Optical Trapping, Manipulation, and 3D Imaging of Disclinations in Liquid Crystals and Measurement of their Line Tension

We demonstrate optical trapping and manipulation of defects and transparent microspheres in nematic liquid crystals (LCs). The three-dimensional director fields and positions of the particles are visualized using the Fluorescence Confocal Polarizing Microscopy. We show that the disclinations of both half-integer and integer strengths can be manipulated by either using optically trapped colloidal particles or directly by tightly-focused laser beams. We employ this effect to measure the line tensions of disclinations; the measured line tension is in a good agreement with theoretical predictions. The laser trapping of colloidal particles and defects opens new possibilities for the fundamental studies of LCs.

1. INTRODUCTION

2. EXPERIMENT

2.1. Materials and Cell Preparation

[illegible] #). [illegible] $\widehat{\mathbf{P}}$ [illegible] $\widehat{\mathbf{P}}_e \| \widehat{\mathbf{P}}$ [illegible] $\widehat{\mathbf{P}}_f \| \widehat{\mathbf{P}}$ [illegible]. [illegible] ([illegible]) [illegible]. [illegible] # [illegible] # [illegible]. [illegible]. [illegible]. [illegible] ~ [illegible] ([illegible]) [illegible] ([illegible] $\widehat{Z}$) [illegible].

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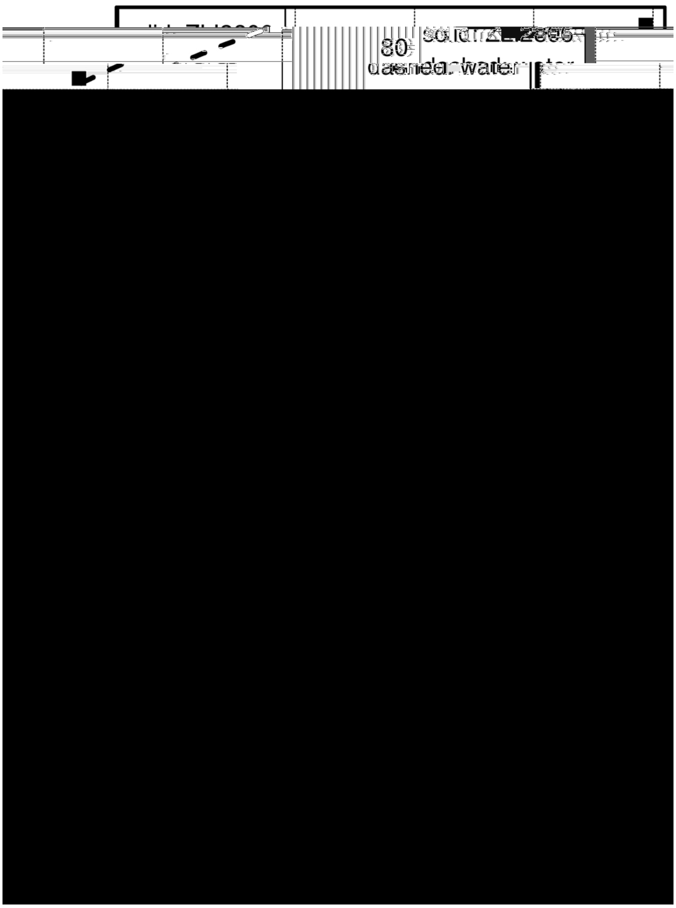

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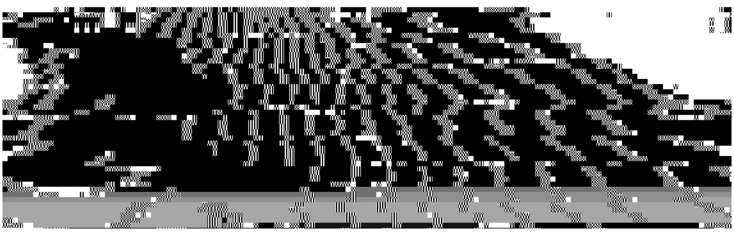
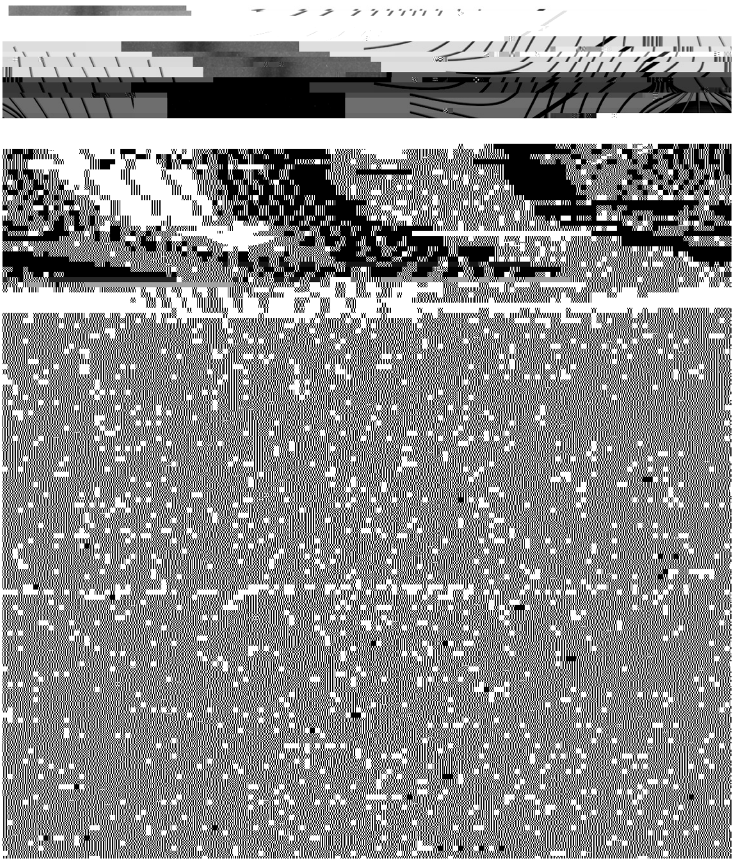
$m =$, $\Delta n \approx$. ,

[illegible] $\widehat{n}(r)$, γ [illegible]





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3.3. Measurements of the Disclination Line Tension

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$T_d = -$

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