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Broadband femtosecond laser pulse interaction with natural photonic structures: Manipulation and control

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Photonic integrated system depends on an ability to develop various compact optical components and facilities their integration on a common substrate. Of course, there are many photonic integrated circuit components that have not been realized due to their complexity or certain difficulties in processing. In this regard, nature has developed a fascinating hierarchical arrangement of photonic micro-nanostructures on various surfaces like plants, flowers, beetles, insect wings. While the direct use of natural bio-photonic structures for optical applications is limited since they are composed of bio-polymers with rather poor mechanical and photo stability but the investigation of these structures allows both a better understanding of the host species evolutionary development and provide intriguing templates for biomimetic applications (reverse engineering) to enable production of novel photonic systems that perform similar tasks if mimicked. In recent study, we probed the natural quasi-ordered complex photonics structures on the transparent insect wings of rainfly (Termite) by a simple, non-invasive, real time transmission optical diffraction technique using monochromatic CW lasers and broadband femtosecond laser pulses. Our observations directly demonstrate the coherent manipulation and control of light in these photonic systems and detail understanding of our observation could provide a platform for the development of novel photonic devices for biomimetic technological applications.

Biography

Pramod Kumar has received his MPhil (Instrumentation Physics) degree from Indian Institute of Science Roorkee, India in 2000, and PhD (Laser Physics) degree from Jawaharlal Nehru University, New Delhi, India in 2009. He worked as Assistant Professor in Delhi University, India in 2010. He worked as Research Associate (2011-2014) in Femtosecond Laser Laboratory, IISER Mohali, and Punjab, India. He has been with the University College Cork since Jan 2015, where he is currently senior laser research staff. His research interest is in the field of ultrafast non-linear photonics with covers various fundamental and applicative aspects, in particular understanding, manipulation and control of ultrashort pulse.

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