Light Science & Applications

Advancing the art of ultrafast laser writing

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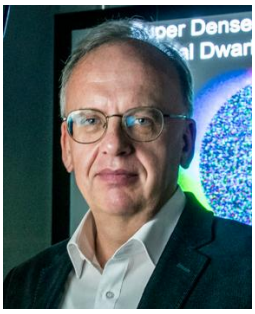
Demonstrations of self-assembled nanostucturing and related form birefringence have uncovered new science and applications including flat optics elements exploiting geometrical phase. The S-waveplate is one of such elements, which can be used for polarization and phase shaping with application ranging from material processing and optical trapping to extreme ultraviolet vector beam generation. The two independent parameters describing self-assembled form birefringence in quartz glass, the slow axis orientation (4^{th} dimension) and the strength of retardance (5^{th} dimension), were also explored for the optical encoding of information in addition to three spatial coordinates. The data optically encoded into five dimensions was successfully retrieved by quantitative birefringence measurements. The storage allows unprecedented parameters including hundreds of terabytes per disc data capacity and thermal stability up to 1000°. The recording of the first digital documents in 5D memory crystal including the eternal copy of Newtons Opticks is a vital step towards an eternal archive insuring the preservation of the memory of mankind. These and other demonstrations challenging common beliefs in optics including ultrafast laser calligraphy and anisotropic writing in transparent materials are reviewed.



Short Bio:

Peter G. Kazansky studied physics in Moscow State University and received Ph. D from the General Physics Institute in 1985. From 1989 to 1993 he led a group in the GPI, which unraveled the mystery of light-induced frequency doubling in glass. In 1992 he joined the ORC at the University of Southampton where since 2001 he is a professor pursuing his interests in new optical materials and phenomena. More recently he pioneered the field of ultrafast laser nanostructuring in glass leading to invention of "5D memory crystal," which holds a Guinness world record for the most durable data storage medium. From 2014 he is also a director of the International Centre of Laser Technologies in Mendeleev

University of Technical Technologies. He is a Fellow of the Optical Society of America.