# Perimeter regularization of attractive-repulsive nonlocal energies

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We consider a nonlocal interaction model defined over sets of given volume where an attractive-repulsive interaction is perturbed by a surface energy controlled by a parameter. These energies are directly connected to some aggregation models, which have a wide range of applications from collective behavior such as biological and robotic swarming to models of granular media and self-assembly of nanoparticles. We first show that while attractive-repulsive energies do not admit minimizers for small volumes, this regularization restores the existence of minimizers for all values. We furthermore investigate the stability thresholds of the ball, and obtain its local minimality. Our results show that for small perimeter regularizations, the ball is a stable critical point of the energy for small and large volumes; however, it loses its stability for intermediate values of volume. This is a joint work with Marco Bonacini.

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