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Spreading of Charged Microdroplets

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We consider the spreading of a charged conducting droplet on a flat dielectric surface. Two forces drive the spreading: surface tension and electrostatic repulsion. By using the lubrication approximation we derive a fourth order nonlinear partial differential equation that describes the evolution of the height profile. We find that the equation has a two-parameter family of selfsimilar solutions. Some of the solutions are explicitly computed while the other solutions are studied numerically. We show that the solutions have moving contact lines and the radius of the drop is a power law of time with exponent one-tenth. We also construct explicit solutions corresponding to non-circular drops, whose interfaces are ellipses with constant focal length.

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