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Experimental Study of Rayleigh-Taylor Instability Using Paramagnetic Fluids VLADIMER TSIKLASHVILI, OLEG LIKHACHEV, JEFFRY JACOBS, University of Arizona — Experiments that take advantage of the properties of paramagnetic liquids are used to study Rayleigh-Taylor instability. A gravitationally unstable combination of a paramagnetic salt solution and a nonmagnetic solution is initially stabilized by a magnetic field gradient that is produced by the contoured pole-caps of a large electromagnet. Rayleigh-Taylor instability originates with the rapid removal of current from the electromagnet, which results in the heavy liquid falling into the light liquid due to gravity and, thus, mixing with it. The mixing zone is visualized by back-lit photography and is recorded with a digital video camera. For visualization purposes, a blue-green dye is added to the magnetic fluid. The mixing rate of the two liquids is determined from an averaged dye concentration across the mixing layer by means of the Beer-Lambert law. After removal of the suspending magnetic field, the initially flat interface between the two liquids develops a random surface pattern with the dominant length scale well approximated by the fastest growing wavelength in accordance with the viscous linear stability theory. Several combinations of paramagnetic and nonmagnetic solutions have been considered during the course of the research. A functional dependence of the mixing layer growth constant, α , on the properties of the liquids is a primary subject of the present study.

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