**A drop of spectroscopy**

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**The Phenomenon**

- Silicon oil (1.5, 10, 100 cSt)
- Silicon oil (1000 cSt)

\[ \omega = 2\pi f \]

\[ \Gamma = \frac{A\omega^2}{g} \]

\( \rightarrow \) Vibrate the liquid surface


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**Plan**

1. Bouncing droplet mechanism
2. Resonant and rolling droplet

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**Bouncing Threshold**

![Graph showing bouncing threshold for different viscosities](image)

**Bouncing droplet mechanism**

\[ F_{app} = \frac{\Gamma d^2}{2x} \]

\[ \Gamma = mg(\cos(2\pi ft) - 1) + F_{App} \]

*NEW*

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**Bouncing droplet**

\[ F \leftrightarrow F_{app} \]

Lubrication force

Dynamic of the air film

*Droplet deformation*
Bouncing droplet mechanism

- Bouncing droplet = Damped driven harmonic oscillator
- surface tension = restoring force
- viscosity = damping process

Threshold curve
- minimum: system resonance frequency $\omega_{res}$
- divergence: droplet natural resonance $\omega_c$

Rayleigh spherical harmonics $Y_l^m$

Threshold curve
- $f(\text{Hz})$
- $\omega_{res}$, $\omega_c$

 usually, $f\text{resonance}(\ell) = \alpha f_R(\ell)$ with $\alpha \rightarrow$ excitation geometry

Resonant Modes

Roller Mode

Divergence?
Bouncing droplet mechanism
- Bouncing droplet = damped driven harmonic oscillator
- Threshold curve extrema -> resonance

Self-propelled droplet
- Roller

Mayonnaise droplet

see GFM 2008