Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

How a scalar puff that is written in turbulence disperses: theory and experiment WILLEM VAN DE WATER, Physics Department Eindhoven University of Technology, ENRICO CALZAVARINI, Laboratoire de Mécanique de Lille CNRS/UMR 8107, Université Lille, MEHRNOOSH MIRZAEI, Institute for Molecules and Materials, Radboud University of Nijmegen, BRUNO ECKHARDT, Fachbereich Physik, Philipps-Universität Marburg, FEDERICO TOSCHI, Physics Department, Eindhoven University of Technology, NICO DAM, Mechanical Engineering Department, Eindhoven University of Technology — When a blob of passive scalar is released in turbulence, it will spread due to the combined action of turbulence and molecular diffusion. It is a still unresolved question whether molecular diffusion helps or suppresses the spreading of the blob. We write a scalar puff in a strongly turbulent flow of air using molecular tagging with two crossed UV laser beams. The puff is made by fusing N_2 and O_2 molecules to NO, which is then used as a tracer. The dispersion of the puff is followed using laser–induced fluorescence. When the blob is small (size $\approx 10\,\eta$), the evolution of its Gaussian parameters Γ satisfies a simple linearized equation driven by the gradients of the turbulent velocity field [1]. It was computed using the velocity field of a direct numerical simulation ($\mathrm{Re}_\lambda = 400$). At short times we find striking agreement between experiment and numerical simulation. A question is whether the strongly anomalous statistics of the gradients will endow the fluctuations of Γ with special properties. A preliminary conclusion is that this is not the case, with the fluctuations being close to log–normal. [1] H. Tennekes and J. L. Lumley, *A First Course in Turbulence*.

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Date submitted: 04 Aug 2013 Electronic form version 1.4