College of Engineering
Department of
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Dynamics of evolving jets during single drop impact and dynamics of two drops falling in tandem on a liquid pool

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The transition regimes between complete-coalescence and splashing of drops include jet formation with single or multiple secondary drops. One of the main features in this regime is the formation of a central liquid jet followed by breakup of the jet in the form of drops. Earlier studies have shown that the diameter of the secondary drop lies between 0.58 and 0.94 times the diameter of the impacting drop. We perform investigations based on a coupled level-set and volume-of-fluid method to elucidate the earlier observations. The investigations reveal the creation of a variety of secondary drops depending on the impact conditions. The present study also reveals that secondary drops, larger than the initial drop, can be obtained at higher impact velocities. We identify the importance of capillary forces and cavity shapes on the formation of jets and other pertinent parameters that are responsible for drop ejection. Furthermore, we examine the coalescence dynamics of two ethanol drops of equal and unequal size, impacting an ethanol pool at low impact velocity using a high-speed shadowgraph. By altering the separation distance between the drops and their size ratios, different coalescence outcomes, such as total coalescence, interacting partial coalescence, and non-interacting partial coalescence, have been observed. Two distinct dynamics have been identified, namely, (*i*) when the primary drops coalesce first before the resulting conglomerate coalesces into the liquid pool and (*ii*) when the drops coalesce in the liquid pool separately, resulting in capillary waves interaction and affecting the coalescence outcomes. We also observe another fascinating phenomenon for certain parameters as the satellite drops coalesce as they ascend from the liquid pool.

*Prof. Gautam Biswas is presently a JC Bose National Fellow at the Department of Mechanical Engineering of Indian Institute of Technology Kanpur. Earlier, he has been Director of the Indian Institute of Technology Guwahati, and Director of the CSIR-Central Mechanical Engineering Research Institute (CMERI) at Durgapur. He was the G.D. and V.M. Mehta Endowed Chair Professor, and Dean of academic affairs at IIT Kanpur. The research group of Professor Biswas at IIT Kanpur identified the phenomenon of Rayleigh-Taylor Instability during the bubble formation in film boiling. This was a significant addition to the classical theory, based on Taylor Helmholtz instability. Professor Biswas is the author of more than 150 publications in the top-tier International Journals.