XIN YANG LU, Lakehead University

A physicality-enforcing convex singular potential

Liquid crystals (LC) are an intermediate state of the matter between solids and liquids, exhibiting significant mobility, but also having a preferred orientation, commonly referred to as "director". 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. Modeling LCs has been a long standing problem. One of the most widely models is the Landau-de Gennes theory. In 3D, the main quantity is a 3×3 Q-tensor matrix. 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 singular convex potential ψ, introduced by Ball and Majumdar. Powerful from a theoretical point of view, such ψ is defined only implicitly, as the integral of an entropy-like term, making its analysis quite challenging. In this talk, we will present several crucial estimates on ψ and its derivatives.