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Measurements of multi-scalar mixing in a turbulent coaxial jet[1]

ALAIS HEWES, LAURENT MYDLARSKI, McGill University — There are relatively few studies of turbulent multi-scalar mixing, despite the occurrence of this phenomenon in common processes (e.g. chemically reacting flows, oceanic mixing). In the present work, we simultaneously measure the evolution of two passive scalars (temperature and helium concentration) *and* velocity in a coaxial jet. Such a flow is particularly relevant, as coaxial jets are regularly employed in applications of turbulent non-premixed combustion, which relies on multi-scalar mixing. The coaxial jet used in the current experiment is based on the work of Cai *et al.* (*J. Fluid Mech.*, 2011), and consists of a vertically oriented central jet of helium and air, surrounded by an annular flow of (unheated) pure air, emanating into a slow co-flow of (pure) heated air. The simultaneous two-scalar and velocity measurements are made using a 3-wire hot-wire anemometry probe. The first two wires of this probe form an interference (or Way-Libby) probe, and measure velocity and concentration. The third wire, a hot-wire operating at a low overheat ratio, measures temperature. The 3-wire probe is used to obtain concurrent velocity, concentration, and temperature statistics to characterize the mixing process by way of single and multivariable/joint statistics.

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