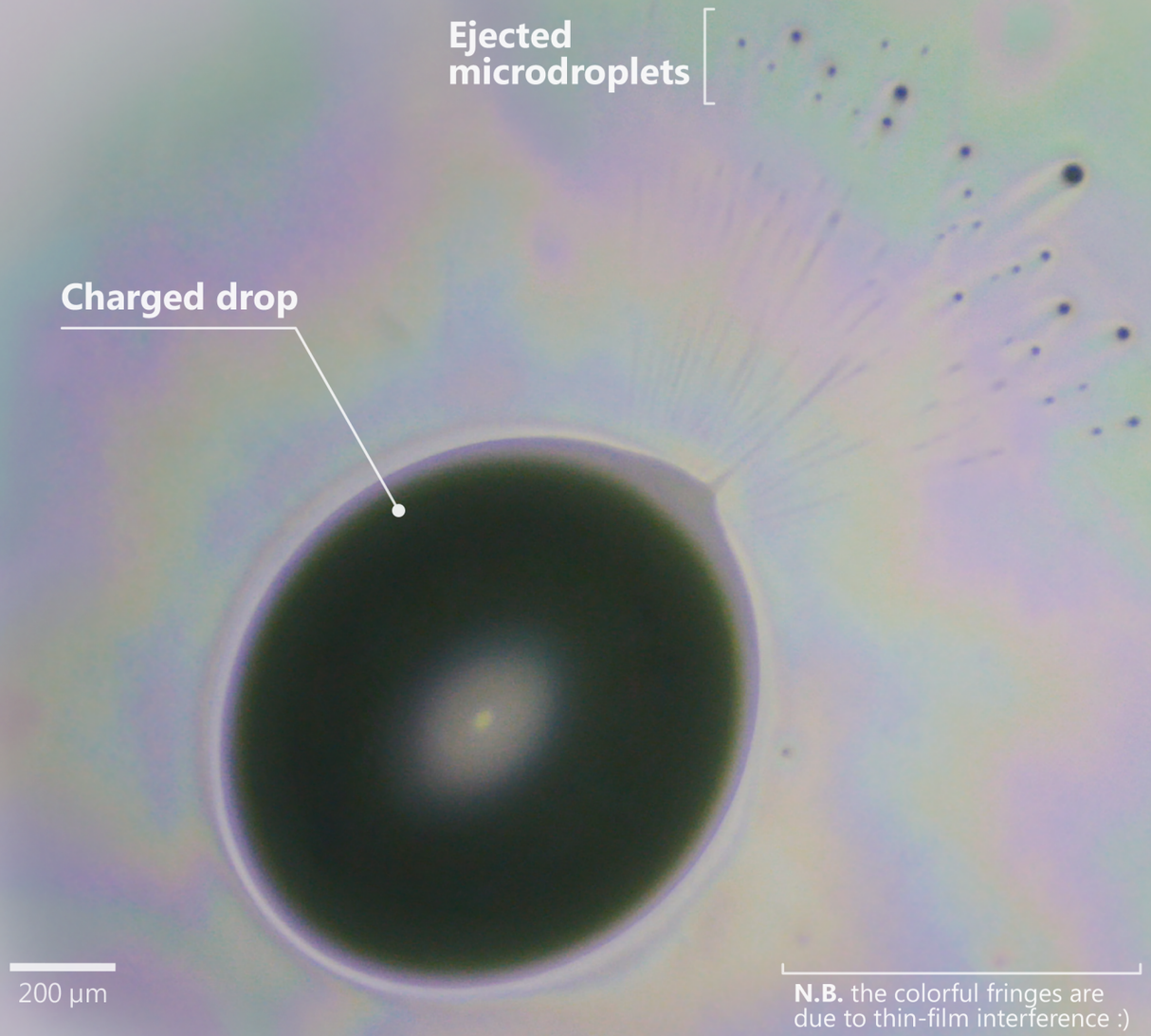
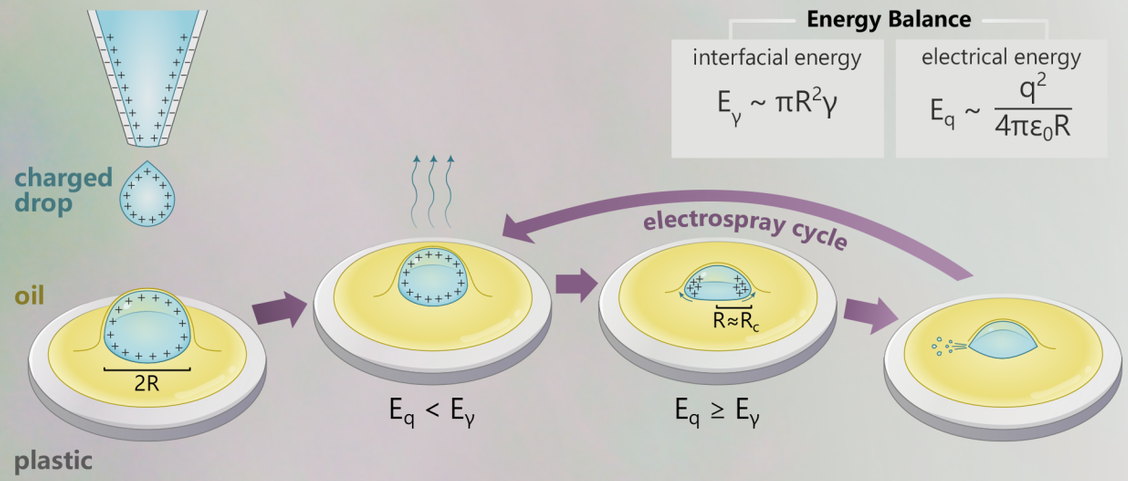
Electrospray-in-a-drop on Lubricated Surfaces

Marcus Lin, Fauzia Wardani, Dan Daniel - KAUST

droplet lab
https://dropletlab.science

Check out our winning video of the **electrospray**! ▶





Our recent study reveals fascinating **electrospray** behavior when a charged water drop evaporates on a plastic surface coated with a thin oil film. The drop acquires its charge through **contact electrification** with a plastic pipette during deposition. As it evaporates and approaches a critical size R_c, its **charge density increases until $E_q > E_\gamma$**, triggering the emission of a fine jet that disintegrates into 20–30 charged microdroplets. These microdroplets repel one another and spread outward in a pattern reminiscent of electrosprays. The removal of excess charge allows the drop to regain its spherical shape before repeating the electrospray cycle.

A single millimetric drop can undergo transient but **highly periodic electrospray events** (> 60 cycles in 30 minutes), each occurring within microseconds, offering exciting opportunities for controlled micro- and nanoscale material fabrication.