CONTROLLED ACTUATION OF SELF-PROPELLED DROPLETS

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Liquid in a wedge...

Natural occurrence: feeding phalarope shorebird

Theoretical equilibrium: energy based model

\[ U = A_{SL} \gamma_{SL} + A_{LG} \gamma_{LG} + A_{SG} \gamma_{SG} = \gamma_{SG} (A_{SL} + A_{SG}) + \gamma_{LG} (A_{LG} - A_{SL} \cos \theta) \]

Self-propulsion behaviour...

... And superhydrophobic surfaces

Super-non-wetting regime (lotus leaf effect)
- Contact angle \( \theta > 150^\circ \)
- Cassie-Baxter model

Surface fabrication
Using NeverWet for the present study

Actuation of protein-laden droplets

Further development potential
- Droplet generation and transport
- Combining self propulsion and electrowetting for enhanced control over actuation
- Digital microfluidics using localised deflection of flexible membranes

Conclusion

Self-propulsion of liquid in non-wetting wedges offers interesting development perspectives for handling biomaterial-laden droplets in lab-on-a-chip devices

References