Abstract

Dipl.-Phys. Jana Heuer: Electro-optic phenomena in nematic liquid crystals

Liquid crystals are due to their striking elektro-optic properties not only fundamental for many technologies but they are also object of fruitful basic research. On the one hand they are fundamental for the development of displays, electronic ink or adaptive lenses. But liquid crystals are also particularly suitable to investigate for example pattern forming phenomena und dynamic properties of periodically excited systems in general.

In the present dissertation, two electro-optic phenomena in nematic liquid crystals are studied: the electro-hydrodynamic convection (EHC) as well as the Fréedericksz transition. The first topic deals with the investigation of the dynamic properties of convection patterns. The spatio-temporal properties of the electrically driven patterns depend on the temporal symmetries of the excitation wave form. Here, depending on these symmetries, the changes of the properties of the EHC patterns are investigated when the excitation function is time reversed.

The formation of novel structures in unconventional liquid crystal materials is the second topic. The dependence of the type of the convection patterns on the excitation parameters, the certain optic properties as well as transitions between different pattern types are investigated.

The third topic is the Fréedericksz transition. This reorientation of the director ist studied under the influence of a combination of an inhomogeneous electric field and a magnetic field. An experimentally observed effect that breaks the spatial symmetry is described theoretically and investigated by means of numeric calculations.