IC2020_12_SP-CFDMS_BCAM SEVERO OCHOA JOINT POSTDOCTORAL PROGRAM

Company Description

BCAM is the Research Center on applied mathematics created with the support of the Basque Government and the University of the Basque Country, which aims to strengthen the Basque science and technology system, by performing interdisciplinary research in the frontiers of mathematics, talented scientists' training and attraction, so the excellence of our results are recognized by the Society.

Information

Deadline: 2021-01-21
Category: Business
Province: Bizkaia
Country: Basque Country
City: Bilbao

Company

BCAM

Main functions, requisites & benefits

Main functions

Postdoctoral Fellowship in SP & CFDMS. In the framework of the BCAM Severo Ochoa Joint Postdoctoral Fellowship Program, the research lines: Statistical Physics CFD Modelling and Simulation Position in the following topic: Investigation of Anomalous Diffusion in Hydrodynamics Via the Smoothed Dissipative Particle Dynamics Method: This PostDoc project is devoted to study anomalous diffusion within the hydrodynamics framework by using the Smoothed Dissipative Particle Dynamics method (SDPD). The selected candidate will work on the extension of SDPD to complex hydrodynamic/diffusive transport problems [1,2]. The goal of this project is the understanding of the causes for the emergence of anomalous diffusion in hydrodynamical systems and its main characteristics. Anomalous diffusion is a diffusive process characterized a by non-Gaussian distribution of particles andor a nonlinear growth in time of the particle displacement variance [3]. The main features are nonlocality in space and memory in time. Modelling approaches for anomalous diffusion are traditionally restricted to the continuous-time random walk – for jump processes - and to over-dumped stochastic differential equations – for continuous processes. The random walks are formulated through ad hoc features with infinite variance and the Langevin-type stochastic differential equations are sometimes equipped with a colored noise or with a random diffusion coefficient, namely the "diffusive diffusivity" model [4]. Although these approaches can reproduce several features of anomalouscomplex diffusion, they are limited to non- hydrodynamic regimes being particle mass, momentum and energy not conserved quantities. The SDPD is a novel stochastic particle method based on pairwise interactions. As a result, total mass and momentum are exactly conserved. Moreover, the method can be formulated within the so-called GENERIC approach [2], enabling the conservation of the total energy as well as a strictly positive entropy increasing. Stochastic pairwise forces acting between particles are modelled as generalized tensor Wiener processes which satisfy exactly the fluctuation- dissipation theorem that makes this approach suitable to simulate fluctuating hydrodynamic regimes in a thermodynamically-consistent way. First, the suitability in SDPD of existing literature approaches developed for generating anomalous diffusion from single particle Langevin equation will be studied with respect to the displaying anomalous scaling, nonlocal and memory effects, as well as with respect to the preservation of thermodynamics consistency. To the best of our knowledge, there is only one paper in literature where a memory kernel has been used to model non-Markovian inter-particle interactions [5], whereas no "diffusive diffusivity" models have been considered so far. Later, novel approaches within the thermodynamics constraints will be investigated with the aim to provide mathematical and physical insights into unsolved issues in complex fluid dynamics.

Requisites

Applicants must have their PhD completed before the contract starts. PhD degree related to the subject of the offer.