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Improved optical-field reconstruction of ultrashort pulses by two-step phase-shifting spectral interferometry

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Spectral phase interferometry for direct electric-field reconstruction (SPIDER) is one of the major methods to measure and retrieve the electric field information of ultrashort laser pulse. Compared to frequency-resolved optical gating (FROG), which iteratively reconstructs light field from the measured two-dimensional spectrograms, SPIDER allows one to retrieve directly the spectral phase from spectrograms. However, traditional SPIDER, which encodes the spectral phase into the spaces between the fringes of the interferogram, operates at a high sampling rate typically 5~10 times of the Nyquist limit. This paper presents a novel SPIDER method based on two-step phase-shifting (TSPS), which records two one-dimensional spectral interferograms with π phase shifting and is experimentally proven to be able to remove efficiently the effect of the dc component which occurs in traditional SPIDER. This method can reduce greatly the demand of resolution of the spectrograph. In other words, it can allow SPIDER works at very low pulse interval (means very broad fringe spacing) to increase the number of sampling points in one fringe, and improve the measured SNR. TSPS method can extend the ability of the traditional SPIDER device to characterize the test pulses both with complicated temporal/spectral structures and with narrow bandwidth.

Biography

Yi Cai is an Assistant Professor at the College of Electronic Science and Technology, Shenzhen University. He has completed his PhD in 2010 from Shanghai Institute of Optics and Fine Mechanics (SIOM), Chinese Academy of Sciences (CAS) in the year of 2010. His research interests include Ultrafast Laser Measurement and Ultrafast Imaging. His researches are supported by the National Natural Science Foundation of China, and Specialized Research Fund for the Shenzhen Strategic Emerging Industries Development. He has published more than 20 papers in reputed journals.

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