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Immiscible experiments on the Rayleigh-Taylor instability using simultaneous particle image velocimetry and planar laser induced fluorescence concentration measurements MATTHEW MOKLER, JEFFREY JACOBS, University of Arizona — Incompressible Rayleigh-Taylor instability experiments are presented in which two stratified liquids having Atwood number of 0.2 are accelerated in a vertical linear induction motor driven drop tower. A test sled having only vertical freedom of motion contains the experiment tank and visualization equipment. The sled is positioned at the top of the tower within the linear induction motors and accelerated downward causing the initially stable interface to be unstable and allowing the Rayleigh-Taylor instability to develop. Forced and unforced experiments are conducted using an immiscible liquid combination. Forced initial perturbations are produced by vertically oscillating the test sled prior to the start of acceleration. The interface is visualized using a 445nm laser light source that illuminates a fluorescent dye mixed in one of the fluids and aluminum oxide particles dispersed in both fluids. The laser beam is synchronously swept across the fluorescent fluid, at the frame rate of the camera, exposing a single plane of the interface. The resulting images are recorded using a monochromatic high speed video camera. Time dependent velocity and density fields are obtained from the recorded images allowing for 2D full field measurements of turbulent kinetic energy and turbulent mass transport.

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