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**Resolving anomalies in contrasting droplet dynamics under direct and alternating current electrical forcing** KIRTI SAHU, Indian Institute of Technology Hyderabad, SUMAN CHAKRABORTY, Indian Institute of Technology Kharagpur, India — Electrically driven dynamics of droplets has given rise to several apparent anomalies, as attributable to complex interconnections between the underlying physical forces and geometrical dimension driven morpho-dynamic topology. In sharp contrast to reported theory on electro-mechanics of droplets that trivially predicts shape oscillations of a droplet subjected to alternating current electric field about the steady state deformation under an equivalent root mean square direct current electric field under all possible electrical conductivity and permittivity contrasts of the droplet and the carrier phase, here we bring out a novel dimensionality driven physical paradigm under which the same does not necessarily hold true. Our results reveal a dramatic reversal in shape transition to an elongated profile in a direction orthogonal to the electric field, in contrast to the classically postulated elongated shape in the direction of the electric field, as the electric field is changed from alternating to a direct one, for contrasting permittivity and electrical conductivity ratios. We attribute these findings to dimensionality driven topological transitions and validate the same with reported experiments.

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