An isoperimetric problem with capacitary repulsion

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Talk Abstract

I will discuss a classical variational model of a charged droplet, given by the sum of a surface energy and a capacitary term, showing that it is mathematically ill-posed irrespectively of the degree to which the liquid is electrified. More specifically, an isolated spherical droplet is never a local minimizer, no matter how small is the total charge on the droplet, since the energy can always be lowered by an arbitrarily small distortion of its surface. This is in contrast with the experimental observations that a critical amount of charge is needed in order to destabilize a spherical droplet.

On the other hand, if the repulsion is stronger than the usual Coulombic one, the surface energy dominates the capacitary term at small scales. In this case, one can prove existence and regularity of minimizers for small charges. Combining this result with the stability of the ball under small regular perturbations, this leads to the minimality of the ball for small charges.

Keywords: charged droplets, nonlocal energies, isoperimetric problems.