Effect of flexoelectricity on the defect cores in nematic liquid crystals

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Nematic liquid crystals have an apolar director. Nevertheless, a macroscopic polarization can be induced in the medium by splay and bend elastic deformation of the director field[1]. Flexoelectric polarization is given by gradients of the director field. Consequently, it is largest in the regions surrounding the nematic defects and it can become of substantial importance in confined geometries such as nematic colloids, in particular if external fields are applied.

Here we present initial results of our numerical study, which characterizes various configurations of the nematic in terms of flexoelectricity. Modelling is based on numerical minimization of the phenomenological total free energy[2] combined with the iteratively coupled numerical determination of the electric potential in the anisotropic nematic medium. Director configurations of a bend-splay cell and radial nematic-filled sphere are first considered. The study shows that the electric potential of ~0.4 V can be induced by flexoelectric effect in nematic-filled sphere with diameter of 650nm. The flexoelectric contribution to the total free energy is discussed. For different flexoelectric coupling strengths, changes in the core of the defects are observed. Flexoelectric study is generalized to nematic liquid crystal colloids with single and entangled particles.

(1) P.G. de Gennes and J. Prost, *The Physics of Liquid Crystals* **1993**, Oxford University Press
(2) M. Ravnik and S. Žumer, *Soft Matter* **2009**, *5*, 269

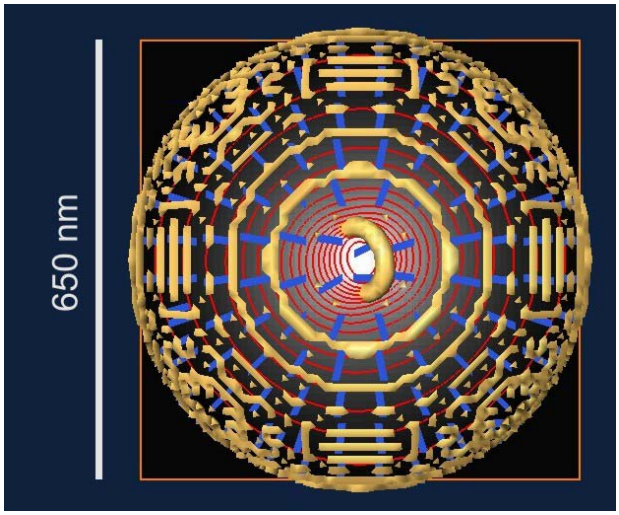

Figure: Potential induced by flexoelectricity in a radial nematic-filled sphere. Radial point defect has opened into a small ring and is drawn as an isosurface of the nematic degree of order S=0.4. Director is shown in blue. Isolines in red represent electric potential and differ for 0.02 V.