collaborators in France, UK, Japan, and the USA.

The project aims to understand and quantify the impact of nonlinearity on flow and transport in confined porous media. We put particular emphasis on three sources of nonlinearity: non-Newtonian rheology, large driving rates leading to dynamic capillary pressure and hysteresis in multiphase flow, and the complex phase behavior of multicomponent mixtures described by realistic equations of state. Achieving this goal requires an integrated approach, from fundamental theory, laboratory experiments, and detailed numerical simulations, to mesoscale pore network modeling and upscaling to continuum-scale theories that can be applied in application-relevant geometries and conditions.

You will receive extensive training in (i) theoretical knowledge of interfacial instabilities, capillary phenomena, scaling theories, hydrodynamic flow in disordered media; (ii) image and data acquisition in experimental fluid mechanics, and the use of specialized software such as MatLab and LabView for image / data analysis and instrument control; and (iii) computational simulations and modeling. You will also gain professional skills such as time and data management, oral communication, and scientific writing. Short training stays at the Laboratoire de Physique of the ENS-Lyon (France) and Nottingham-Trent University will provide you with additional expertise. Additionally, you will be enrolled in the UBICS (University of Barcelona Institute of Complex Systems) and participate regularly in its various training and research activities, as well as the weekly seminars in IDAEA-CSIC.

Qualifications and selection criteria

- **Required**: Degree in physics, geosciences, civil or mechanical engineering; Strong interpersonal skills, interest in teamwork and collaborations; Good level of English;
- **Preferred**: Background and/or experience in experiments and modeling transport processes of complex flows of normal/complex fluids, ideally in porous media; scientific programming (Python, Matlab, etc).

Conditions

- Enrolment in "Advanced Physics" PhD program in UB
- Full-time contract for 4 years (Standard FPI predoc salary, estimated ~€25,500/yr)
- Start date: Fall 2026

How to apply

If you meet the qualification criteria, please send an email to both Prof. Jordi Ortin (jordi.ortin@fmc.ub.edu) and Dr. Ran Holtzman (ran.holtzman@csic.es) titled "NonLinFlow_PhD", which includes the following documents: (1) CV; (2) motivation letter; (3) complete course grades and transcripts (informal scans ok); (4) contact information of two references (no references yet); (5) links/copies of your MSc thesis and/or publications.