Review of the PhD thesis submitted by Martin Albrecht

Laser-generated short-wavelength coherent sources and their applications

The thesis is devoted to a study of coherence properties of short pulse partially coherent XUV sources. The submitted report has a clear logical structure. It consists of nine chapters loosely linked to each other's.

After two standard opening chapters the theoretical description of coherence properties is summarized in chapter 3. The chapter 4 is dedicated to experimental estimation of Ni-like Mo SXR laser pulse duration, based on speckle pattern analysis. Chapter 5 summarizes principles of lensless coherent diffractive imaging (CDI) and ptychographic diffractive imaging. Experiment based on CDI, resulting in spatial coherence estimation of Zn SXR laser, is reported in chapter 6. HHG Beamline system realized at ELI Beamlines facility is described in chapter 7, including a single high harmonics separation system. Experimental results of EUV coherent diffractive imaging and ptychography, employing monochromatic radiation HH21 beam (λ_{H21} = 37.9 nm) are subject of chapter 8.

Verification of the coherence properties of short wavelength lasers and development of coherent imaging in the SXR spectral region is an extremely important research topic due to the absence of classical optical elements (lens, beam splitters, etc.). The author used the opportunity of his workplace and performed and described a number of findings with various partially coherent sources: SXR lasers and high harmonics of a classical laser.

The report contains three significant experimental results. All of them are presented in the same way: The theoretical backgrounds are summarized first, then the experiments are described and followed by processing and analysis of the obtained data.

The dissertation has fulfilled its rather broadly stated objective and has introduced new methods of coherence study of newly developed SXR radiation sources in Czech laboratories and has tested methods of coherent diffractive imaging with them.

In my opinion, each of the three experiments could be a subject of a thesis and deserve a deeper analysis and more detail description.

I consider the coherent diffractive imaging with the use of one selected high harmonics to be the most important result and as a real scientific contribution should be published. In the same time I am lacking assessment of the spatial coherence of the individual high harmonics (missing measurement or estimation of the complex degree of coherence or coherence distance) in this part.

The submitted thesis satisfies all the requirements for the PhD thesis.

I recommend it for the defense and the award of the PhD degree to the author.

Kladno, November 6, 2023

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