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Water entry without surface seal: extended cavity formation MOHAMMAD MANSOOR, JEREMY MARSTON, IVAN VAKARELSKI, SIGURDUR THORODDSEN, King Abdullah University of Science and Technology — We report results from an experimental study of cavity formation during the impact of hydrophobic spheres onto water. Using a splash-guard mechanism, we block the spray during initial contact from closing thus eliminating the phenomenon known as "surface seal," which typically occurs at $Fr = O(100)$. As such, we are able to observe the evolution of a smooth cavity in an extended parameter space than has been achieved in previous studies. By systematically varying the tank size and sphere diameter, we examine the influence of increasing wall effects on these guarded impact cavities and note the formation of surface waves with wavelength $\lambda = O(10)$ cm and acoustic waves $\lambda_a = O(D_0)$along the cavity interface, which produce multiple pinch-off points. Acoustic waves are initiated by pressure perturbations, which themselves are generated by the primary cavity pinch-off. Using high-speed particle image velocimetry (PIV) techniques we show the larger waves ($\lambda = O(10)$ cm) have a standing nature. We show that previously deduced scalings for the normalised (primary) pinch-off location $H_p/H = 1/2$ and time $\tau \propto (R_0/g)^{1/2}$ do not hold in the presence of strong wall effects for $D_0/D_{tank} \geq 1/16$.

Mohammad Mansoor
King Abdullah University of Science and Technology

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