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The Experimental Study of Rayleigh-Taylor Instability using a Linear Induction Motor Accelerator NICHOLAS YAMASHITA, JEFFREY JACOBS, University of Arizona — The experiments to be presented utilize an incompressible system of two stratified miscible liquids of different densities that are accelerated in order to produce the Rayleigh-Taylor instability. Three liquid combinations are used: isopropyl alcohol with water, a calcium nitrate solution or a lithium polytungstate solution, giving Atwood numbers of 0.11, 0.22 and 0.57, respectively. The acceleration required to drive the instability is produced by two high-speed linear induction motors mounted to an 8 m tall drop tower. The motors are mounted in parallel and have an effective acceleration length of 1.7 m and are each capable of producing 15 kN of thrust. The liquid system is contained within a square acrylic tank with inside dimensions 76 x76x184 mm. The tank is mounted to an aluminum plate, which is driven by the motors to create constant accelerations in the range of 1-20 g's, though the potential exists for higher accelerations. Also attached to the plate are a high-speed camera and an LED backlight to provide continuous video of the instability. In addition, an accelerometer is used to provide acceleration measurements during each experiment. Experimental image sequences will be presented which show the development of a random three-dimensional instability from an unforced initial perturbation. Measurements of the mixing zone width will be compared with traditional growth models.

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