THE MAYONNAISE DROPLET

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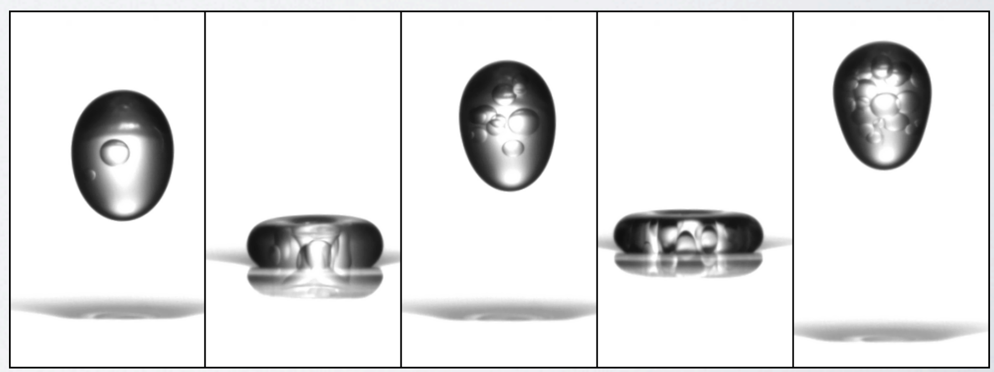
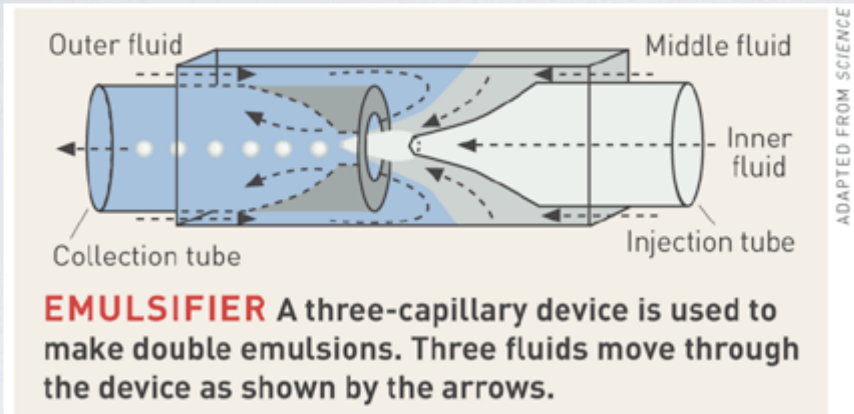
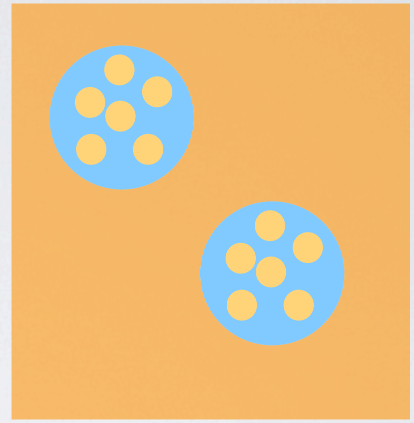
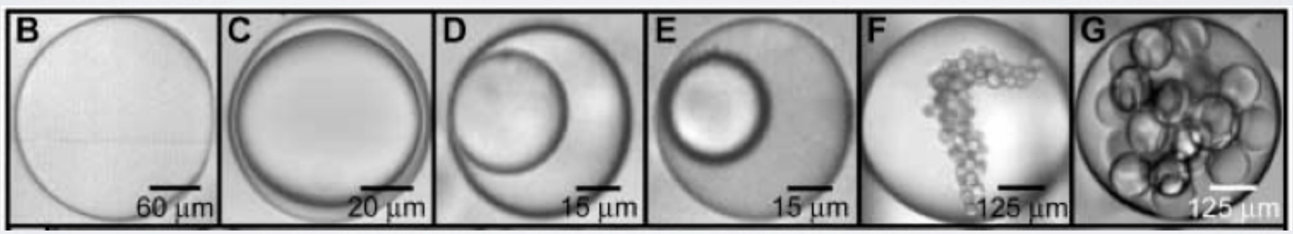


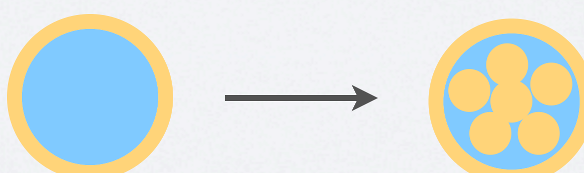
INTRODUCTION



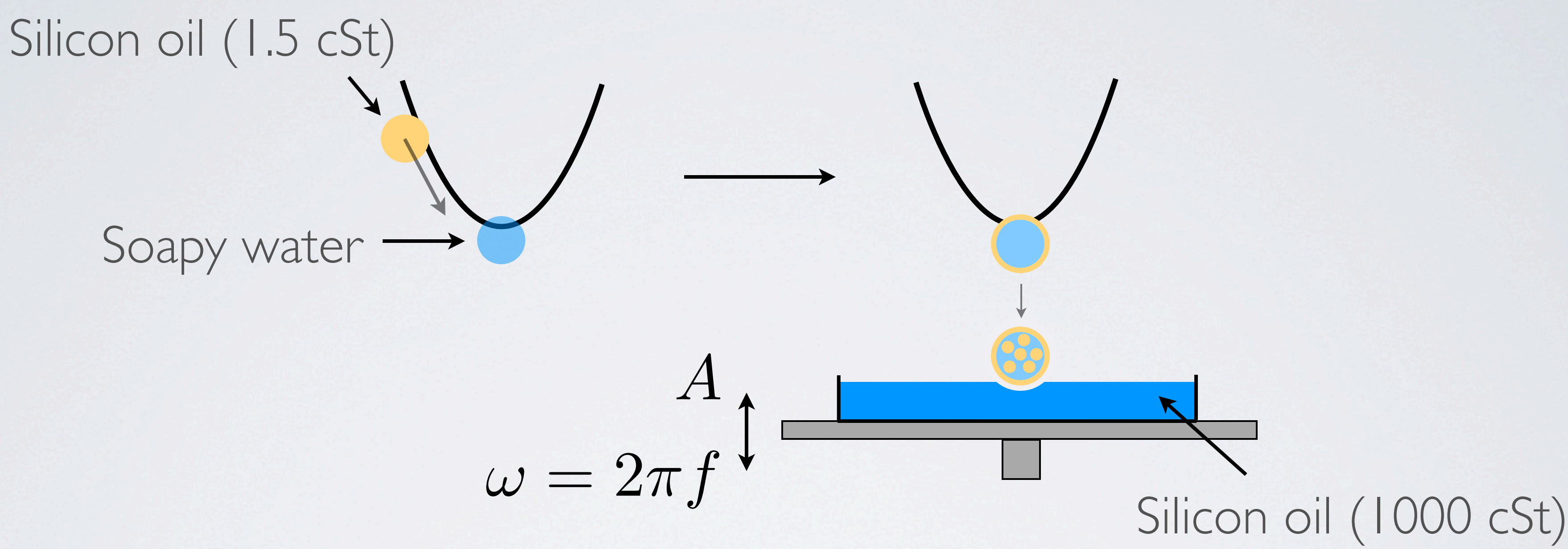




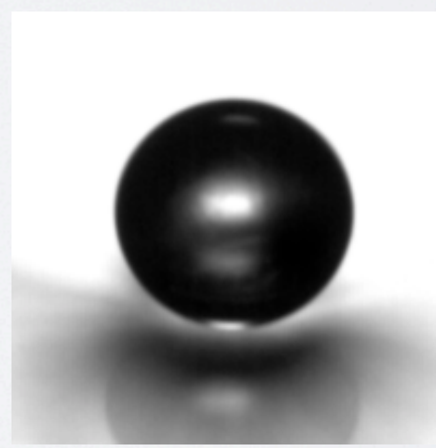
A. S. Utada et al., Science, 308, 1109164 (2005)



EXPERIMENTAL SETUP



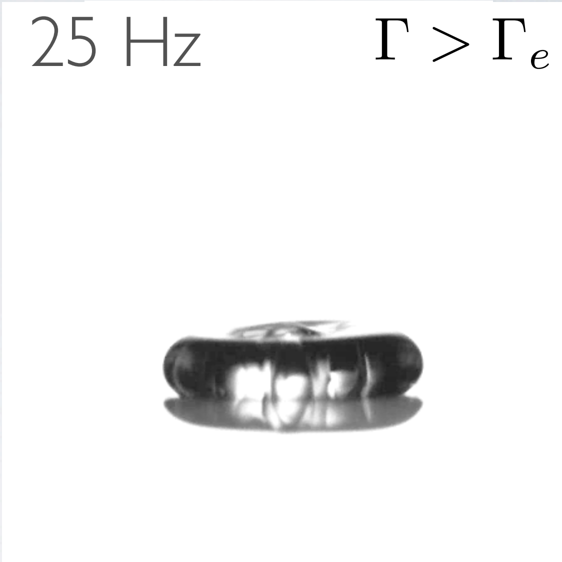
$$\Gamma = \frac{A\omega^2}{g}$$



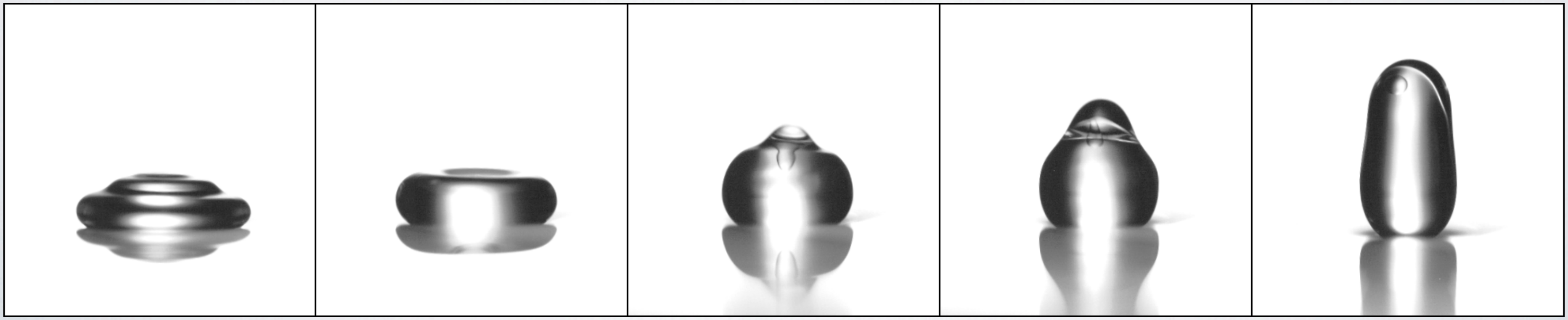
Y. Couder et al., Phys. Rev. Lett. 94, 177801 (2005)

DOUBLE EMULSION

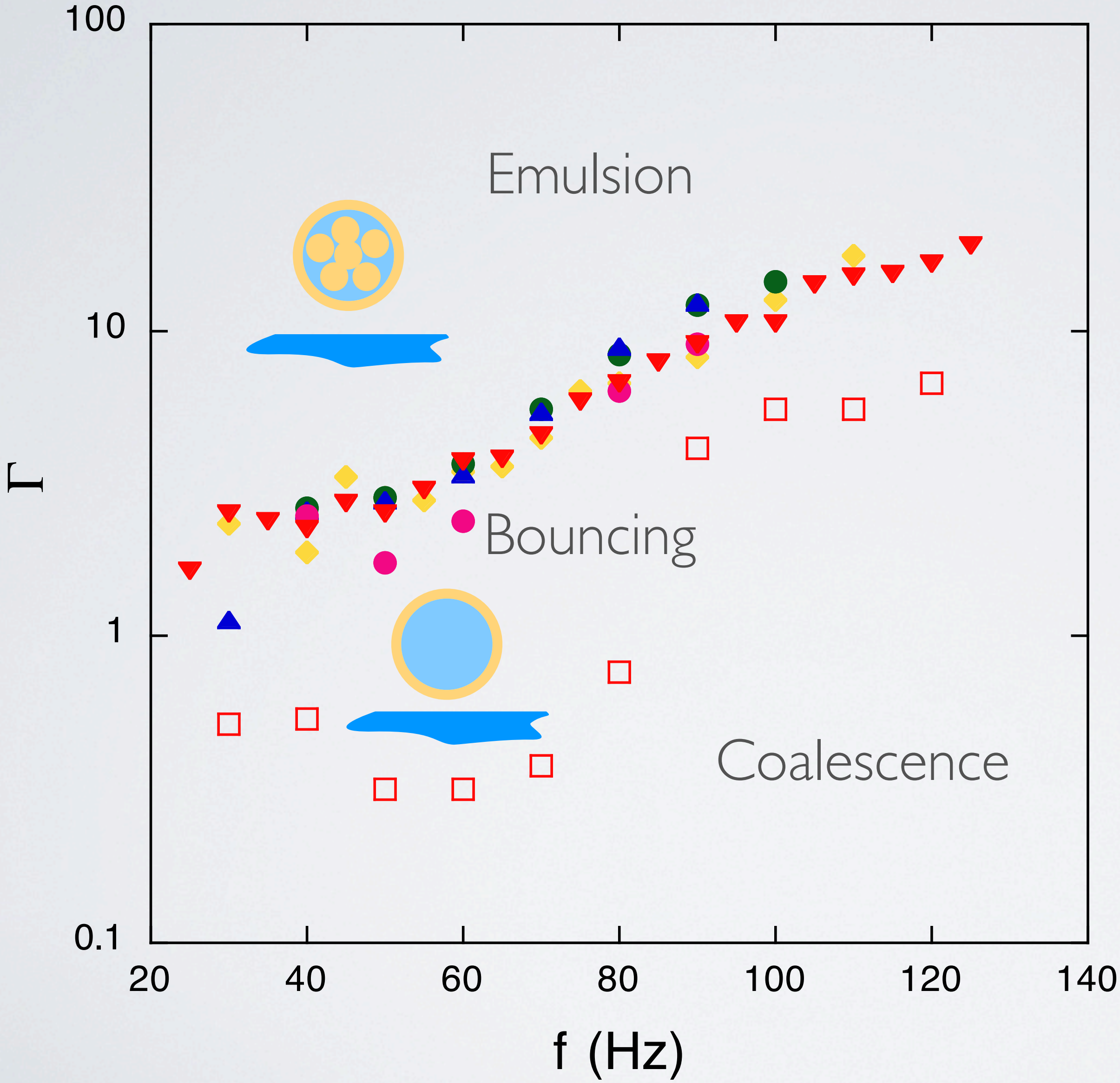
Beginning of the emulsion



Later



PHASE DIAGRAM

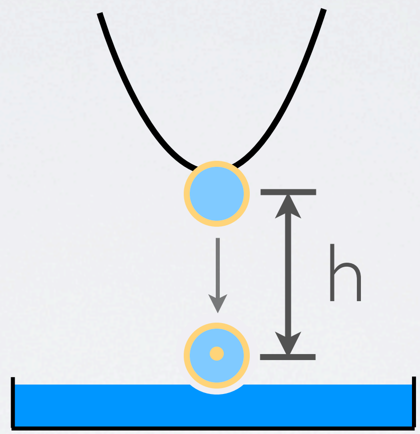


1.6 mm < D < 2 mm

≠ volume ratio
40% to 70% water
volume ratio

EMULSION THRESHOLD

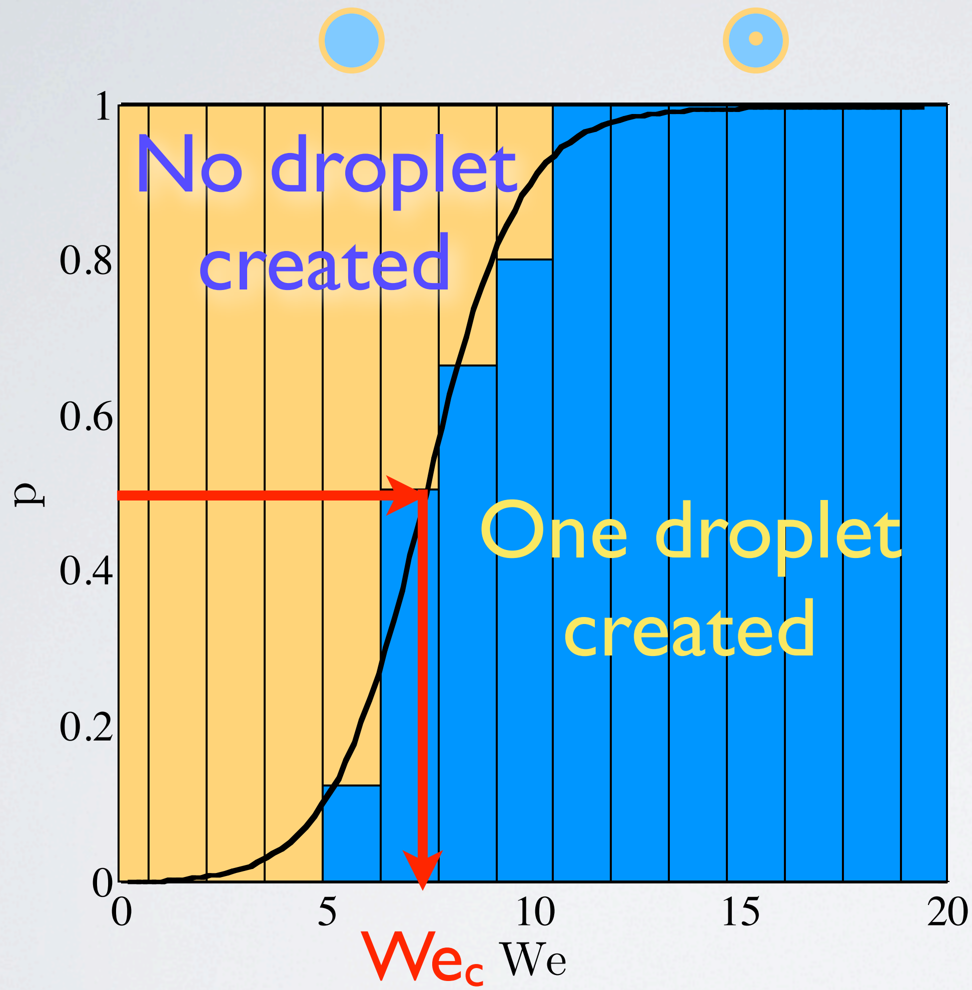
- Static bath : minimum impact speed for emulsion

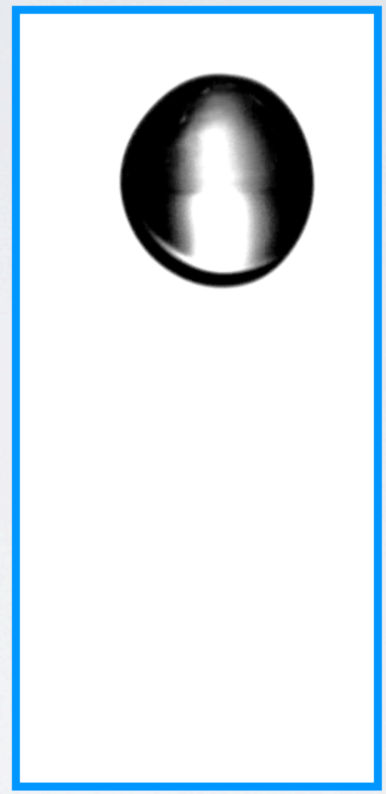


$$We_c = \frac{\rho v_c^2 D}{\sigma}$$

- How to link the static case and the vibrated one ?

STATIC BATH





$1.6\ \mathrm{mm} < D < 2\ \mathrm{mm}$

$\neq$ volume ratio

$$We_c = 7.45 \pm 1.4$$

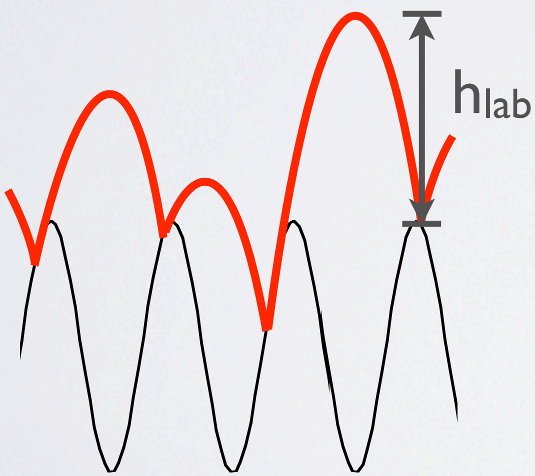
$$We_c = \frac{\rho v_c^2 D}{\sigma}$$

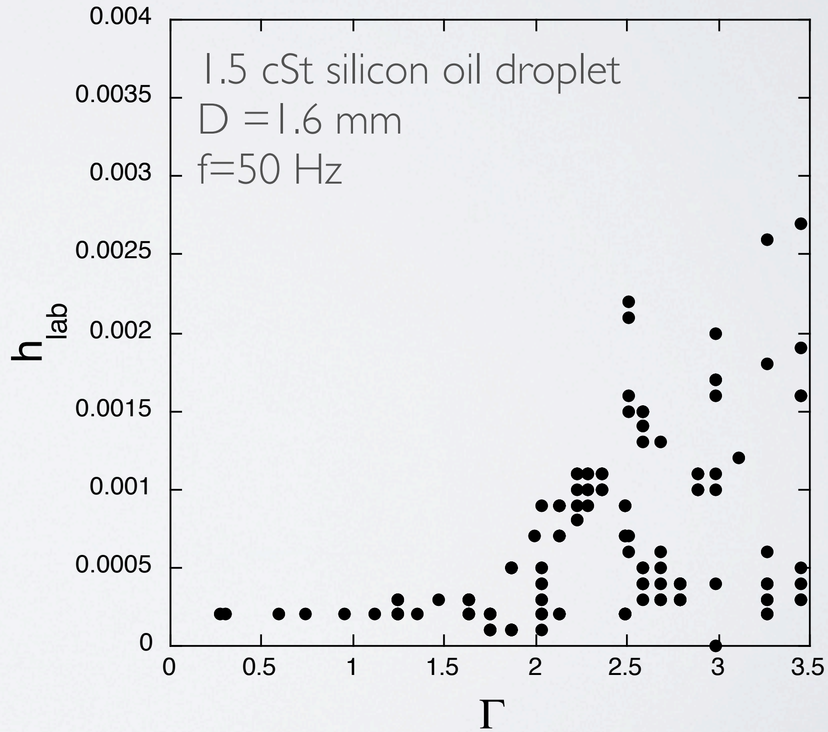
Vibrated : for which Γ do we have $We > We_c$

BIFURCATION DIAGRAM

$$We_c = \frac{\rho(v_{freefall} + v_{bath})^2 D}{\sigma}$$

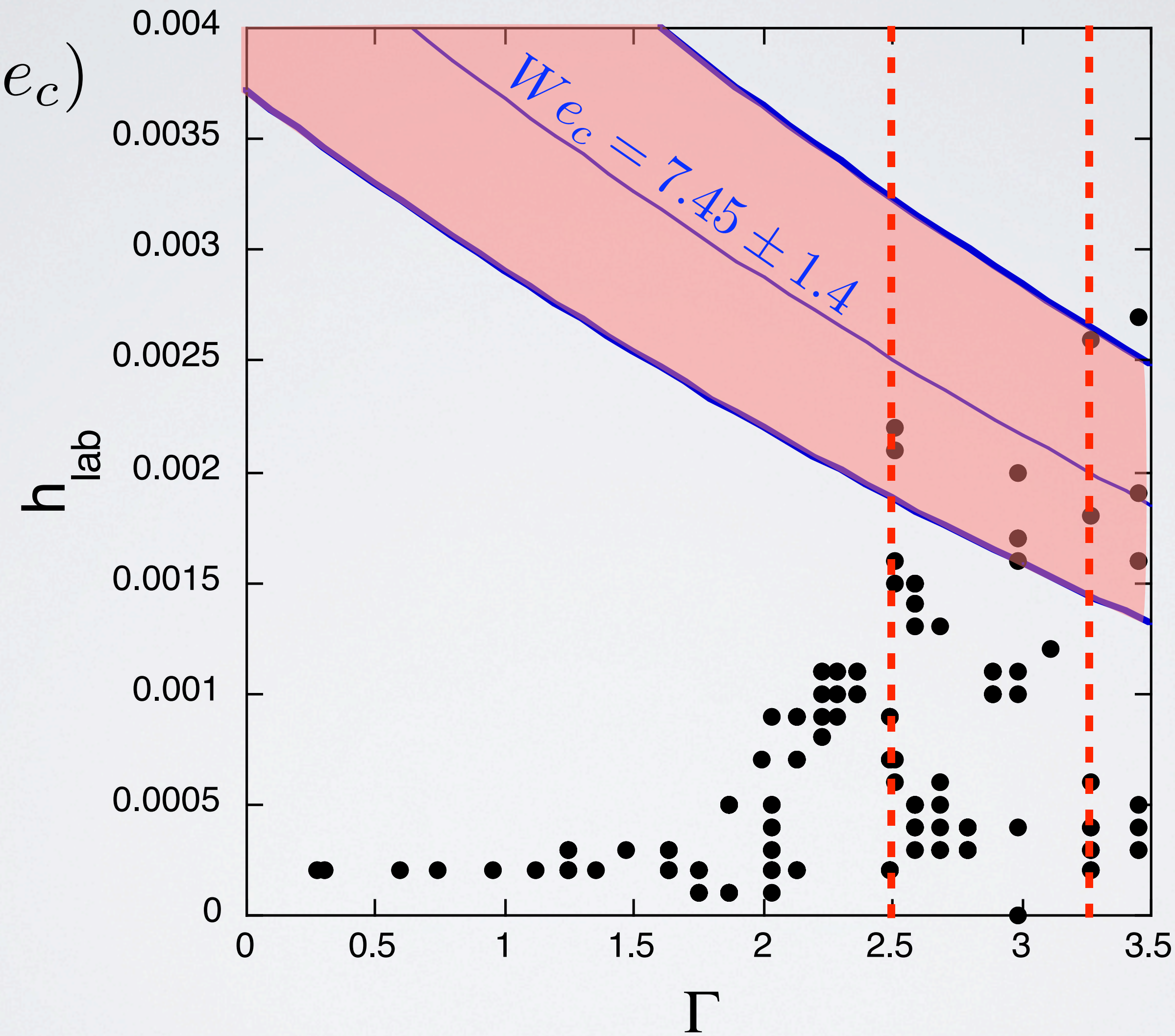
$$v_{freefall} = \sqrt{2gh_{lab}} \qquad v_{bath} = A\omega^2$$





STATIC ↔ VIBRATED

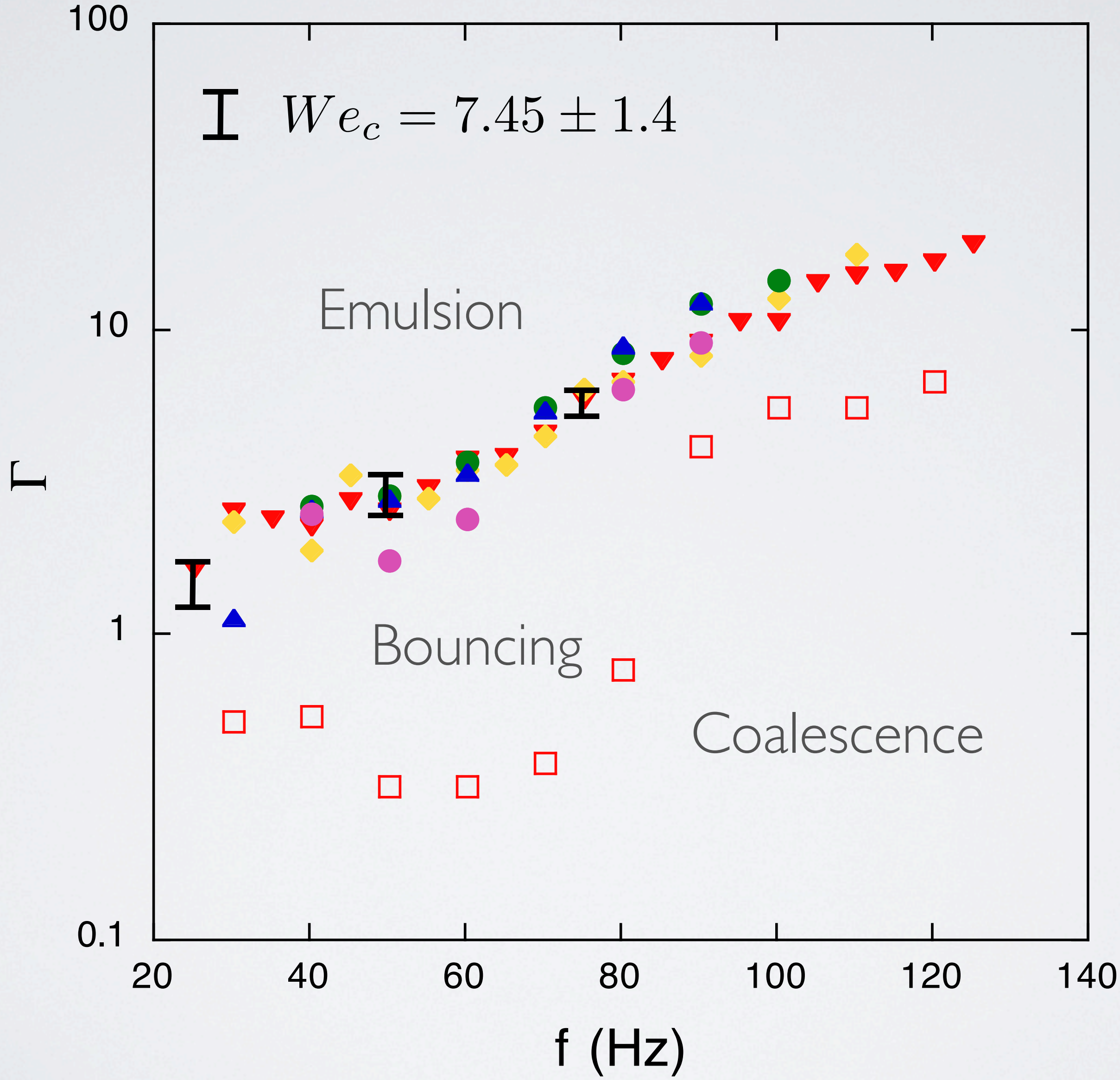
$$h_{lab} = f(We_c)$$



1.5 cSt silicon oil droplet
D =1.6 mm
f=50 Hz

$2.5 < \Gamma_e < 3.25$

PHASE DIAGRAM



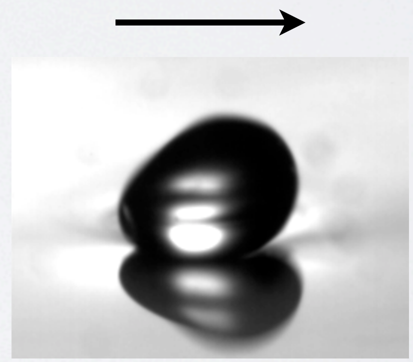
CONCLUSIONS

Double emulsion in a compound drop (oil + soapy water)

→ bouncing ($We > We_c$)

Perspectives :

- Stabilization of the emulsion
- Manipulation of the drop → Roller*



(*) S. Dorbolo et al., New J. Phys., 10, 113021 (2008)


THANK YOU