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Introduction

Since the last SPIE X-Ray Laser and Applications Conference in 2005, there has been rapid progress in both source development and applications of extreme ultraviolet (EUV) soft x-ray lasers. This volume reviews the field, presents new topical areas, and shows new directions for the future. Other related topics are included on recent free electron lasers (FELs) with applications, hard x-ray synchrotron sources, as well as higher order harmonic generation (HOH).

New activities in seeded lasers were reported by several groups where a selected harmonic was used as the oscillator to wavelength-match and seed amplifier stages of either laser-driven solid targets or optical field ionization-driven (OFI) gas targets. The improved parameters of these seeded lasers included better wavefront, coherence, collimation, and peak brightness characteristics. The conclusion was that the seeded laser had better parameters than either of the two starting lasers.

Improvements in x-ray laser performance were reported for several different laser schemes when laser pre-pulse energy or delay were adjusted. This indicates that plasma optimization continues to be an important area. New experimental results also showed the possibility of achieving lasing simultaneously from different gases driven by the OFI scheme. Many presentations reported 10–50 nm soft x-ray experiments requiring low laser drive energy from smaller tabletop facilities including OFI, capillary discharge, and grazing incidence laser pumping schemes. Large scale laser drivers also played an important role for short wavelength laser development below 10 nm and applications requiring pulsed, high-output, millijoule soft x-ray energy. New facilities and new laser technology, for example zig-zag slab amplifiers and upgraded laser facilities with multiple beam capability, were discussed indicating that the driver technology continues to advance.

This conference showed an ever-growing list of new applications based on improved x-ray laser sources with expanded capability. X-ray optics development was shown as a necessary activity to realize these applications. Time-of-flight mass spectroscopy was used to determine the reactivity of coating materials for EUV optics and give insight to the chemistry of clusters. Tabletop x-ray laser-based microscopy with zone plates revealed results with spatial resolution approaching 50 nm close to the wavelength of the probe. Holographic imaging was presented while lensless imaging was demonstrated for both FEL and capillary discharge lasers. Focused x-ray laser beams could be used for heating or nanoscale damage studies drilling holes less than 100 nm in diameter. X-ray laser probe beams were shown for interferometry of colliding plasmas, potential use as a Thomson scattering diagnostic, mass ablation studies and the opacity of laser-heated foils.
We appreciate and gratefully acknowledge the continuation of this series of conferences on plasma-based x-ray lasers by SPIE. The organization of the conference and the publication of the proceedings volume would not be possible without the considerable effort and support of the SPIE staff. We would like to thank the advisory board for suggesting invited talks and to the session chairs for helping in the running of the conference. Finally, we give our thanks to the many speakers for their participation and contributions to the successful 2007 meeting.

James Dunn
Gregory Tallents