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Theory of water and charged liquid bridges

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The phenomena of liquid bridge formation due to an applied electric field is investigated. A new solution for the charged catenary is presented which allows to determine the static and dynamical stability conditions where charged liquid bridges are possible. The creeping height, the bridge radius and length as well as the shape of the bridge is calculated showing an asymmetric profile in agreement with observations. The flow profile is calculated from the Navier Stokes equation leading to a mean velocity which combines charge transport with neutral mass flow and which describes recent experiments on water bridges.

Comments: 10 pages 12 figures, misprints corrected, assumptions more transparent

Subjects: **Classical Physics (physics.class-ph)**; Soft Condensed Matter (cond-mat.soft); Fluid Dynamics (physics.flu-dyn)

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