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Liquid crystals, nonlinear optics and besides

Throughout their long history, liquid crystals (LC) gained outstanding popularity and appearance in modern optoelectronic and photonic technologies due to their large birefringence and strong responsiveness to external fields.

As far as holography needs are concerned, a strict one-to-one correspondence between the light intensity and refractive index modulation is required. It is not the case with the renowned orientational nonlinearity of LC because of the presence of elastic forces. A phenomenological model of Light-Induced Order Modification (LIOM) is presented that accounts for the changes of the refractive indices of an LC layer resulted from the light-induced changes of the LC molecular ordering. The LIOM-type mechanism does not depend on the cell thickness, works for the whole range of light wavelengths and runs by far faster than the LC director reorientation. Moreover, since the optical read-out is spectrally independent from the pumping, such a mechanism could be useful for fast control of optical signals of very high intensity, for instance, in the IR range and beyond.

Besides, the random scattering and emission in strongly disordered chiral CLC layers have been investigated. Characteristics of the scattering differential cross section and stimulated emission appeared strongly influenced by the spectral position of the CLC band gap. The threshold of random lasing sharply drops down when the CLC selective reflection band overlaps with the fluorescence bend of the dye.

Short Bio

Dr. Andrey Iljin got his PhD in Material Science in the Institute of Advanced Technologies and Chemistry of Military University of Technology (Warsaw, Poland). He has been long working in the Institute of Physics (Kyiv, Ukraine) in the field of Liquid Crystals with his main research interests covering nonlinear optics and photonics of chiral liquid crystals, optical and electro-optical properties of heterogeneous Soft Matter systems, all-optical beam control and metamaterials. He has established and maintained efficient collaboration with research groups in France, Japan, China, Poland and USA. Currently he is a fellow of the Philipp Schwartz Initiative of Alexander von Humboldt Foundation at the Institute of Applied Physics, University of Münster (Germany).