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Flatness of nonlocal phase transition in low dimensions

Eleonora Cinti¹, Joaquim Serra², Enrico Valdinoci¹

We consider nonlocal functionals, like fractional perimeter or the energy functional associated to the fractional Allen-Cahn equation, in dimensions $n = 2$ and $n = 3$. It is known that nonlocal minimal surfaces are flat in dimension 2, and that the level sets of minimizers for the s -fractional Allen-Cahn equation in the all space are flat in dimension 2 for any s and in dimension 3 for any $1/2 \leq s < 1$. We give a quantitative version of these results, in the following sense: we prove that the level sets of minimizers in a ball of radius R are nearly flat in B_1 , when R is large enough. More precisely, we establish a quantitative estimate on how close these surfaces are (in the L^1 -sense and in the L^∞ -sense) to be a plane, depending on R . Our approach does not use the Caffarelli-Silvestre extension, and can be applied to more general nonlocal functional, like, for example, the anisotropic fractional perimeter. This is a joint work with Joaquim Serra and Enrico Valdinoci.

¹Weierstras Institut fur Angewandte Analysis und Stochastik,
Hausvogteiplatz 11A, 10117 Berlin, Germany.
cinti@wias-berlin.de, enrico.valdinoci@wias-berlin.de

²Universitat Politècnica de Catalunya,
Departament de Matemàtica Aplicada I,
Diagonal 647, 08028 Barcelona, Spain.
joaquim.serra@upc.edu