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High-harmonic generation from solid and gas targets with infrared FEL pulses

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Research into high-harmonic generation (HHG) from solid-state and gas targets holds significant importance in advancing high-field photon science, particularly in the realm of attosecond VUV and X-ray pulse generation. Thanks to the recent advancements in few-cycle pulse generation in superradiant FEL oscillators [*], HHG photon sources driven by infrared FEL pulses are becoming feasible. Marking a seminal milestone in FEL-HHG, we report experimental results of harmonic generation from solid and gas targets conducted at two FEL facilities: KU-FEL at Kyoto University and LEBRA-FEL at Nihon University. In these experiments, FEL pulses of 2-8 um wavelength were focused on solid-state and gas targets, and the harmonics generated were measured with a photomultiplier tube and a semiconductor detector. So far, up to 13th-order harmonics from a ZnSe plate and 7th-order harmonics from oxygen and argon gases were observed. In this talk, we will describe the details of the experimental results and future prospects for attosecond X-ray generation through FEL-HHG [*]. This work was supported by MEXT Q-LEAP (JPMXS0118070271) and JSPS KAKENHI (22H03881).

Footnotes

*H. Zen et al., Sci. Rep. 13, 6350 (2023). doi:10.1038/s41598-023-33550-z**R. Hajima, 2019 IEEE Photonics Conference (2019) doi:10.1109/IPCon.2019.8908339.

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