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Instability of the crown formed by a splashing droplet XINJUN GUO, Department of Physics, Brown University, SHREYAS MANDRE, School of Engineering, Brown University — Splashing from impacts between liquid drops and a surface is of importance for many natural and industrial processes. The mechanism which dominates the crown breakup has mostly been proposed to be the capillary instability of the rim that forms and grows at the boundary of the crown. But no such theory has so far captured the main properties of the crown. Rayleigh's theory of capillary thread breakup predicts the size of secondary drops to be comparable with the thickness of the unperturbed rim, but the rim is constantly growing. Motivated by this puzzle, we study the instability of a cylindrical thread of liquid, which is constantly growing due to a source of liquid along its centerline. This is our idealized model for the breakup of a liquid lamella rim into droplets. We find that the most unstable wavelength grows with time proportionally to the radius of the thread and the amplitude of the perturbations do not grow like $e^{\lambda t}$ but like $e^{\lambda t^{1/4}}$. Also, the stability theory we use on this time-dependent non-autonomous system generalizes the traditional modal stability theory and the non-modal approaches that have developed more recently.

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