Fundamentals of mixing: a unified framework for mixing dynamics

Marseille, January 17th to 21st 2022 — Aix-Marseille Univ. & CNRS

	Morning	Afternoon
J1	Travel	**Welcome** **1h30** Presentation of CoPerMix & workshop programs, PhDs introduce themselves & PhD projects, Practical information for PhDs. **History of mixing & motivation** **1h30** **E. Villermaux** Mixing across ages. The eternal quest of mixing.
J2	**Prerequisite on hydrodynamics & transfer** **3h00** **M. Dentz** Brownian motion, random walk, Fick's law, Diffusion equation, Gaussian & Erf solutions, Advection-diffusion, Péclet number, Elementary fluid mechanics (Navier-Stokes, Reynolds number, Stokes reversibility, basic concepts of turbulence).	**Applications of mixing 1** **1h00** **E. Santanach Carreras — Total** **Applications of mixing 2** **1h00** **To be updated** **To be updated** **1h00** **J-L. Thiffeault — Univ. Wisconsin**
J3	**Lamellar approach** **3h00** **E. Villermaux** Diffusion on a moving substrate, Ranz's transform, Mixing time, Batchelor scale, concentration field & concentration distribution, Case of a simple shear, of a log-normal stretching, Limits of Ranz's transform, Taylor-Aris dispersion.	Trip to Marseille island Frioul
J4	**Stirring protocols** **3h00** **T. Le Borgne** Some stirring protocols, Dispersion, Chaotic flows, KAM tori, Lyapounov exponent, Statistics of stretching, origin, noise & drift, Coalescence, phenomenology & modeling.	**Experimental techniques** **3h00** **B. Metzger, H. Lhuissier** Practical: Perform a basic mixing experiment (imaging, fluorescence, PIV, concentration field & distributions), Discuss experimental limits (spatial resolution, background noise, photobleaching), Compare different stretching protocols. Demo: Brownian motion & Taylor reversibility exp.
J5	**Numerical methods** **3h00** **J. Schumacher, P. Meunier** Principles of Direct Numerical Simulation, Diffusive Tracers Methods, Diffusive Strip Method, Technical aspects & computational times, Strengths & limits (low/high Péclet number, flow separatrix...)	Travel