X-ray Lasers and Coherent X-ray Sources: Development and Applications

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Editors

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Introduction

The X-ray Lasers and Coherent X-ray Sources: Development and Applications conference was held in Prague, Czech Republic on April 24-27, 2017. The conference was part of the SPIE Optics and Optoelectronics Conference that attracts 16 other topical conferences, some of which complement the topics covered by X-ray Lasers and Coherent X-ray Sources: Development and Applications. The conference gathered an international group of participants that through invited and contributed talks described the most recent developments in the generation and applications of intense X-rays from plasma-based x-ray lasers, 4th generation accelerator-based sources and high-order harmonic (HOH) generation. Three joint sessions on accelerator based sources, metrology and applications were co-organized with SPIE conference 10237 “X-Ray Free Electron Lasers: Advances in Source Development and Applications”. There were also several sessions that described the state-of-the art in optics and applications of these sources in imaging and spectroscopies.

Work presented at the conference showed significant advances of plasma based x-ray lasers. Seeding of x-ray laser amplifiers with high order harmonics (HOH) is providing opportunities to control polarization, realize full spatial coherence and potentially achieve femtosecond pulse duration. Besides already demonstrated high average power, plasma based x-ray lasers have reached output wavelengths down to 6.89 nm with micro-joule pulse energies suited for applications. Some high energy laser facilities already established and others that are projected to come into operation in the next few years are paving the way to further the development of plasma based x-ray lasers as well as other coherent high brightness x-ray sources.

The conference held three joint sessions on “Scientific Applications of Laser- and Accelerator-based X-ray Sources,” “Temporal, Spatial and Coherence Diagnostics of Ultrashort X-ray Pulses,” and “High Brightness and Ultrashort X-ray and EUV Sources,” with SPIE Conference 10237 that were very well attended. Seeding of Free Electron Lasers to control coherence, reaching attosecond pulse durations and generating high quality electron beams to improve FEL output were discussed. Diagnostics of the temporal, spatial and coherence properties of the x-ray sources’ output incentivized interest from the whole community as precise diagnostics of the output of coherent x-ray sources is critical for applications.

The sessions in applications highlighted important advances in imaging, and spectroscopy that are impacting materials science and biology. Access to excitation of inner shell electrons in atoms and molecules with the energetic X-ray photons has enabled the implementation of absorption, near edge and photoelectron emission spectroscopies some of which are exploiting the short
pulse duration of the x-ray emission to track ultrafast dynamics, such as in bond breaking. Advances in high resolution x-ray imaging using different geometries that include lensless, phase contrast imaging, holography and aerial geometries using table-top x-ray lasers, HOH and incoherent sources were presented. The control of polarization in HOH and plasma and accelerator based soft x-ray lasers, the ability to generate phase vortices with advanced optics or by tailoring the driving laser output as in HOH as presented at the conference will have a significant impact in broadening the application’s landscape.

We gratefully acknowledge the continued support of SPIE for the field of x-ray lasers. The outstanding organization of the conference at all stages as well as the efforts of the staff towards the publication of the proceedings volume is also acknowledged. We would like to thank the Program Committee for their support and guidance and to the session chairs for their help in the running of the conference. Finally we thank the many participants for their high quality scientific contributions to the 2017 meeting.

Annie Klisnick
Carmen S. Menoni