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Breakup of a Liquid Drop Falling Through a Quiescent Media: A DNS Study MAZIYAR JALAAL, KIAN MEHRAVARAN, School of Engineering, University of British Columbia, 3333 University Way, Kelowna, V1V 1V7 BC, Canada — The breakup of falling liquid droplets in a stationary media is studied using Direct Numerical Simulations (DNS). An adaptive Volume of Fluid (VOF) method based on an octree Cartesian grid generation is employed, considerably reducing the computational cost. Fragmentations are followed reaching approximately stable clouds of droplets up to 1/1000 of the initial droplet diameter. Three different simulations are performed investigating the influence of the initial Eötvös number. The mechanism of breakup, one of the most unclear phenomena in multiphase systems is described in detail. The wave growth over the bag, creation and retraction of punctures and ligament formation are presented and results are compared with recent theoretical investigations of (*Savva & Bush, J. Fluid. Mech.* ***626****: 211-240.*) and (*Bermond & Villermaux, J. Fluid. Mech.* ***524****: 121-130.*). The roles of Rayleigh-Taylor and Rayleigh-Plateau instabilities on breakup are also described and their influences on further cluster-of-fragments creation are shown. The outcomes can be used to develop current secondary atomization models. Moreover, the results can be used for better understanding of rain drop atomization during precipitation, as well as water droplet atomization in cooling towers.

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