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# ***X-Ray Lasers and Coherent X-Ray Sources: Development and Applications XI***

**Annie Klisnick  
Carmen S. Menoni**  
*Editors*

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## Introduction

The *X-ray Lasers and Coherent X-ray Sources: Development and Applications XI* conference held in San Diego, California, 12–13 August 2015, attracted an international group of participants. Through invited and contributed talks they described the most recent developments in the generation and application of intense x-rays from plasma-based x-ray lasers, 4th generation accelerator-based sources and high-order harmonic (HOH) generation. The unique and complimentary characteristics of these sources, in combination with novel optics and instrumentation, make possible new fundamental studies of x-ray laser/materials interactions and innovative applications in spectroscopies and imaging.

Work presented at the conference in plasma based x-ray lasers showed these table-top sources continue on their path to realize an average power nearing a milliwatt at sub-20 nm wavelengths and to extend emission down to 7.3 nm with substantially lower pump energies. Seeding of x-ray laser amplifiers with HOH was extensively discussed. Experiments and modeling showed prospects for achieving femtosecond pulse duration and extremely high peak brightness. Work on Free Electron Laser (FEL) sources reported fully coherent x-ray emission in the 20-100 eV range at Fermi@Elettra FEL, with the first implementation of a double-cascade seeding technique. HOH source development and their applications in the probing of molecular structure and ultrafast dynamics were also extensively covered. The conference program included a section on new x-ray sources where concepts that involve resonant XUV excitation of an atomic gas simultaneously irradiated by an IR laser field to generate attosecond pulses, the prospects of inner-shell x-ray lasers to achieve gain at higher photon energies than those demonstrated, and new scaling of high order harmonics from relativistic electron cusps were discussed. Essential to effectively use these x-ray sources in applications is complete diagnostics of the output beam. Novel concepts for the polarization of x-ray lasers, for the characterization of spatial coherence with Wigner distributions, and the understanding of the impact of partial temporal coherence on their spectral properties were presented.

The conference held a joint session on “Optics for Coherence Sources” with SPIE Conference 9588 *Advances in X-Ray/EUV Optics and Components* that was very well attended. The trends in multilayer optics are in developing broad band coatings capable to sustain ultrashort pulses. New processing methods enable the fabrication of high aspect ratio diffractive optics, which are needed in the x-ray regime.

Applications of coherent x-ray sources are now impacting more and newer scientific and technological areas. High resolution imaging techniques were discussed including ptychography, structural 3D imaging and composition imaging

of biological samples. Recent progress in fundamental studies of interaction of intense x-ray pulses with solid materials were presented, including ablation of solid surfaces or generation of warm dense matter. Applications of ultrashort pulses to novel spectroscopies and ultrafast dynamics in gas phase and solids were also reported.

We gratefully acknowledge the continued support of SPIE for the field of x-ray lasers. We thank SPIE for the outstanding organization of the conference at all stages as well as the considerable efforts of the staff towards the publication of the Proceedings volume. We would like to thank the Programme 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 2015 meeting.

**Annie Klisnick**  
**Carmen S. Menoni**