Variational convergence of liquid crystal energies to line and surface energies

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In the first part of this talk we present the main results based on [1]. We consider the Landau-de Gennes model for liquid crystals with an external magnetic field to model the occurrence of the Saturn ring effect around a spherical particle under the assumption of rotational equivariance. After a rescaling of the energy, a variational limit is derived. Our analysis relies on precise estimates around the singularities and the study of a radial auxiliary problem in regions, where a continuous director field exists. Studying the limit problem, we explain the transition between the dipole and Saturn ring configuration and the occurence of a hysteresis phenomenon, giving a rigorous explanation of what was derived and simulated previously by [2].
In the second part we want to show some ideas of an ongoing work on how to remove the assumption of rotational equivariance leading to a fully three-dimensional problem. Furthermore we consider the natural generalization of our energy for particles of non-spherical (in particular non-convex) shape.

[1] F. Alouges, A. Chambolle, D. Stantejsky. *The saturn ring effect in nematic liquid crystals with external field : effective energy and hysteresis*, 2020. Http ://arxiv.org/pdf/2005.06238v1.

[2] H. Stark. *Director field configurations around a spherical particle in a nematic liquid crystal.* Eur. Phys. J. B, **10(2)**, 311–321, 1999. doi :10.1007/s100510050860.

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