Minimality of the ball for a model of charged liquid droplets

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We study minimizers for a variational model describing the shape of charged liquid droplets. The surface tension forces the particles to stay together whereas the electric charge causes repulsion. Thus, one expects a certain transition to happen when increasing the charge. This heuristic is indeed confirmed by the experiments first conducted by Zeleny in the beginning of the previous century. A spherical droplet, when exposed to an electric field, remains stable until the charge reaches a certain critical value. The droplet then starts developing singularities.

There are several models trying to capture this phenomenon. We work with the variational model proposed by Muratov and Novaga, as the most commonly used Rayleigh's one is ill-posed. Using the recent regularity result by De Philippis, Hirsch, and Vescovo we are able to prove that the only minimizers in the case of small charge are balls.

This is a joint work with Giulia Vescovo.