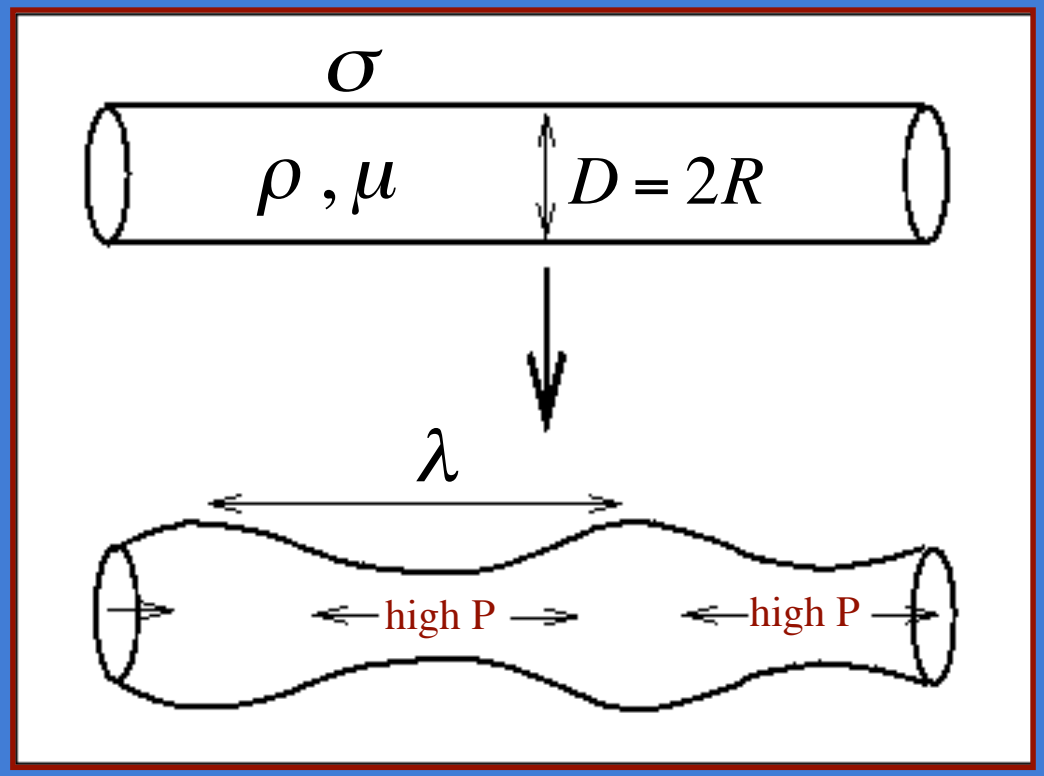
18.357: Lecture 12

Variations on the theme of Rayleigh-Plateau

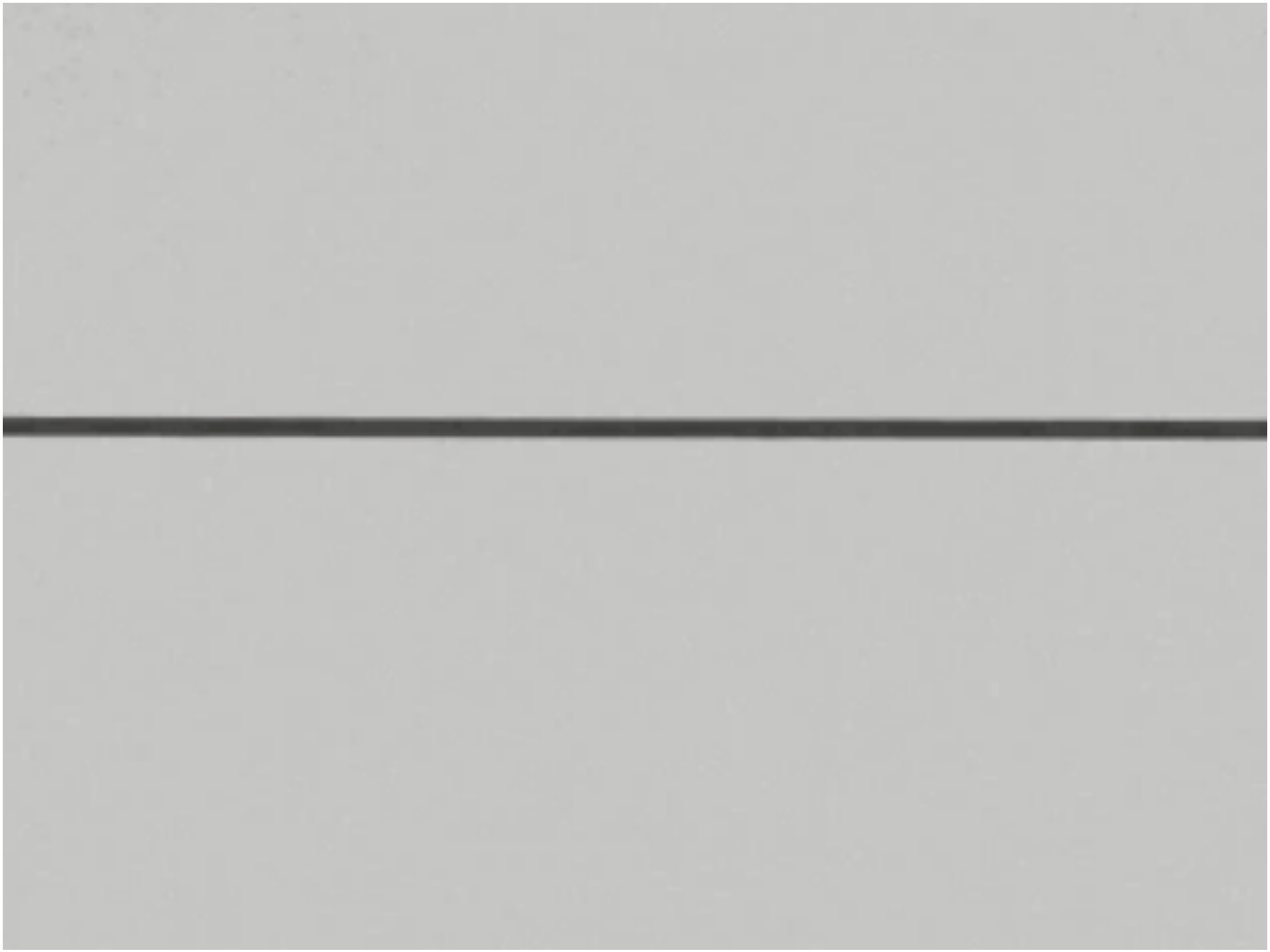
& Sheet retraction

Viscosity and the Rayleigh-Plateau Instability

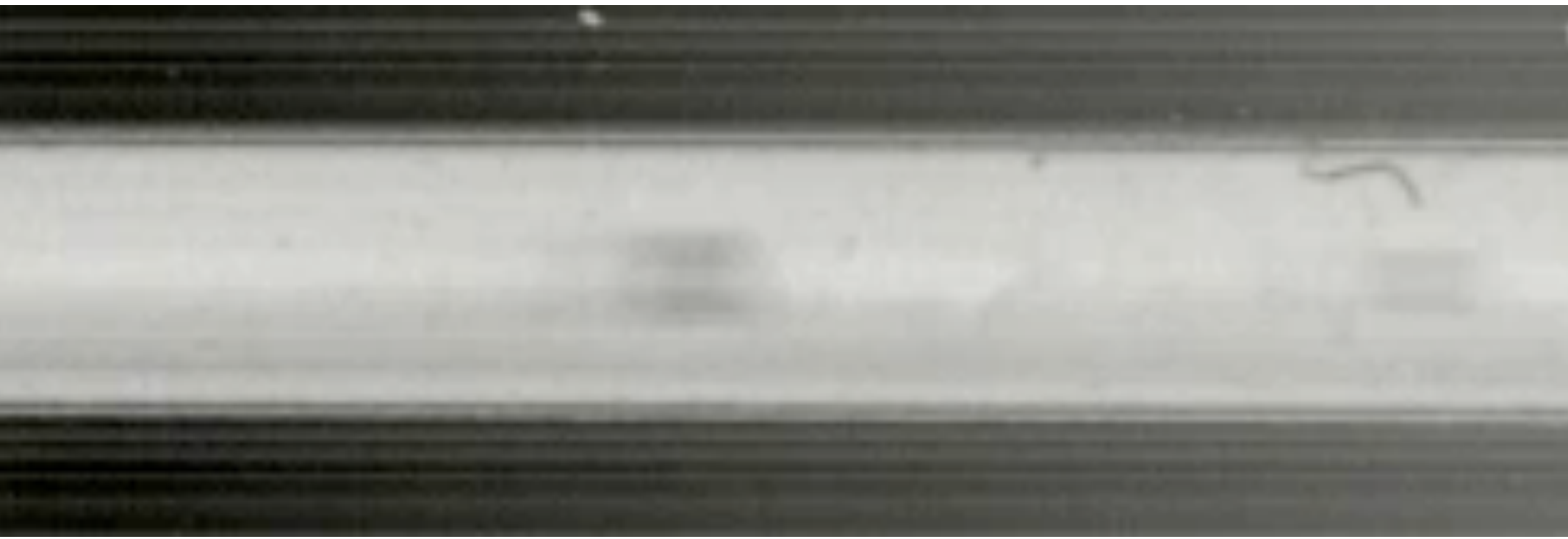


- pinch-off depends on Ohnesorge number $\mathrm{Oh} = \dfrac{\sigma R}{\mu v}$
- at high Oh: $\tau_p \sim \left(\dfrac{\rho R^3}{\sigma}\right)^{1/2}$ and $\lambda = 9.02\, R$
- at low Oh: $\tau_p \sim \dfrac{\mu R}{\sigma}$ and λ increases with μ

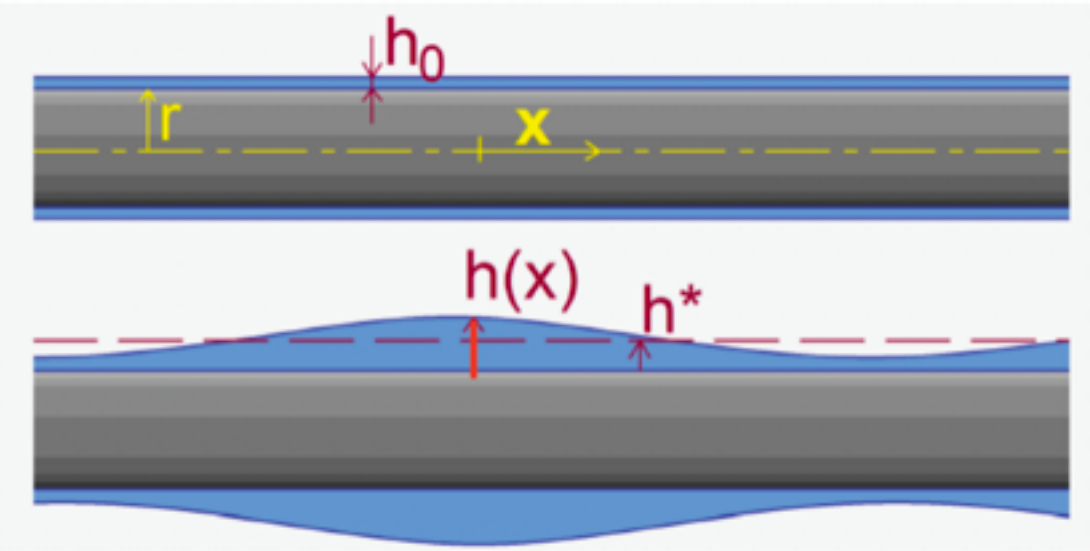
Coating a wire

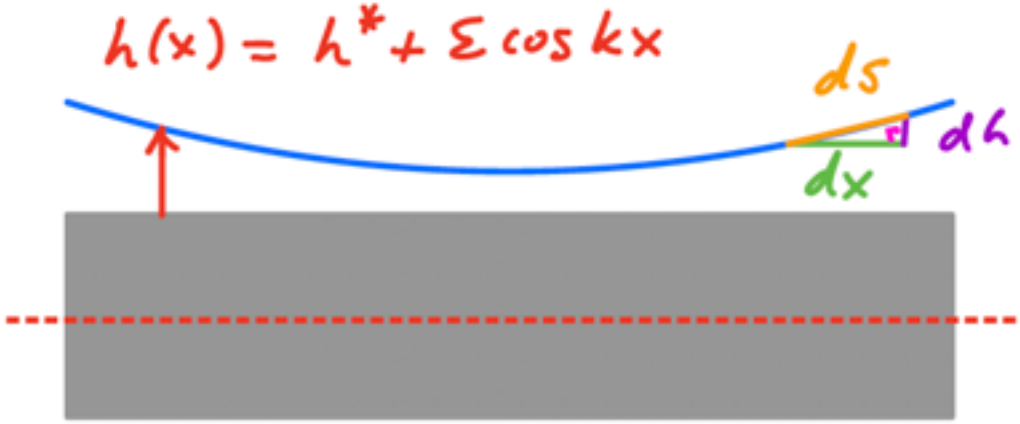


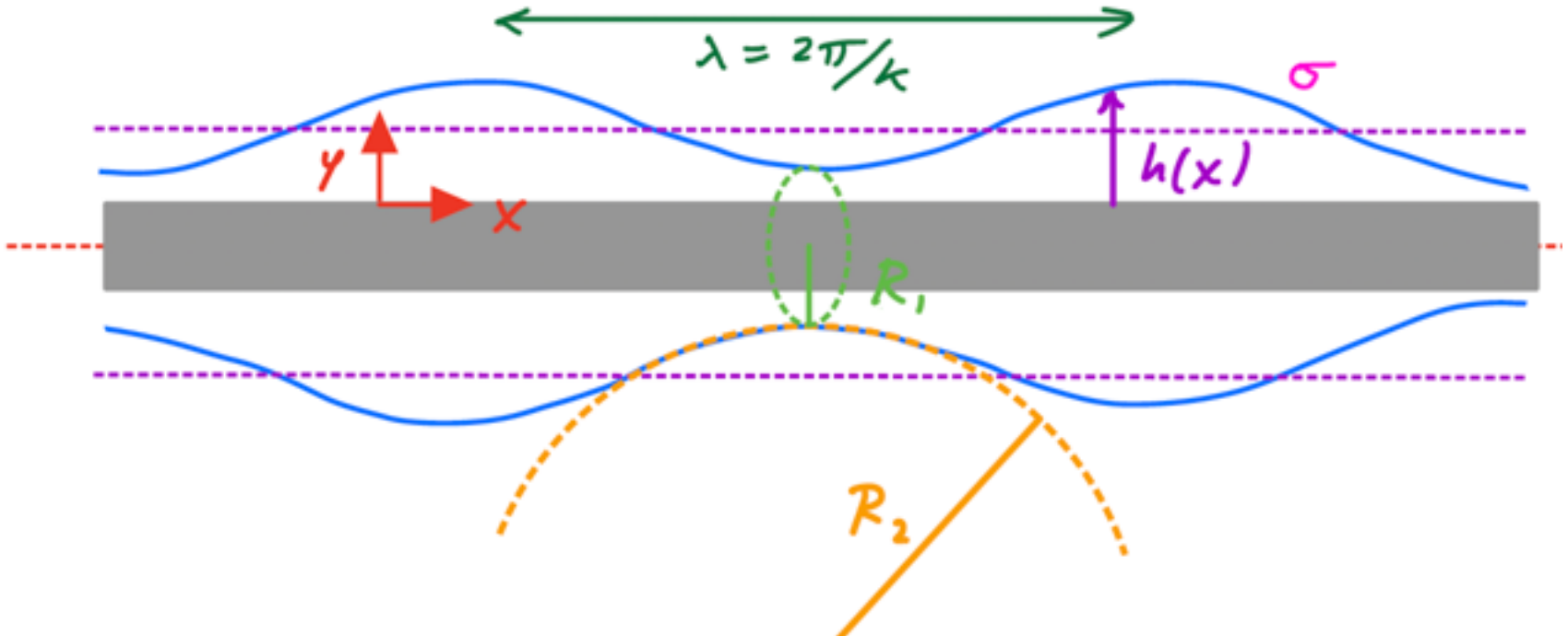
Bubble formation within a hose



Instability of a fluid coating on a fiber

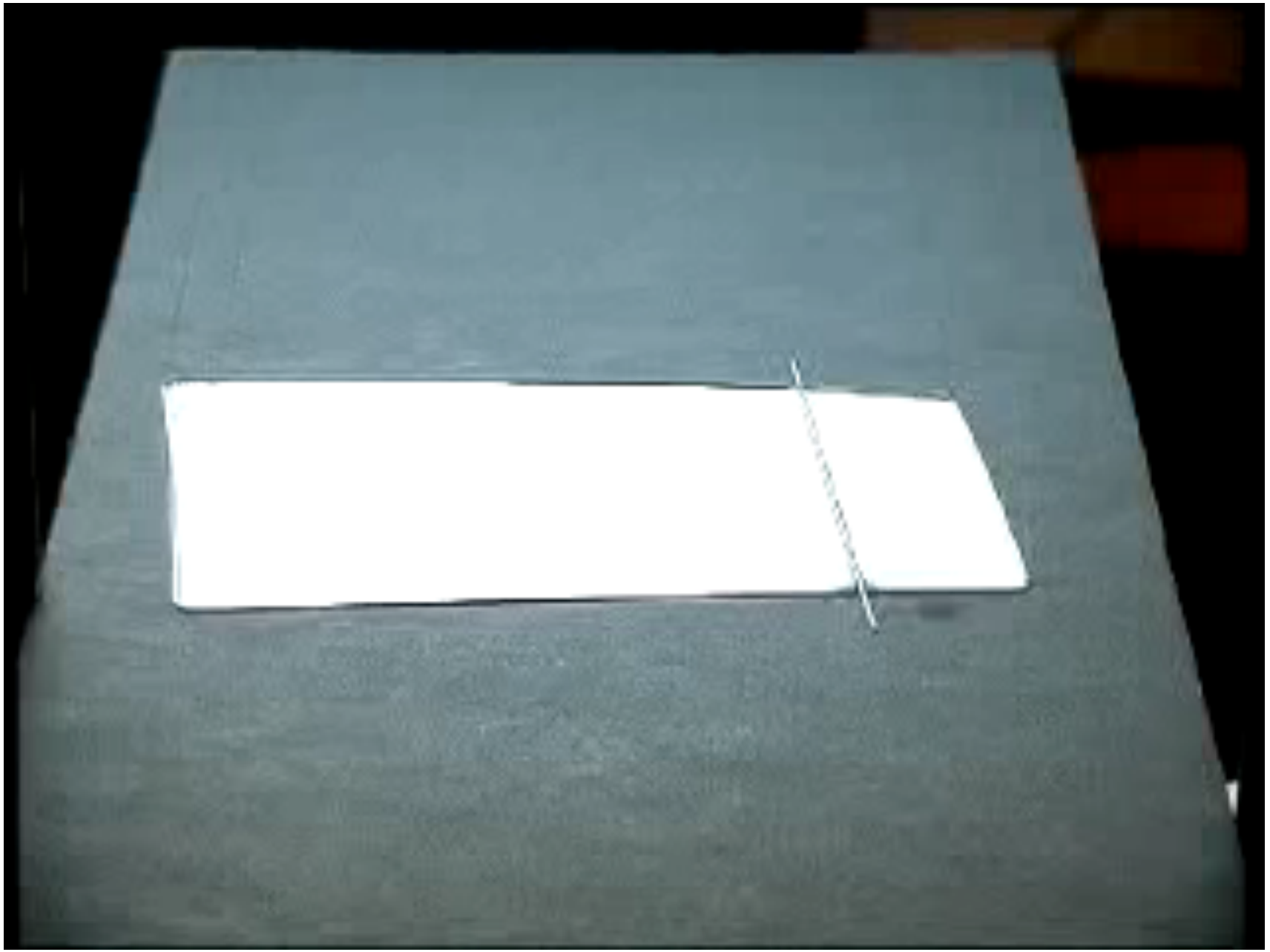






Fluid sheets

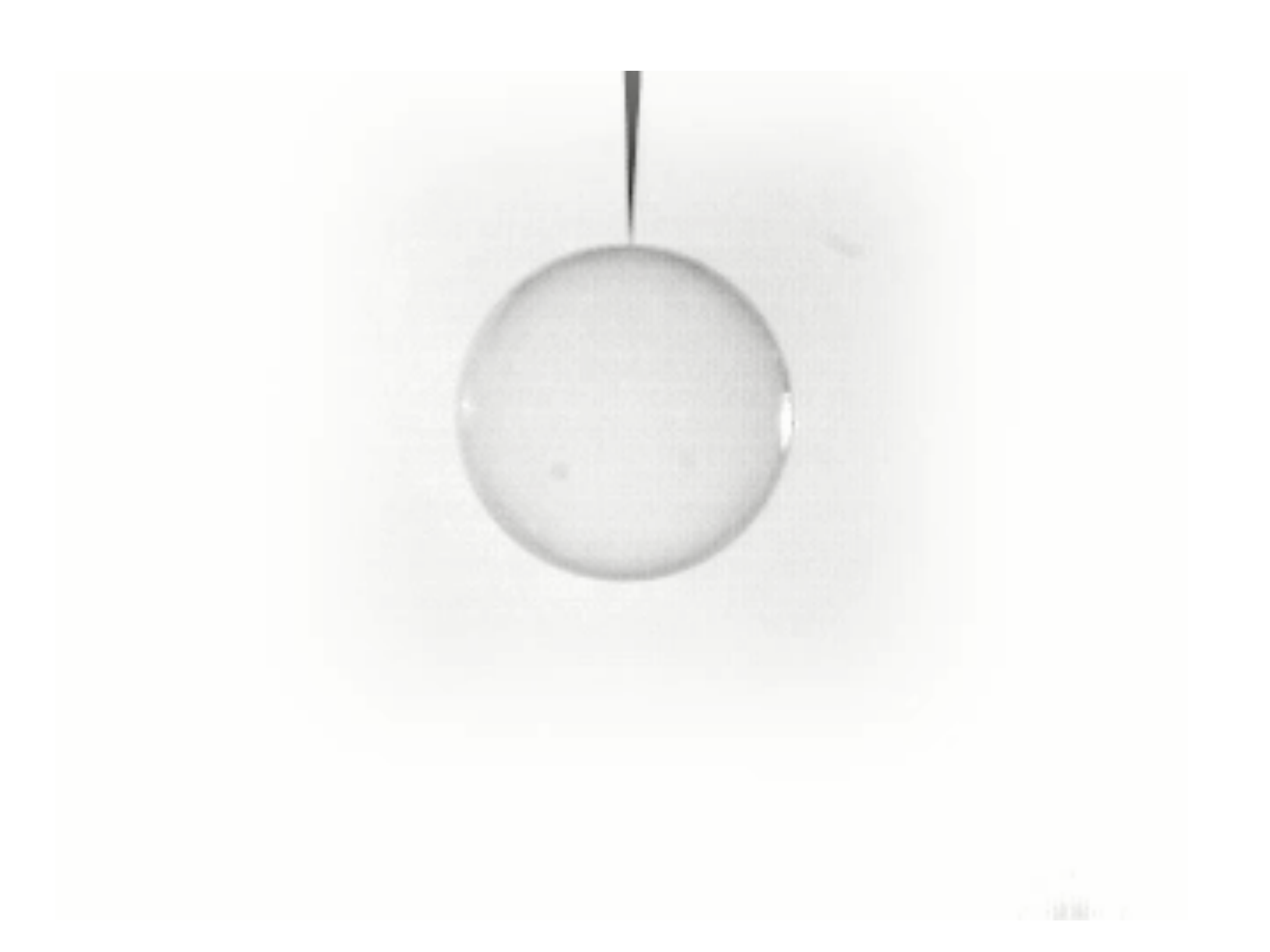
A burst soap film



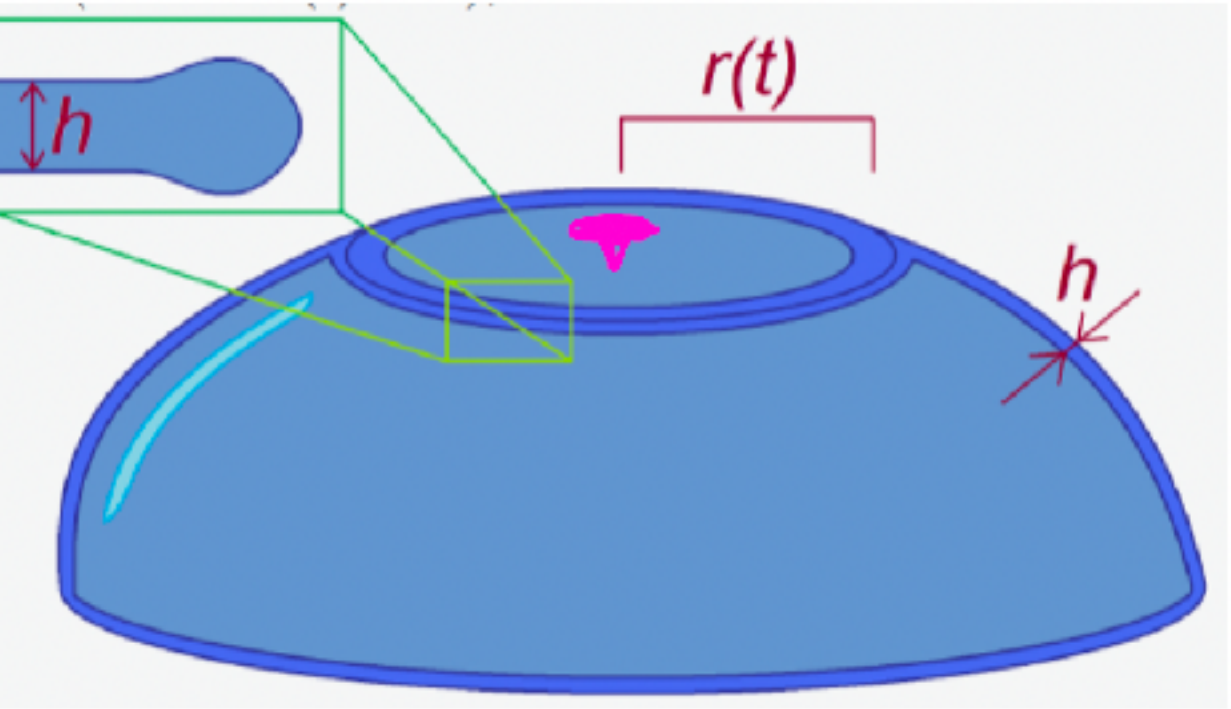
How fast does the rod move?

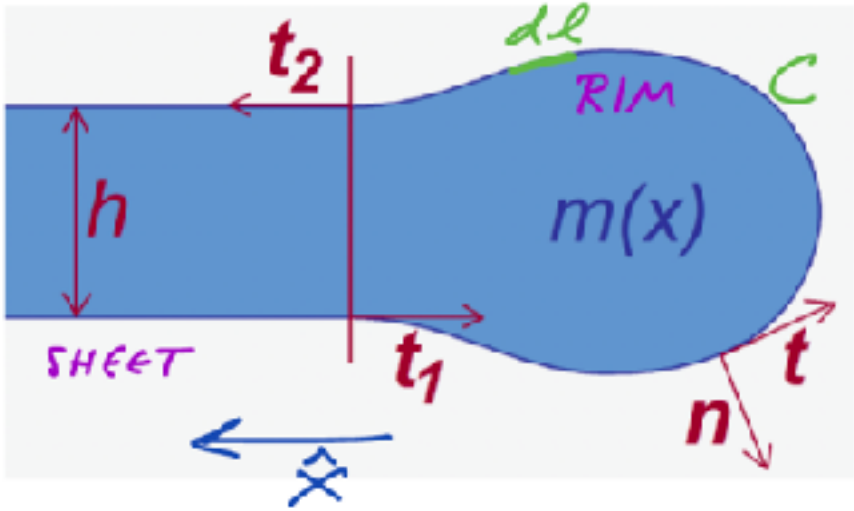
A bursting bubble

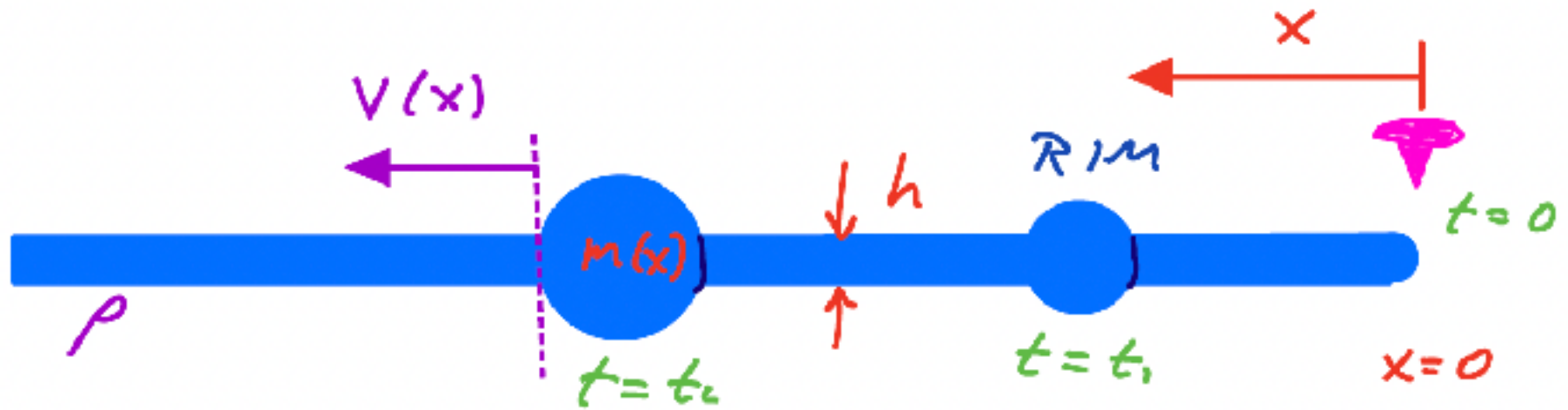
Speed of retraction? Film shape and stability?



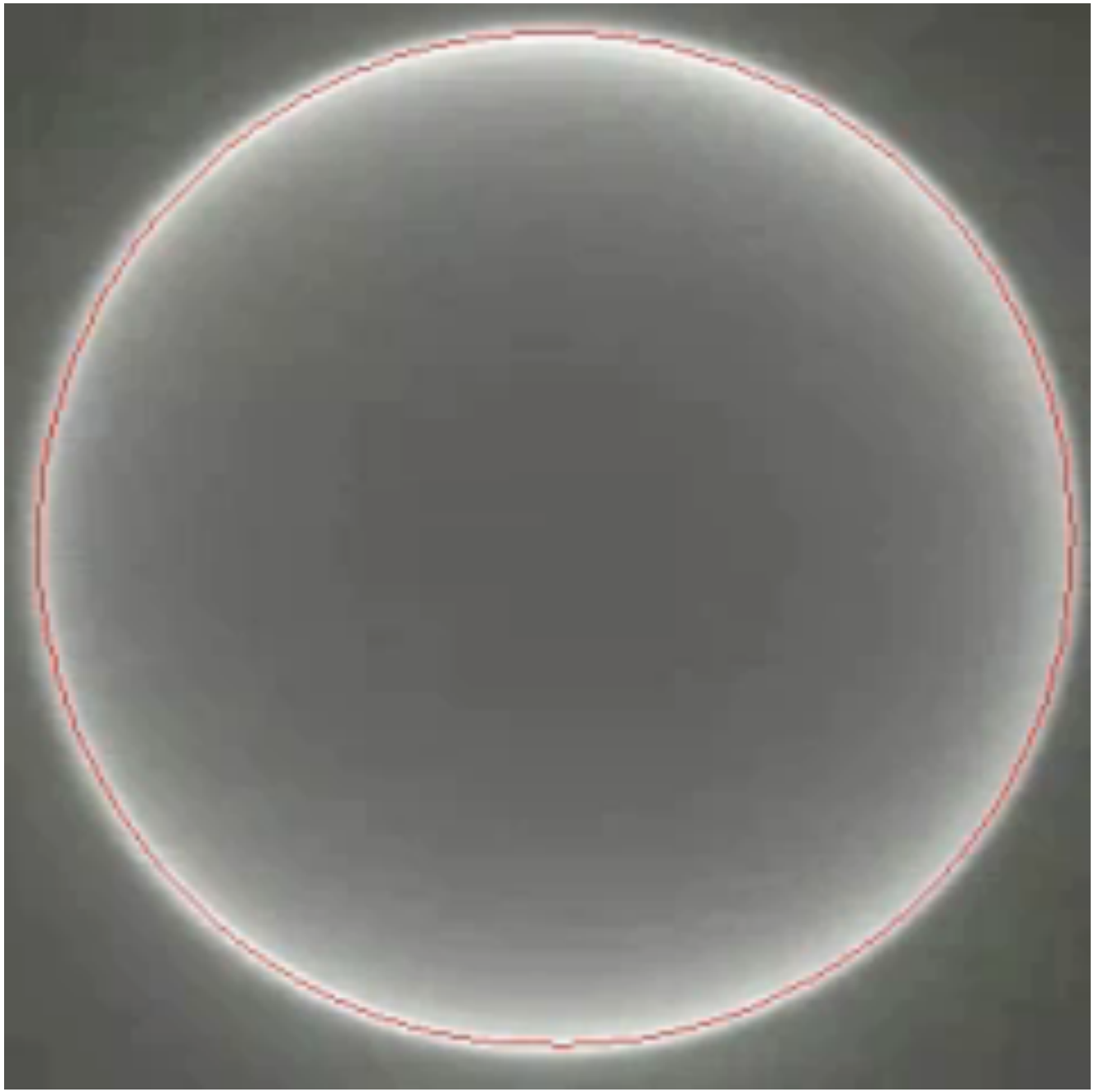
Sheet retraction



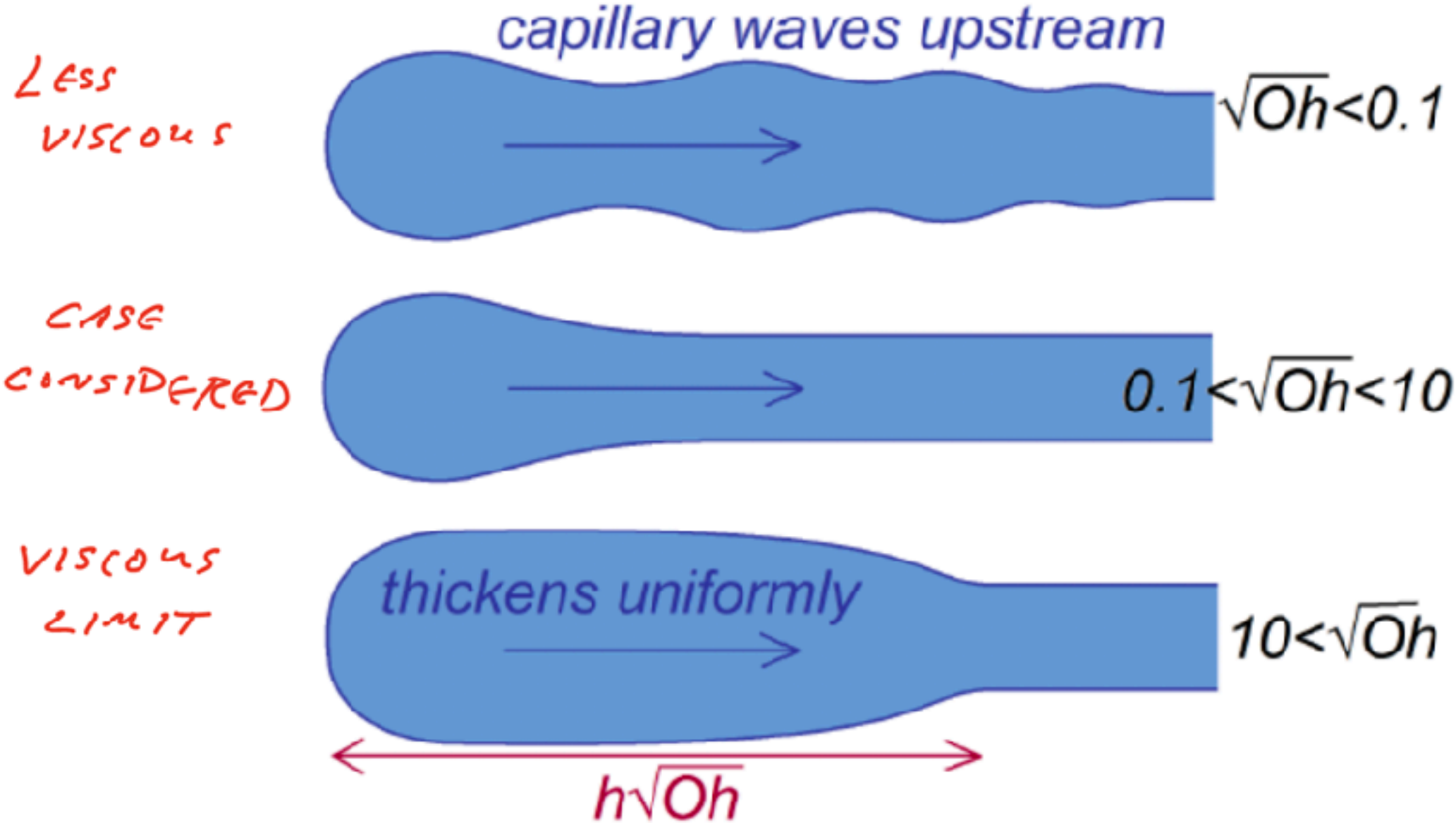




A self healing bubble

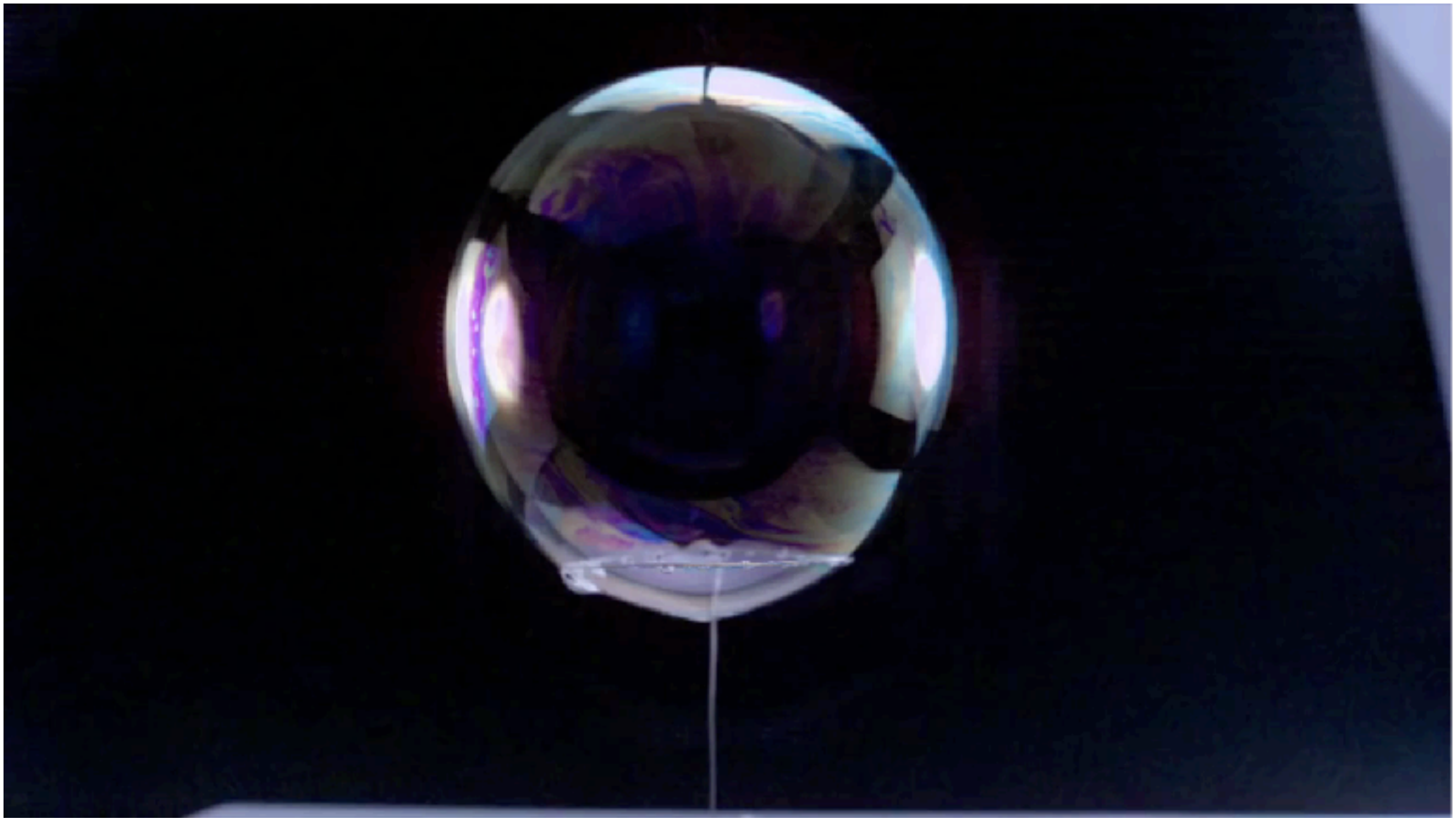


Dependence of dynamics on Oh

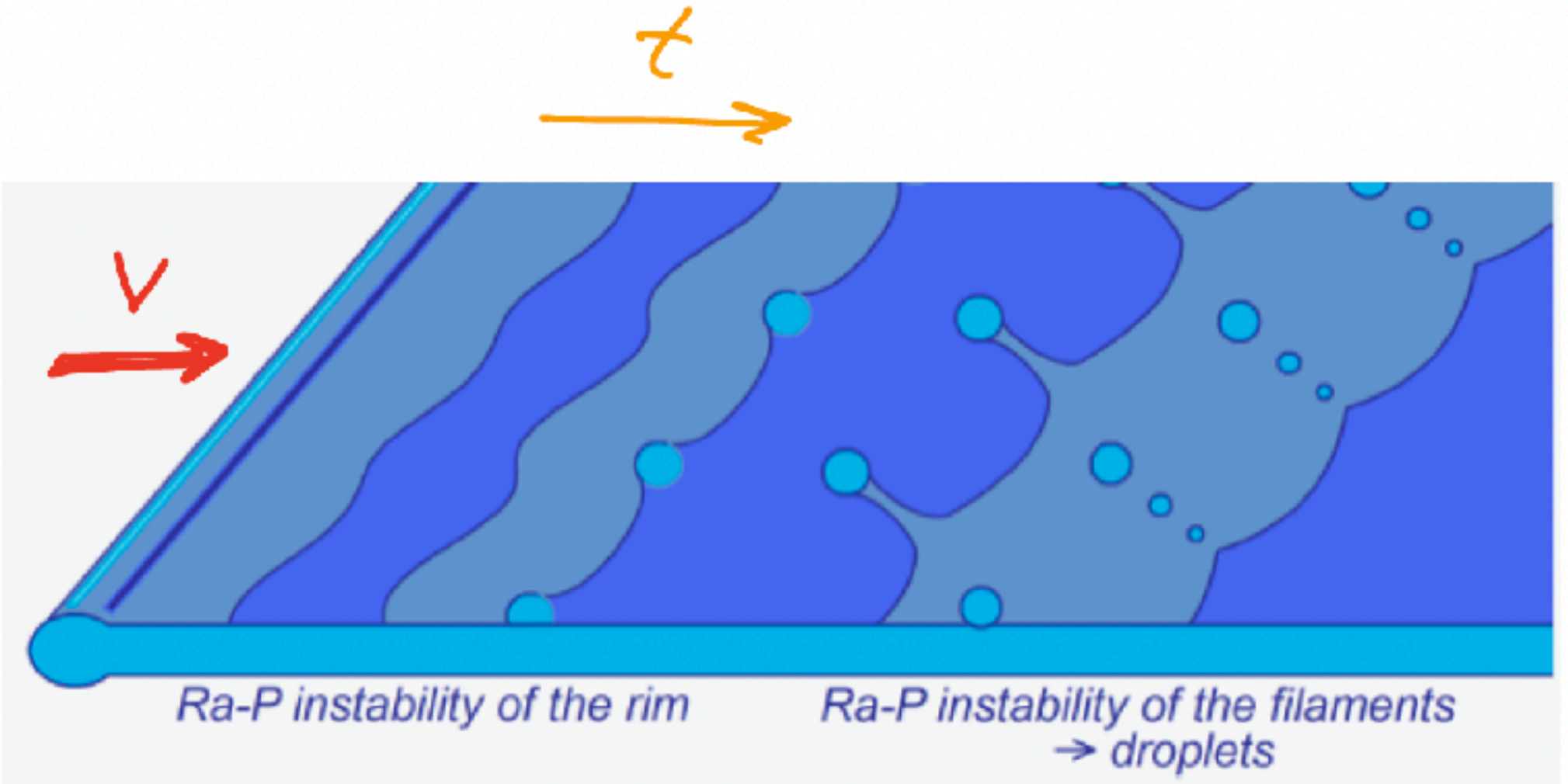


Savva & Bush (JFM, 2009)

Another look at film retraction



Capillary break-up of retracting rim



Flapping retracting soap films

(Lhuissier & Villermaux, *PRL*, 2009)

- rationalized in terms of Marangoni elasticity of the film