LadHyX Seminar – November 8, 10:45

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The turbulent Faraday instability for miscible fluids - Numerical simulations and experiments

I will present the first results obtained during my post-doc started in January 2018, in partnership with CEA (Benoît-Joseph Gréa), at CMLA ENS Cachan, on the numerical simulations of the turbulent Faraday instability. This instability has been known for almost two centuries, but analytical developments are quite recent. When an interface between immiscible fluids is excited periodically and vertically, fascinating organized structures can appear.

In our case, we focus on miscible fluids, and we aim at predicting the final size of the turbulent mixing zone, while most of the previous research has focused on the onset of the instability. A prediction was recently derived and assessed numerically for a wide range of parameters. Using the super-computer COBALT of CEA, we wish to assess this prediction again, with a better resolution, and to capture the harmonic to sub-harmonic transition of the instability. I will briefly talk about the anisotropy and turbulent features of these two regimes. Then, we determine the mixing efficiency of the instability, which is quite challenging, using the concepts of sorted fields and background potential energy.

We have also spent four weeks doing experiments at GTT, where we were able to assess our predictions by analysing the instability in tanks much larger than common ones used in the literature. First comparisons to DNS will be presented as well, but this is of course still an ongoing work.

Finally, I will show you an original case where the forcing is horizontal, which creates a strong oscillating mean shear at the interface and allows very interesting and robust structures to develop. Mechanisms are somehow more complex than the vertical forcing, but we nevertheless proposed a new theoretical prediction which seems quite relevant.