DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)

Self-organizing three dimensional photonic structures – optical and electrooptical properties of the liquid crystal blue phase in microstructures.

The main goal of this project is to investigate the optic and electrooptic properties of the blue phase (BP) of chiral liquid crystals (LCs). The blue phase has unique optical properties coming from its complex structure. It is, for instance, characterized by multi-wave selective light reflection in the visible and ultraviolet light spectrum. Otherwise than in ordinary anisotropic LCs the BP is not sensitive to the polarization state and shows faster switching times. The blue phase does not need any alignment layers which may be revolutionary for the new generation of liquid crystal displays (LCDs). The amazing property of the blue phase is that it is an optically isotropic material. In the absence of the external fields the blue phase does not reveal birefringence. The LCBP has been already known since the discovery of liquid crystals at the end of XIX-th century, but now the new research methods make possible to investigate its properties and design new applications in optical systems and devices. In this research project much effort will be done to reach thermal and orientational stabilization of the BP in photonic crystal fibers and to obtain voltage control in such structures. Then, the blue phase will be modified with nano-materials and studies will be made to describe the influence of the nano-material dopants on optical and electrooptical properties. Optical properties of the blue phase, which is undoubtedly a complex structure, may be also modified by geometry of the medium in which it is placed. Applying the micro-capillaries of the cylindrical geometry may change the optical properties and help to get new interesting effects which may find future applications in optical setups useful in science and industry. According to our knowledge, there are only a few papers, in the world literature, describing optical properties and light propagation in photonic crystal fibers infiltrated with the blue phase. With our research, ideas and observation we are convinced that we expand the knowledge in this field.