Abstract Submitted
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Measuring turbulent fluid dispersion using laser induced phosphorescence[1] DENNIS VAN DER VOORT, NICO DAM, WILLEM VAN DE WATER, RUDIE KUNNEN, HERMAN CLERCX, GERTJAN VAN HEIJST, Eindhoven Univ of Tech — Fluid dispersion due to turbulence is an important subject in both natural and engineering processes, from cloud formation to turbulent mixing and liquid spray combustion. The combination of small scales and often high velocities results in few experimental techniques that can follow the course of events. We introduce a novel technique, which measures the dispersion of "tagged" fluid particles by means of laser-induced phosphorescence, using a solution containing a europium-based molecular complex with a relatively long phosphorescence half-life. This technique is used to measure transport processes in both the dispersion of droplets in homogeneous isotropic turbulence and the dispersion of fluid of near-nozzle spray breakup processes. By tagging a small amount of droplets/fluid via laser excitation, the tagged droplets can be tracked in a Lagrangian way. The absolute dispersion of the droplets can be measured in a variety of turbulent flows. Using this technique it is shows that droplets around $\mathrm{St} = \tau_p/\tau_\eta \approx 1$ (Stokes number) disperse faster than true fluid tracers in homogeneous isotropic turbulence, as well as differences between longitudinal and radial dispersion in turbulent sprays.

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