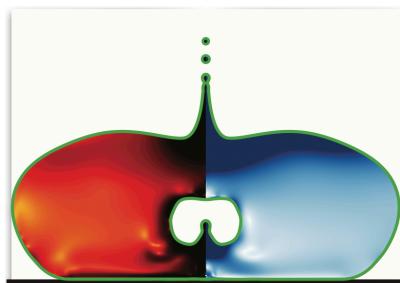


Singularities in soft matter systems

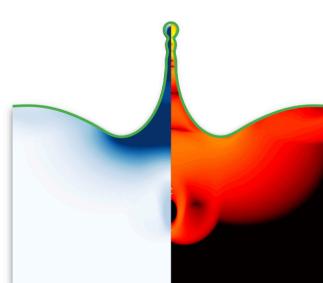
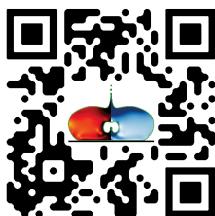


Vatsal Sanjay (CoMPhy Lab)

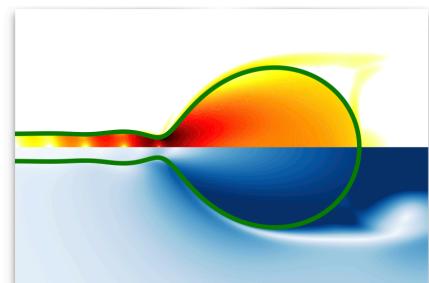
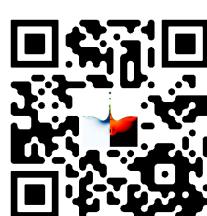
Soft matter flows frequently exhibit hydrodynamic singularities arising from the interplay of capillarity, inertia, viscosity, and elasticity. This talk explores such singularities across drops, bubbles, and thin films, combining experiments, direct numerical simulations, and theory. First, we investigate Worthington jets produced by drop impacts on superhydrophobic substrates, where discrete peaks in normal force mark singular events [1]. Next, we examine bursting bubbles in Newtonian and viscoelastic media, connecting elastic and viscous stresses to jet formation and droplet ejection [2]. Finally, for retracting liquid films, we demonstrate that classical Taylor–Culick dynamics harbours singular limits: a viscous anomaly in the Newtonian case and elastic stress blow-up in the viscoelastic regime [3]. By exploring this multidimensional phase space, we uncover new physical insights into these systems. The findings carry direct implications for manufacturing processes, droplet transport, and pathogen dispersal mitigation.



1. Drops



2. Bubbles



3. Sheets



References

- [1] V. Sanjay, B. Zhang, C. Lv, and D. Lohse, "The role of viscosity on drop impact forces on non-wetting surfaces," *J. Fluid Mech.*, vol. 998, p. A40, 2024, doi: [10.1017/jfm.2024.982](https://doi.org/10.1017/jfm.2024.982).
- [2] A. K. Dixit, A. Oratis, K. Zinelis, D. Lohse, and V. Sanjay, "Viscoelastic Worthington jets and droplets produced by bursting bubbles," *J. Fluid Mech.*, vol. 1010, p. A2, 2025, doi: [10.1017/jfm.2025.237](https://doi.org/10.1017/jfm.2025.237).
- [3] V. Sanjay, U. Sen, P. Kant, and D. Lohse, "Taylor–Culick retractions and the influence of the surroundings," *J. Fluid Mech.*, vol. 948, p. A14, 2022, doi: [10.1017/jfm.2022.671](https://doi.org/10.1017/jfm.2022.671).

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