

18<sup>th</sup> International Conference on Ferroelectric Liquid Crystals

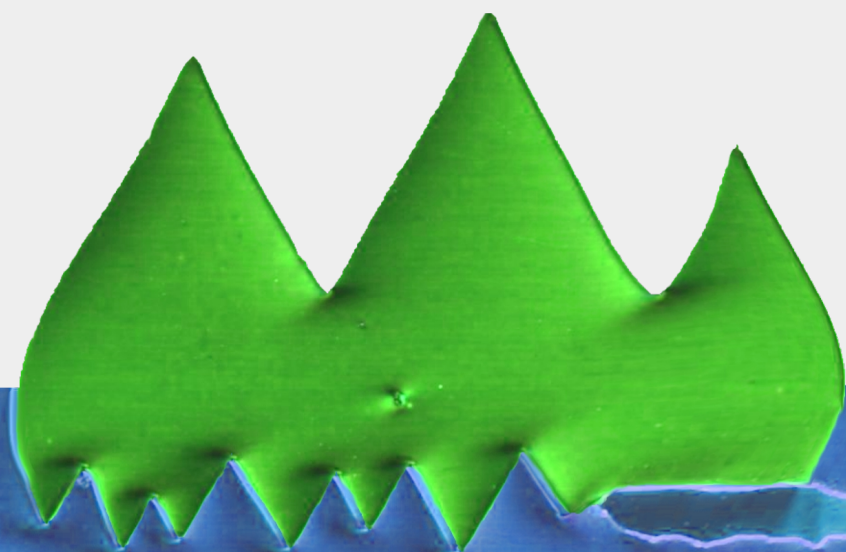
# Polarity and Chirality in Soft Matter

September 6–10, 2021

Ljubljana, Slovenia

## Book of Abstracts

Editor: Mojca Vilfan



## Polarization rotation by cholesteric layers with tangential-conical boundary conditions

V.S. Sutormin<sup>1,2</sup>, M.N. Krakhalev<sup>1,2</sup>, I.V. Timofeev<sup>1,2</sup>, R.G. Bikbaev<sup>1,2</sup>,  
O.O. Prishchepa<sup>1</sup>, and V.Ya. Zyryanov<sup>1</sup>

<sup>1</sup> Kirensky Institute of Physics, Federal Research Center KSC SB RAS, Krasnoyarsk, Russia

<sup>2</sup> Siberian Federal University, Krasnoyarsk, Russia

Cholesteric liquid crystal (CLC) is a chiral molecular system with high sensitivity to external factors. Nowadays, the CLC cells with tangential, homeotropic, and hybrid homeplanar boundary conditions are well studied. Recently, the orientational structures of CLC with tangential-conical boundary conditions have been investigated [1,2]. In the present work, we consider the polarization characteristics of light passed through such CLC cells.

The experiment was carried out with sandwich-like cells consisting of two glass substrates coated with polymer films and the cholesteric layers of various thickness between them. The nematic mixture LN-396 (Belarusian State Technological University) doped with the left-handed chiral additive cholesterylacetate was used as a cholesteric liquid crystal. One substrate was covered by the polyvinyl alcohol and another one was covered by poly(isobutyl methacrylate) which for LN-396 specify the tangential and conical boundary conditions, respectively. The ratio of CLC layer thickness  $d$  to the helix pitch  $p$  was 0.61 for all samples under study.

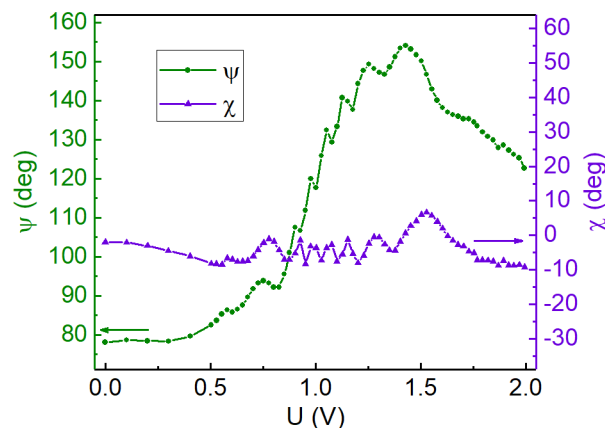


Figure 1: Experimental dependence of the polarization azimuth  $\psi$  and ellipticity angle  $\chi$  of the transmitted light from the applied voltage  $U$ . Thickness of CLC layer  $d = 35.3 \mu\text{m}$ . Cholesteric pitch  $p = 57.6 \mu\text{m}$ . Wavelength of incident linear-polarized light  $\lambda = 632.8 \text{ nm}$ .

It has been revealed that considered CLC cells with tangential-conical boundary conditions can operate as electrically controlled achromatic polarization rotator. Such cells allow turning the polarization azimuth more than  $70^\circ$  using the control voltage less than 2 V. The observed behaviour of polarization rotation is connected with the unique untwisting effect of the cholesteric helix due to the free azimuthal rotation of the director on the substrate with conical anchoring.

This work was supported by the Russian Science Foundation (No. 18-72-10036).

[1] M.N. Krakhalev, R.G. Bikbaev, V.S. Sutormin, I.V. Timofeev, V.Ya. Zyryanov, *Crystals* **9**, 249 (2019).

[2] M.N. Krakhalev, O.O. Prishchepa, V.S. Sutormin, R.G. Bikbaev, I.V. Timofeev, V.Ya. Zyryanov, *Scientific Reports*, **10**, 4907 (2020).