Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

The diameters and velocities of the jet droplets produced after bubble bursting[1] FRANCISCO J. BLANCO-RODRIGUEZ, JOSE M. GORDILLO, Universidad de Sevilla — Here we provide a theoretical framework revealing that the radius R_d of the top droplet ejected from a bursting bubble of radius R_b can be expressed as $R_d = 0.22\, R_b \left(1 - \left(\frac{Oh}{Oh'_c}\right)^{1/2}\right)$ for $Oh \leq Oh'_c \simeq 0.03$ and $Bo \leq 0.1$ with with $Oh = \mu/\sqrt{\rho R_b \sigma} \ll 1$ the Ohnesorge number, $Bo = \rho g R_b^2/\sigma$ the Bond number and ρ, μ and σ the liquid density, viscosity and surface tension coefficient respectively. This prediction, which agrees very well with both experimental data and numerical simulations for all the values of Oh and Bo investigated, can be particularized to express the diameters of the jet droplets produced from the bursting of sea bubbles with radii $R_b \leq 1$ mm, with implications in marine aerosol production. The velocities of the first drops ejected are also expressed as a function of Oh and Bo, being this initial drop velocity largely reduced by air drag at tiny distances $\sim R_b$ above the interface. We find that the ratio between the radius of curvature at the tip of the jet and the jet radius controls the growth of capillary instabilities, a fact explaining why no droplets are ejected from the tip of the fast Worthington jet for values of Oh slightly larger than Oh'_c.

[1]Francisco J. Blanco-Rodríguez would like to acknowledge funding received from the Spanish Government (Juan de la Cierva Incorporación grant IJCI 2016-30126).

Francisco J. Blanco-Rodriguez
Universidad de Sevilla

Date submitted: 31 Jul 2019 Electronic form version 1.4