Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Viscous growth and rebound of confined bubbles[1] SEBASTIEN MICHELIN, LadHyX - Ecole Polytechnique, GIACOMO GALLINO, FRANCOIS GALLAIRE, LFMI - Ecole Polytechnique Fdrale de Lausanne, ERIC LAUGA, DAMTP - University of Cambridge — In many applications (e.g. bubble-powered micro-rockets), microscopic gas bubbles nucleate and grow in close proximity with a rigid bounding surface. This has profound hydrodynamic consequences, as the bubble is geometrically constrained and must translate away from the wall as its radius increases, in order to maintain mechanical equilibrium with the non uniform hydrodynamic stresses applied on its surface.
This dynamic process is analyzed theoretically for a spherical inflating gas bubble in a viscous fluid, focusing specifically on the drainage dynamics of the thin lubricating film separating the bubble from the wall and for bubble surfaces of different physical nature, ranging from "clean" (i.e. stress-free) to "polluted" or rigid (i.e. slip-free) interfaces. Different bubble surface conditions lead to fundamentally different behaviors: bubbles may thus drain the lubrication film monotonically or bounce off the surface before eventually draining the film. A final universal regime (i.e. for all bubble surface conditions) is finally identified.

[1]European Research Council through Grant Agreements 714027 (SM), 280117 (FG) and 682754 (EL)

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Date submitted: 24 Jul 2019 Electronic form version 1.4