Scanning the optical path of a tabletop vortex EUV beam

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The ability to control the properties of light beams has enabled the appearance of multiple technologies. In recent years the study of the manipulation of orbital angular momentum (OAM) of light has been an exciting topic of research. There are many promising applications in various fields using different light wavelengths from visible to x-rays, and even promising applications in plasma accelerators [1].

In the particular case of extreme ultraviolet (EUV) light, one of the most promising applications is the generation of skyrmionic defects which have been proposed for future magnetic memory devices [2]. Among the many different EUV sources available, high harmonic generation (HHG) in gases is an accessible, tabletop way to generate coherent EUV light with attosecond resolution.

In this work, we induced orbital angular momentum in a HHG EUV beam by using Spiral Zone Plates (SZP) [3] of different angular momentum - l. We scanned the beam near the focus of each one of the generated harmonics and recorded each beam profile with a lithium fluoride (LiF) crystal, a well characterized x-ray and EUV detector [4]. The different HHG wavelengths were spatially separated using a diffraction grid. As shown in Figure 1, we obtained high spatial resolution images of OAMs generated in the tabletop EUV source.

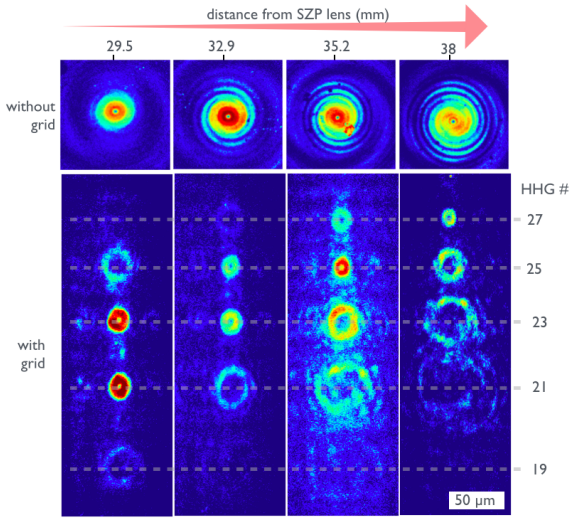

Figure 1: Photoluminescense images obtained on LiF of the EUV beam intensity distribution near the focus position of SZP with $l = 2$, without (top) and with $(bottom)$ diffraction grid .

References

[1] J. Vieira, J.T. Mendonça, and F. Quéré Phys. Rev. Lett. 121, 054801, 2018

[2] H. Fujita and M. Sato Phys. Rev. B 95, 054421

[3] A.Sakdinawat and Y. Liu, Opt. Lett. 32, 2635-2637 (2007)

[4] P. Estrela, E. Maçôas, G. Williams, M. Hussain, and M.Fajardo, J. Opt. Soc. Am. B 38, 2234-2238 (2021)