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Bouncing off the Walls: The Influence of Gas-Kinetic and van der Waals Effects in Drop Impact[1] JAMES SPRITTLES, MYKYTA CHUBYNSKY, University of Warwick, KIRILL BELOUSOV, ITMO University, St Petersburg, DUNCAN LOCKERBY, University of Warwick — The remarkable discovery that reductions in ambient gas pressure can suppress splashing [Xu et al., Phys. Rev. Lett. 94, 184505] prompted a flurry of experimental analyses aimed at elucidating the influence of air films during drop impact. This culminated in recent experimental observations revealing that when the impact speed is below a critical threshold, mm-sized drops no longer wet the solid but are able to skate over air nanofilms and rebound from surfaces of any wettability [Kolinski et al., Europhys. Lett. 108, 24001 (2014); de Ruiter et al., Nat. Phys. 11, 48 (2015)]. In this talk, I will demonstrate that the bouncing-wetting threshold can only be accurately predicted by accounting for micro-physics that is usually neglected - namely, gas kinetic effects (GKE) and van der Waals (vdW) forces. An efficient FEM computational model incorporating these effects is developed and shown to reproduce experimental results. To isolate GKE, the pressure dependence of the threshold is mapped and provides experimentally verifiable predictions. There are two principal modes of contact leading to wetting and both are associated with a vdW-driven instability of the film. This research has been recently published in [Phys. Rev. Lett. 124, 084501].

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