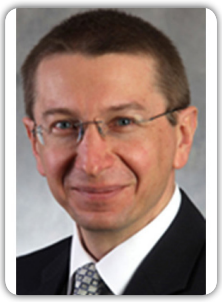

Anatoliy V Glushchenko

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Liquid crystal polymer composites doped with ferroelectric nanoparticles – novel optical materials for tunable lenses, prisms and beam steering devices

This presentation addresses the critical need 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. Two technologically innovative research areas are pursued in parallel and then merged, resulting in the creation of a new class of optical materials - ferroelectric nanoparticles doped liquid crystal / polymer composites. The first research direction advances the development of a liquid crystal being 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 1 mm, in comparison with available today only 50 microns thick aligned liquid crystal layers). On the other hand, 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, progressed as the second research direction simultaneously with the first one, 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 Ph.D. in Physics in 1997 from the Institute of Physics, National Academy of Science (Kyiv, 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.

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