



Electrical Driven Motions and Rotational Dynamics of Colloidal Platelets in Nematic Liquid Crystals

Chaitan P. Lathia^{1,2}, Sreyas H. Suresh^{1,2}, G. M. S. V. I. S. Iyer^{1,3,*}

¹Department of Physics and Liquid Crystals Materials Research Center, University of Colorado at Boulder, Boulder, Colorado 30309, USA

²Department of Chemistry and Biochemistry, Department of Physics and Astronomy, and California Nanosystems Institute, University of California at Los Angeles, Los Angeles, California 90095, USA

³Renewable and Sustainable Energy Institute, University of Colorado at Boulder, Boulder, Colorado 30309, USA

*Corresponding Author: Email: isyer@colorado.edu

Abstract: We study the rotational dynamics of colloidal platelets in a nematic liquid crystal under the influence of an external electric field. The platelets are shown to exhibit a rich variety of rotational behaviors, including steady-state rotation, oscillatory rotation, and non-rotational states. The rotational dynamics are governed by the interplay of the electric field, the nematic director field, and the hydrodynamic interactions between the platelets and the surrounding liquid crystal. The results are compared with theoretical predictions and experimental observations.

Keywords: Colloidal platelets, Nematic liquid crystal, Rotational dynamics, Electric field, Hydrodynamic interactions.

1. Introduction: Liquid crystals (LCs) are a class of materials that exhibit a degree of molecular order between the solid and liquid states. They are widely used in various applications, including displays, sensors, and microfluidics. In recent years, there has been significant interest in the study of colloidal particles in LCs, particularly in the context of active matter and soft matter physics. Colloidal particles in LCs can exhibit a variety of behaviors, including self-assembly, pattern formation, and collective motion. One of the most interesting aspects of colloidal particles in LCs is their rotational dynamics. In this paper, we study the rotational dynamics of colloidal platelets in a nematic LC under the influence of an external electric field. The platelets are shown to exhibit a rich variety of rotational behaviors, including steady-state rotation, oscillatory rotation, and non-rotational states. The rotational dynamics are governed by the interplay of the electric field, the nematic director field, and the hydrodynamic interactions between the platelets and the surrounding LC. The results are compared with theoretical predictions and experimental observations.

2. Experimental Setup: The experiments were performed using a custom-built setup. A nematic LC was confined between two glass plates. Colloidal platelets were dispersed in the LC. An external electric field was applied to the system using two electrodes. The electric field was controlled using a function generator and an amplifier. The rotational dynamics of the platelets were observed using a polarizing microscope. The data were collected using a camera and a computer. The results are presented in the following sections.

3. Results and Discussion: The rotational dynamics of the platelets in a nematic LC under the influence of an external electric field are shown to exhibit a rich variety of behaviors. The platelets can exhibit steady-state rotation, oscillatory rotation, and non-rotational states. The rotational dynamics are governed by the interplay of the electric field, the nematic director field, and the hydrodynamic interactions between the platelets and the surrounding LC. The results are compared with theoretical predictions and experimental observations. The following sections discuss the experimental setup, the results, and the discussion.

4. Conclusion: In conclusion, we have studied the rotational dynamics of colloidal platelets in a nematic LC under the influence of an external electric field. The platelets exhibit a rich variety of rotational behaviors, including steady-state rotation, oscillatory rotation, and non-rotational states. The rotational dynamics are governed by the interplay of the electric field, the nematic director field, and the hydrodynamic interactions between the platelets and the surrounding LC. The results are compared with theoretical predictions and experimental observations.

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36. Tables: [Tables]

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[Fig. 3()]

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