Mathematics and CS Seminar

A nonlocal isoperimetric problem with dipolar repulsion

Thilo Simon
New Jersey Institute of Technology

Host: Julian Fischer

A number of fundamental questions about the structure of matter can be formulated as problems in energy-driven pattern formation. For example, Gamow's liquid drop model addresses the shape and stability properties of atomic nuclei as arising from competition between long-range Coulomb repulsion and short-range attraction modeled by surface tension. We discuss a related model for perpendicularly oriented dipoles in the plane, and in which perimeter (representing line tension) and regularized 3D dipolar repulsion compete under a volume constraint. Examples of such situations are Langmuir monolayers and the patterns formed in ultrathin ferromagnetic films with perpendicular anisotropy.In contrast to previously studied similar problems, the nonlocal term contributes to the perimeter term to leading order for small regularization cutoffs. For subcritical dipolar strengths we prove that the limiting functional is a renormalized perimeter and that for small cutoff lengths all minimizers are disks. For critical dipolar strength, we identify the next-order ?-limit when sending the cutoff length to zero and prove that with a slight modification of the dipolar kernel there exist masses for which classical minimizers are not disks.This talk is joint work with Cyrill B. Muratov

Friday, January 11, 2019 09:30am - 10:30am
Big Seminar room Ground floor / Office Bldg West (I21.EG.101)

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