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The mixing transition in Rayleigh-Taylor instability

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A mixing transition has been observed in a high-resolution large-eddy simulation of Rayleigh-Taylor instability. During the transition, an inertial range forms in the velocity spectrum and the rate of growth of the mixing zone is reduced. By measuring growth of the layer in units of dominant initial wavelength, criteria are established for reaching the hypothetical self-similar state of the mixing layer. A model including mixing effects is derived for the growth rate. The rate of growth of the mixing layer is determined by the net mass flux through the plane associated with the initial location of the interface. All of the information necessary for predicting the growth rate is contained in this plane. The model incorporates an effective Atwood number and provides a good match to the simulation data. The model suggests reduced growth for miscible fluids, compared to the immiscible case.

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