XINYANG LU, Lakehead University

Estimates on a convex singular potential for nematic liquid crystals

Liquid crystals (LC) are an intermediate state of the matter between solids and liquids, They exhibit significant mobility, but differently from pure liquids, they have a preferred orientation, commonly referred to as "director". They appear from a wide variety of fields, such as electronics, biology, virology, etc. LCs themselves exhibit several phases, e.g. nematic, smectic, chiral/twisted, discotic, conic. Nematic LCs are the simplest ones, being characterized by only a director, without any polarization or more complicated structures.

Modeling LCs has been a long standing problem. One of the most widely models is the Landau-de Gennes theory. The main quantity is a 3×3 Q-tensor matrix, and the associated energy is composed of an elastic and a bulk part. Due to modeling requirements, the eigenvalues of the Q-tensor must be constrained in $(-1/3, 2/3)$, a condition known as "physicality". One way to enforce this is to add a convex singular potential ψ. Powerful from a theoretical point of view, such ψ is defined only implicitly, making its analysis quite challenging. In this talk, we will present several crucial estimates on ψ, and its derivatives.