Anatoliy V Glushchenko

University of Colorado, USA

Influence of nanoparticles on the properties of liquid crystal polymer composites

Liquid crystal polymer composites are the timely response to the needs of a modern optical industry for low driving voltage adaptive materials providing large phase retardation (for UV, visible, and IR) within a sub-millisecond time frame. We consider liquid crystals immersed into a nano-structured sponge like polymer network. The network's long chains impose a desired alignment for liquid crystal molecules enabling the creation of thick homogeneous liquid crystal slabs (up to 1mm, in comparison with available today only 50microns thick aligned liquid crystal layers). The properties of these materials are enriched tremendously by adding various nanoparticles. For example, mixing ferroelectric nanoparticles with a liquid crystal, generates ultrahigh electric fields within the liquid crystal, which combined with their small size, produces a uniquely exciting and largely unexplored system of composite materials which exhibit novel collective particle host interactions. These interactions promise a variety of exotic electro-optic and other applications. In this case, ferroelectric nanoparticles share their high intrinsic sensitivity to electric fields with the entire liquid crystal matrix. Therefore, doping the liquid crystal with ferroelectric nanoparticles brings benefits of a lower driving voltage and faster switching speed than in any liquid crystal devices available today. As a result, we demonstrate the power of nanotechnology to amplify by orders of magnitude the natural properties of liquid crystals by doping them with nanoparticles and hosting them in a nano confining polymer matrix.

Speaker Biography

Anatoliy V Glushchenko received his PhD in physics in 1997 from the Institute of Physics, National Academy of Science, Ukraine. He is a professor of physics at the University of Colorado at Colorado Springs (UCCS) where he teaches advanced physics classes, directs the Center for Advanced Technologies & Optical Materials, and leads the broad range of fundamental and applied research in biophysics and soft condensed matter. He is the author of more than 200 research papers and patents and made more than 250 presentations at various conferences.

e: aglushch@uccs.edu

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