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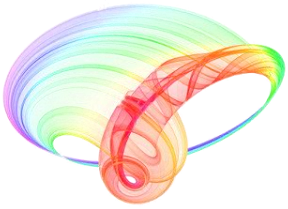

PHOTONICA2017

The Sixth International School and Conference on Photonics

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28 August – 1 September 2017

Belgrade, Serbia

Editors

Marina Lekić and Aleksandar Krmpot

Institute of Physics Belgrade, Serbia

Belgrade, 2017

ABSTRACTS OF TUTORIAL, KEYNOTE, INVITED LECTURES, PROGRESS REPORTS AND CONTRIBUTED PAPERS

of

The Sixth International School and Conference on Photonics PHOTONICA2017

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Editors
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Technical assistance
Marko Nikolić and Danica Pavlović

Publisher
Institute of Physics Belgrade
Pregrevica 118
11080 Belgrade, Serbia

Printed by
Serbian Academy of Sciences and Arts

Number of copies
300

ISBN 978-86-82441-46-5

En route: single-shot THz characterization technique for THz beamline at FLASH1

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High-field THz radiation is a fascinating tool to study the interaction of electromagnetic waves with matter, such as demagnetization dynamics [1], tracking the ultrafast motion of a signal molecule [2], resonant control of states of matter [3] and et al. THz beamline at FLASH1 provides both tunable narrow bandwidth (1-30THz) and broad bandwidth intense THz pulses for user's experiment.

Recently we have developed a THz characterization tool, optimized for FLASH's THz spectral range. It is based on THz electro-optic (EO) sampling, in combination of EO spectral decoding for THz pulse arrival timing jitter correction. It enables characterization of THz pulse, as a statistical average used in the experiment, with high temporal and spectral resolution.

Because of the highly fluctuating nature of the THz generation process at FLASH, for certain class of experiments, knowledge of the individual THz pulse properties is essential. Thus a fast diagnostic of THz parameters is required and single-shot method offers clear advantages. The EO spectral decoding subsystem in the THz pulse characterization tool can be used as independent setup at performing single-shot measurements. However, due to the frequency interference in a long chirped laser pulse, the measured THz temporal profile is almost always distorted [4], particularly when characterizing ultra-broadband THz pulses with realistic probing laser.

In order to study this single-shot technique, the broad bandwidth THz dump radiation is measured by EO spectral decoding setup. The distortion is analyzed in details and the measured profiles show agreement with our calculations.

The measurements can help us to study possible retrieval strategies of the original THz electric field from the distorted measured one. This as a final goal has a single shot characterization of THz pulses for FLASH user experiments.

Authors acknowledge financial support from German Academic Exchange Service (DAAD Grant Number 57219839) and Federal Ministry for Education and Research (BMBF Grant Number 05K12CH4).

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