

Generation, transformation and applications of optical vortices

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Abstract:

In this talk, we would review some recent progresses in the world in the generation, transformation and applications of optical vortices. Optical vortex is a kind of special beam with spiral wavefront so that the photons could bear orbital angular momentum (OAM). Applications of OAM modes include single-molecule optical tweezers, orbital angular momentum multiplexing in optical communications and even future quantum computing. We have just started the research in this field in recent years. Liquid crystal photoalignment techniques are used to produce tunable optical vortices. To write the alignment patterns in to LC cells, a home-made micro-lithography system with a digital micro-mirror device (DMD) as dynamic mask forms arbitrary micro-images on photoalignment layers and further guides the LC molecule orientations. Arbitrary fine photo-patterning fork gratings and Q-plate are thus obtainable. When a voltage is applied on the cell, index re-distribution is induced due to the realignment of LC molecules, and then the optical vortices become tunable. Dynamic switching between Gaussian modes and vortex beams are thus achieved. To further transform the optical vortex, we also studied its quasi-phase-matched (QPM) nonlinear frequency conversion properties. The evolution of the OAM mode is revealed showing some interesting properties. We believe the QPM is an effective way to convert, amplify and switch OAM states in various optical vortex related applications.

Biography:

Yan-qing Lu received both his BS and Ph.D. degrees from Nanjing University, China, in 1991 and 1996 respectively. He has five-year experiences in US and China telecomm industries. He designed and developed a serial of liquid crystal based fiber-optic devices with his colleagues. He is currently a Professor at the College of Engineering and Applied Sciences, Nanjing University. At present, his research interests include liquid crystal photonics and fiber optics. He is the author or co-author of over 100 peer-reviewed papers in Science, Phys. Rev., Appl. Phys. Lett., Opt. Lett. etc. with >1400 citations from ISI web of science. He also holds more than 40 domestic or international patents or pending patents. He currently acts as the deputy editor of *Optical Materials Express*.