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Non-continuous Froude number scaling for the closure depth of a cylinder cavity STEPHAN GEKLE, RAYMOND BERGMANN, ARJAN VAN DER BOS, DEVARAJ VAN DER MEER, DETLEF LOHSE, Physics of Fluids, University of Twente, The Netherlands — A long, smooth cylinder is dragged through a water surface to create a cavity with an initially cylindrical shape. This surface void then collapses due to the hydrostatic pressure, leading to a rapid and symmetric pinch-off in a single point. Surprisingly, the depth at which this pinch-off takes place does not follow the expected Froude$^{1/3}$ power-law. Instead, it displays three distinct scaling regimes separated by discrete jumps, both in experiment and in numerical simulations (employing a boundary integral code). We quantitatively explain the above behavior by incorporating the influence of the capillary waves which are created as the cylinder passes the water surface into the analysis of the collapse. Our work thus gives further evidence for the non-universality of the void collapse.

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