PHD POSITION

Dynamics and statistics of elongated and flexible particles in turbulent flow

Doctoral School Fundamental and Applied Sciences

Expected profile

- Master of Science or equivalent in applied mathematics, physics or mechanical engineering with competences in fluid dynamics or statistical physics
- Good experience in programming (C, C++) and in data post-processing and analysis
- Excellent writing skills, fluent in English
- Rigorous, autonomous, creative and motivated by working at the edge between basic research and industrial applications

Working conditions

The PhD student will be supervised by:

- **Jérémie Bec** (CNRS research director), specialist in turbulent transport
- **Mireille Bossy** (Inria research director), specialist in stochastic modelling
- **Jean-Pierre Minier** (EDF R&D research engineer), specialist in models for biphasic turbulent flows

The research work will be carried out in Laboratoire J.-L. Lagrange at the Observatoire de la Côte d'Azur in Nice. The PhD is co-funded by the excellence initiative (IDEX) of Université Côte d'Azur and EDF. It will be the subject of a three-year doctoral contract with a net salary about 1800 €/month (including illness, maternity and unemployment insurances). The PhD is expected to start by Fall 2017.

Contact and application procedure

Further information can be obtained by contacting J. Bec (jeremie.bec@oca.eu).

Applicants are required to send a cover letter, a CV, transcripts of their Master grades, and at least one recommendation letter before June 8th to the above address.

Numerous industrial situations, ranging from power plants to food processing involve interactions between a fluid flow, boundaries and small particles. Such finite-size inclusions can interact together, form aggregates that possibly break up, lay down on filters or solid boundaries to eventually damp down the fluid flow. The resulting fouling is of notable importance to energy industry. All filtration processes, and especially those involved in cooling systems for thermal or nuclear power plants, require limiting the passage of particles (materials or biological organisms) by capturing them onto filters. Conversely, the deposition of particles onto surfaces can also impair functioning: for example, accumulation of particles on the walls of heat exchangers can lessen thermal transfer and thus significantly reduce the efficiency of power stations.

The aim of this PhD thesis is to contribute to the development of efficient models for the transport, dispersion and deposition of non-spherical flexible particles in turbulent flows. Despite recent theoretical and numerical advances, there remain very strong stakes linked to a good representation of the dynamics of complex objects in turbulent flow. It is intended to address the case of elongated flexible particles such as fibers, polymers and certain types of algae, generally present in water collection points. Only few facts are known on how the particle deformation and global shape, its long-term dynamics, its feedback on the flow and its interactions with other inclusions or with a solid boundary depend upon the fiber mechanical properties, the fluid viscosity and the level of turbulent excitation. Such questions will be tackled by combining analytical approaches from fluid dynamics and statistical physics and massive fine-scale numerical simulations of turbulent flows. The doctoral student will participate to the development of state-of-the-art numerical tools and perform simulations on local servers and national and European computing centers.

This PhD thesis is a part of a strongly transdisciplinary project (mathematics, physics, high-performance computing applied to engineering) at the edge between fundamental and applied research. The doctoral student will benefit much from this environment and will be able to diversify its expertise through strong scientific interactions with the various members of the team. This thesis work is timely, relevant and will lead to publications in international journals of the highest level.