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The Electrostatic Bell GUILLAUME MARTROU, MARC LEONETTI, Aix Marseille Univ, CNRS, Centrale Marseille, IRPHE, Marseille, France — An initially static fluid-fluid interface is known to become unstable under a strong electric field leading to jet instability, surface pattern and spout formation. Applying an electric field to an initial dripping mode accelerates the dripping rate and leads to a continuous jet mode. We show that those two different configurations, when applied to dielectric liquids, can lead to the same instability, the formation of an unexpected macroscopic fluid bell-shape of typical size few times the capillary length even if the needle is as small as 200 μm. The instability results from the competition between the dielectric and the gravity forces, reminiscent of the Taylor-Melcher mechanism. The study is performed on several fluids of various densities, permittivity and surface tension on a large range of electric field. We show that the transition is an imperfect subcritical bifurcation with its characteristic bottleneck effect (lag time). Finally, in the case of flow rate, we established a shape diagram with four domains corresponding to dripping, jetting, bridge and electrostatic bell.

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