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**Instability and pattern formation in electrifield liquid layers** QIMING WANG, York University, DEMETRIOS PAPAGEORGIOU, Imperial College London — The stability and axisymmetric deformation of two immiscible, viscous, perfect or leaky dielectric fluids confined in the annulus between two concentric cylinders are studied in the presence of radial electric fields. The fields are set up by imposing a constant voltage potential difference between the inner and outer cylinders. We derive a set of equations for the interface in the long-wavelength approximation which retains the essential physics of the system and allows for interfacial deformations to be as large as the annular gap hence accounting for possible touchdown at the inner or outer electrode. As the layer thickness is asymptotically small, the system recovers the standard (modified) Hammond equation in the absence (presence) of electric fields. For both perfect and leaky dielectric liquids, the full nonlinear system is investigated numerically. It is shown that a two-side touching solution is possible for both the non-electrified and perfect dielectric cases, while only one-side touching is found in the case of leaky dielectric liquids, where the flattened interface shape resembles the pattern solutions found in literature. Meanwhile the finite-time singular solution agrees qualitatively with the experiments.

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