Bubble collapse regimes in the presence of a wall

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In this talk we will present some numerical, theoretical and experimental results that reveal the existance of different regimes of interaction between a non-spherical collapsing bubble and a wall [1]. We show how the effective contact angle at the instant of maximum expansion determines the mechanisms of interaction between the bubble and the wall. Using the results from the impulse theory, we show that for sufficiently flat bubbles the solution of the Euler equations is singular at the contact line. The existence of this singularity is shown to be responsible of high velocity jets parallel to the wall that eventually lead to the emission of vortices in direction opposite to the wall. The Direct Numerical Simulation of the Rayleigh collapse problem of spherical cap bubbles attached to a wall will be used to validate theoretical predictions and analyze the fully non-linear evolution of the bubble. Experimental observations of the flow generated by the collapse of a bubble generated at the bottom of a water filled tank reveal the formation of these vortices that can eventually lead to long range effects with a free surface (see figure 1).

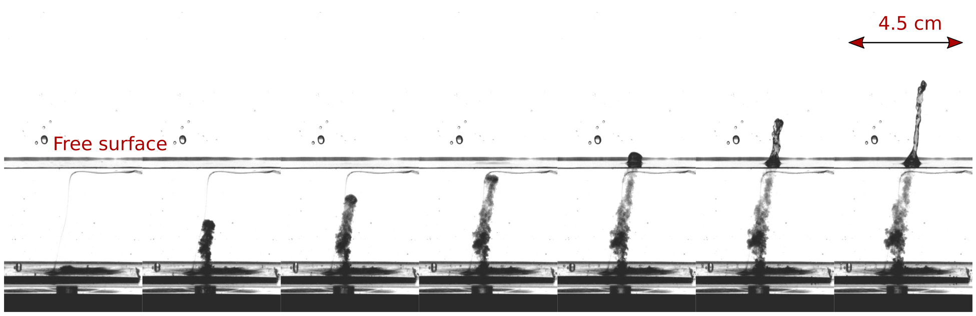

Figure 1. Experimental observation of the emission of a vortex dipole emitted by the collapse of a bubble at the bottom of a water filled tank. A small amount of ink is deposited at the bottom of the tank in order to visualize the flow generated by the bubble. Framerate: 8 ms.

References

1. M. Saini & E. Tanne & M. Arrigoni & S.Zaleski & D. Fuster, On the dynamics of a collapsing bubble in contact with a rigid wall, *Journal of Fluid Mechanics.*, **948**, 1–19 (2022).

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