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Simultaneous planar measurements of multiple mole fractions in a gas phase turbulent jet with differential diffusion C.J. BROWNELL, L.K. SU, Johns Hopkins Univ. — Previous work has demonstrated the usefulness of planar Rayleigh scattering to the study of gas-phase differential diffusion. These Rayleigh scattering measurements typically yield the differential diffusion parameter z, a measure of the normalized difference between two scalars. However, this method cannot provide information about all individual mole fractions in a three-species flow. In this work, we present results from a planar imaging experiment that combines Rayleigh scattering and PLIF to yield the instantaneous mole fractions of all relevant species in a differentially diffusing turbulent flow. In a premixed jet of acetone and helium with an air coflow, PLIF measures the absolute acetone mole fraction while Rayleigh scattering measures the differential diffusion parameter. From these measurements, the mole fractions of helium and air can then be calculated. With this data, we explore the relationship between differential diffusion and the mole fractions of individual species. We are also interested in the influence of differential diffusion on the large-scale organization of the jet, and the effects of Reynolds number on the observed mixing structures.

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