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Mole fraction measurements in three species gas-phase turbulent flows CODY BROWNELL, U.S. Naval Academy, LESTER SU, Johns Hopkins University — Planar imaging techniques are applied to measure the mole fractions of all major species in a nonreacting, acetone-helium jet issuing into air. Planar laser-induced fluorescence is used to measure the mole fraction of acetone, and planar Rayleigh scattering is used to measure the difference between the acetone and helium concentrations. Due to their differing molecular transport properties, and in particular disparate values of molecular diffusivity, the acetone and helium evolve differently and display different downstream concentration fields. Mole fraction profiles show a large-scale similarity between the concentrations of the two jet gases. The acetone field, due to the significantly lower diffusivity of acetone with air, has more small scale structure than the helium field. Scalar spectra for each jet species are presented, as well as the spectrum of the scalar difference, which represents the differential diffusion. Preliminary results suggest an anti-correlation to the scalars, particularly on the outside of the jet. For mixing simulations, this implies that there may be limitations to simulations that assume diffusivity can be represented with a single variable.

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