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Fragmentation dynamics in the droplet bag breakup regime
VARUN KULKARNI, PAUL SOJKA, Purdue University — The closing stages of a droplet bag breakup event is marked by the appearance of several topological changes in the drop shape, followed by its fragmentation owing to hydrodynamics instabilities. In the present work we examine this breakup event, which occurs when a drop enters a continuous jet air stream. The deformed drop before eventual fragmentation is comprised of two main features: a bag and a bounding rim. Our investigation discusses the mechanism of rim/ bag breakup and the ensuing drop size distribution. The role of two possible instabilities, Plateau−Rayleigh and Rayleigh−Taylor, in rim breakup is examined and the dominant role of the Plateau−Rayleigh instability is revealed. In contrast, the Rayleigh−Taylor instability is seen to explain the disintegration of the bag well. The effects of viscosity and air jet velocity are also investigated. The formation of secondary features, such as nodes on the rim and holes on the bag, are also discussed. To conclude, a simple scaling argument based on the characteristic time scales of these instabilities is presented to explain the commonly observed early bursting of the bag, vis-à-vis the rim.

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