Postdoc position

Particle dynamics in quantum turbulence

Duration: 2 years, starting early 2019
Institution: Laboratoire J.L. Lagrange. Observatoire de la Côte d'Azur. Nice, France.
Funding provided by: ANR Jeune chercheur 2018
Contact: Giorgio Krstulovic (**https://www.oca.eu/fr/giorgio-krstulovic**)

Over the last decade, thanks to the development of new experimental techniques, particles have been successfully used in superfluids to enlighten the differences between classical and quantum turbulence. In general terms, superfluids form a particular category among compressible fluids, distinguished essentially by the absence of molecular viscosity at very low temperatures. Examples of superfluids are ^{3}He and ^{4}He, Bose-Einstein condensates (BEC) made of dilute alkaline gases and light in optical non-linear systems. The applications of superfluids range from cooling superconducting materials and infrared detectors, to pure fundamental research in cold atoms and turbulence. The most manifest quantum effect in superfluid turbulence is the presence of quantum vortices. When a superfluid is excited, a rich and complex turbulent regime appears. At meso-scales, classical Kolmogorov turbulence is developed, whereas at smaller scales, a myriad of different physical processes involving quantum vortices and sound are responsible for transferring energy.

This numerical and theoretical project aims at understanding the dynamics and statistics of particles in quantum turbulent flows, mainly focussing on the physical phenomena laying at the crossover between classical and quantum regimes. State-of-the-art numerical simulations of the Hall-Vinen-Bekharavich-Khalatinikov (HVBK) model will be performed to unveil the Lagrangian properties of quantum turbulence. In addition, the role of moving boundaries and objects in HVBK flows will be also addressed. HVBK simulations will be complemented with data form the Gross-Pitaevskii model obtained by members of the team. Such a study is crucial to complement current cutting-edge experiments carried in Europe and the United States.

The postdoctoral researcher will adapt a massively parallel hydrodynamic code already developed by the team to the HVBK model, run simulations in supercomputers and analyse data. Applicants should have a strong background in fluid mechanics and numerical methods. A good knowledge of statistical physics and quantum mechanics will be appreciated.

The postdoctoral researcher will join the Fluid and Plasma Turbulence group of Laboratoire J.L. Lagrange hosted by Observatoire de la Côte d'Azur (https://www.oca.eu/en/fluid-home). The group is composed of experts in classical and quantum turbulence, magnethodrodynamics, plasmas, particle transport, applied mathematics and computational fluid dynamics.

For further questions concerning the application process and/or the project, please contact Giorgio Krstulovic (krstulovic_at_oca.eu) before October 14th 2018.