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**Nonlinear evolution of hydrodynamic instabilities from multimode initial perturbation**

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The RT and RM hydrodynamic instabilities are subjects of intensive experimental and theoretical research because of its critical importance in inertial confinement fusion and astrophysics research. The nonlinear evolutions of those instabilities in 3D, from an initial multimode perturbation, were study experimentally and theoretically. The RM experiments were performed using the BGU shock tube facility, where the turbulent mixing zone evolution following the passage of shocks through the interface of two different fluids wee measured. The RT experiments were performed using the OMEGA laser facility at LLE, where the bubble size distribution evolution from an initial 3D broadband modulation was measured. The experimental result were compared with the prediction of the bubble-competition and the mode-coupling models, developed to describe the nonlinear evolution of the instability from a multimode initial perturbation, as well as with full 3D numerical simulations. Collaborators: O. Sadot, V. Smalyuk, Y. Elbaz, E. Leionov, A. Formoza, G. Malamud, N. Wygoda, A. L. Levin, G. Ben-Dor, J. A. Delettrez, D. D. Meyerhofer, T. C. Sangster, R. Betti, V. N. Goncharov