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The dispersion of patterns written in turbulent air MEHRNOOSH MIRZAEI, NICO DAM, HANS TERMEULEN, Institute of Molecules and Materials, Applied Molecular Physics, Radboud University, Nijmegen, the Netherlands, WILLEM VAN DE WATER, Physics Department, Eindhoven University of Technology, PO Box 513, 5600 MB Eindhoven, the Netherlands — We study the mixing of passive objects in turbulence by writing structures in turbulent air and following their deformation in time. The writing is done by fusing O₂ and N₂ molecules into NO in the focus of a strong ultraviolet laser beam. By crossing several of these laser beams, patterns that have both small and large scales can be painted. The patterns are visualized a while later by inducing fluorescence of the NO molecules with a second UV laser and registering the image. The width of the lines that make the pattern is approximately 50 μm, a few times the Kolmogorov length, the overall size of the patterns (≈ 4mm) is inside the inertial range of the used turbulent jet flow. Thus, we are able to study turbulent dispersion both at micro- and macroscales in a frame of reference that moves with the flow. In this way we have measured the spreading of clouds whose size is a few times the Kolmogorov length and the Batchelor dispersion of objects whose size is inside the inertial range. Patterns are compressible objects and spontaneously develop concentration fluctuations. We show for the first time the remarkable statistical properties of these fluctuations.

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