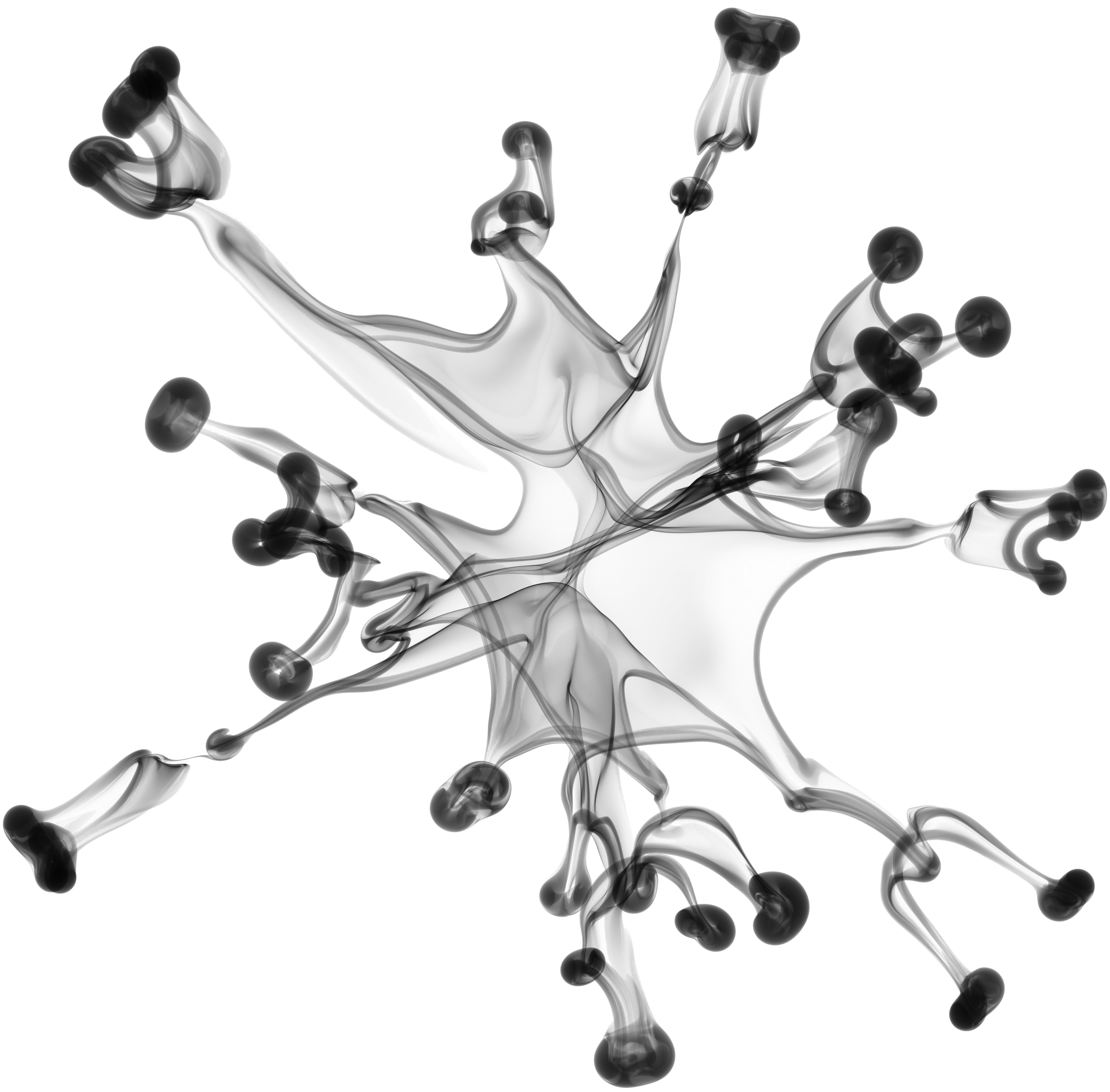
Spherical Rayleigh-Taylor Instabilities



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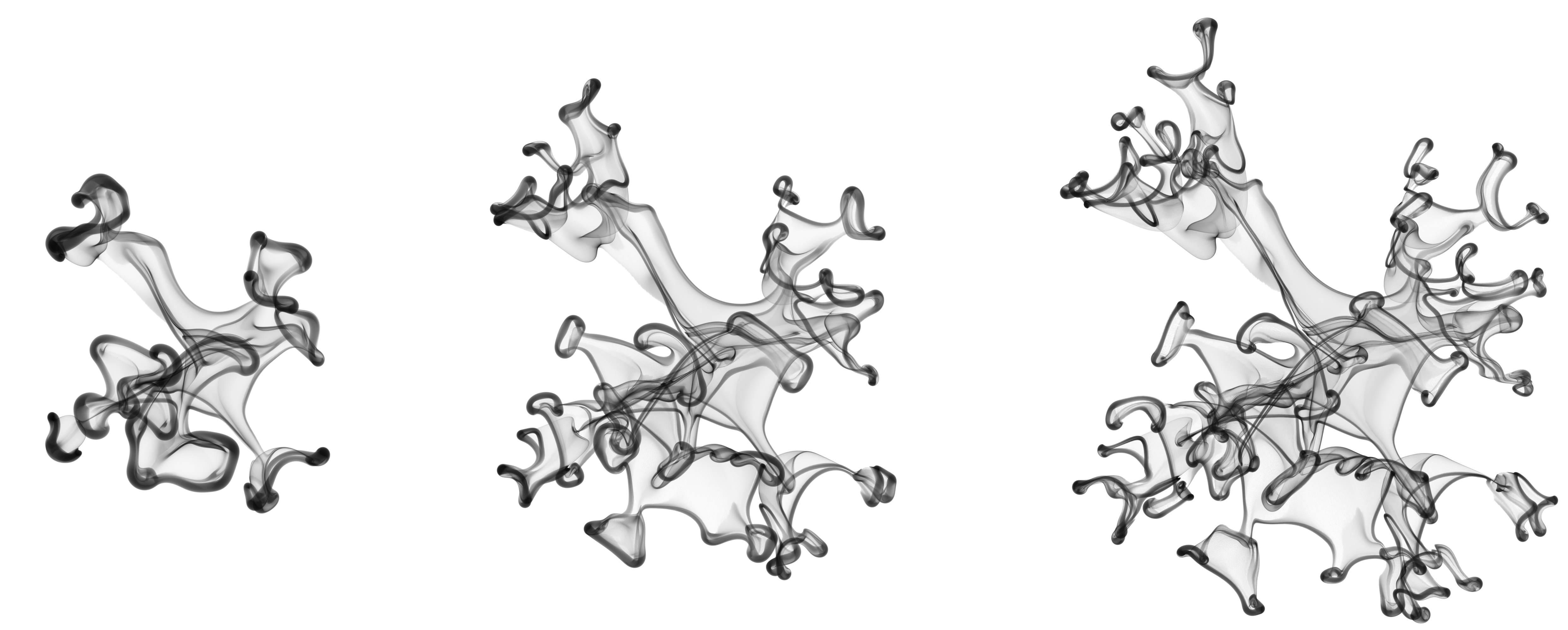

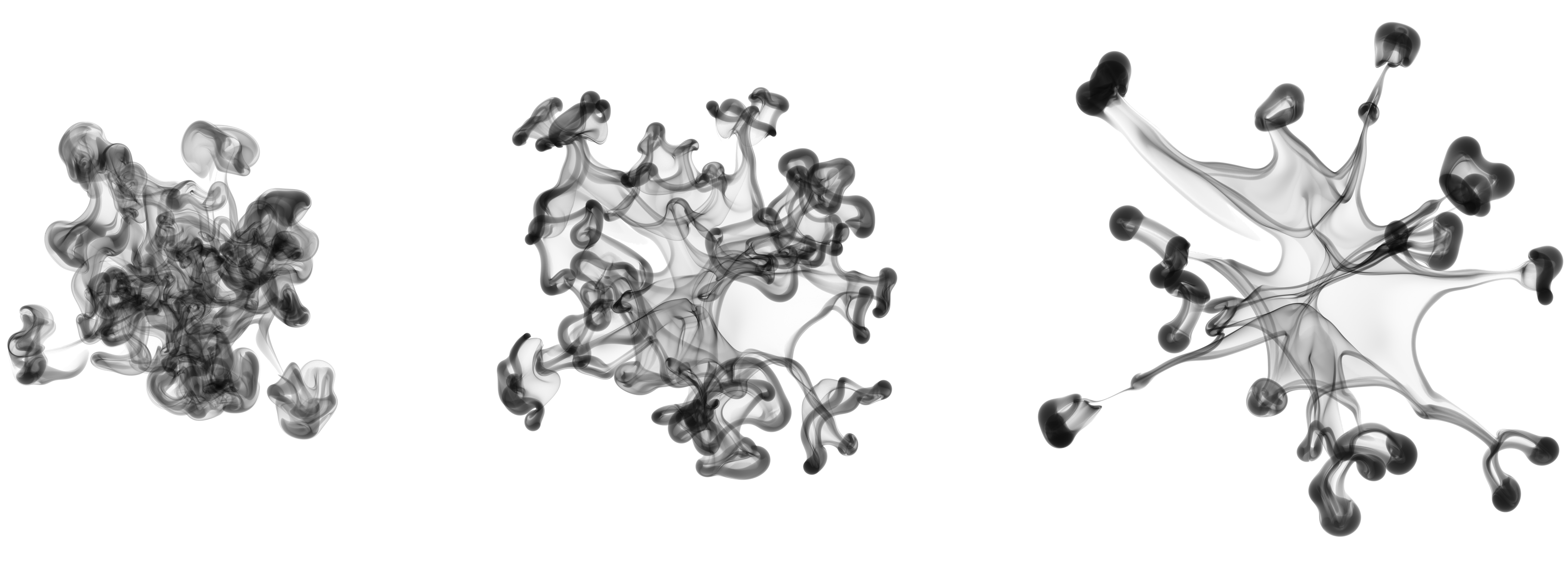

A Spherical Rayleigh-Taylor Instability[1] arises when a fluid density interface is also a potential isosurface of a radial gravitational field. In these computer simulations, a three-dimensional front-tracking vortex method[2] is used to evolve a slightly-perturbed spherical interface between two fluids under the influence of radial gravity. The surface is persistent and adapts to the local strain, a Vortex-In-Cell method performs the vorticity-velocity inversion and limits the smallest scales, and an explicit artificial viscosity term dissipates energy.

The top series of images are from the same simulation but at three different times, showing individual bulbs of fluid stretching and splitting apart as they "fall" through the gravitational field. The images in the bottom series are from simulations with different values of the viscosity term, from inviscid on the left to very strong on the right. The simulation time from which the images are taken increases from left to right, as the viscous fingers move more slowly.

1. H. Sakagami and K. Nishihara (1990). Three-dimensional Rayleigh-Taylor instability of spherical systems. *Phys. Rev. Lett.* 65, 432.

2. M. Stock (2006). *A Regularized Inviscid Vortex Sheet Method for Three Dimensional Flows With Density Interfaces* (dissertation). University of Michigan, Ann Arbor.

Mark J. Stock received his Ph.D. in Aerospace Engineering from the University of Michigan in 2006 under Profs. Werner J.A. Dahm and Gretar Tryggvason and currently makes artwork using computational physics research software from his studio near Boston, Massachusetts. He is represented in California by SENSE Fine Art.