

■ Invited speaker

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Attosecond X-rays reached the water window

Abstract

It was demonstrated in 2001 that the cutoff photon energy of high harmonic spectrum can be extended by increasing the center wavelength of driving lasers [1]. In recent years, mJ level, two-cycle, carrier-envelope phase stabilized lasers at 1.6 to 2.1 micron have been developed by compressing pulses from Optical Parametric Amplifiers with gas-filled hollow-core fibers or by implementing Optical Parametric Chirped Pulse Amplification techniques. When a 3 mJ, 12 fs laser at 1.7 μm laser was used to implement polarization gating, isolated soft X-rays in the water window (280-530 eV) were generated in our laboratory. The number of X-ray photons in the 120-400 eV range per laser shot is comparable to that generated with Ti:Sapphire lasers in the 50 to 150 eV range [2]. By partially compensating atto-chirp, isolated X-ray pulses with 53-as duration were characterized by attosecond streaking [3]. Such ultrabroadband light sources are now being used in time-resolved X-ray absorption near edge structure measurements for studying charge dynamics in atoms and molecules.

References

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- [3] Jie Li, Xiaoming Ren, Yanchun Yin, Kun Zhao, Andrew Chew, Yan Cheng, Eric Cunningham, Yang Wang, Shuyuan Hu, Yi Wu, Michael Chini & Zenghu Chang, *Nature Communications* **8**, 186 (2017).

About the Author

Zenghu Chang is a University Trustee Chair, Pegasus and Distinguished Professor at the University of Central Florida, where he directs the Institute for the Frontier of Attosecond Science and Technology. He is a fellow of the American Physical Society and Optical Society of America. Chang graduated from Xi'an Jiao-tong University in 1982. He then earned a doctorate at the Xi'an Institute of Optics and Precision Mechanics, Chinese Academy of Sciences, in 1988. From 1991 to 1993, Chang visited the Rutherford Appleton Laboratory sponsored by the Royal Society fellowship. He worked at the University of Michigan after 1996. Then joined the physics faculty at Kansas State University in 2001. Chang moved to the University of Central Florida in Orlando in 2010. His notable contributions include the demonstration of high-order harmonic cutoff extension using long wavelength driving lasers in 2001. His group recently generated 53-as X-ray pulses reaching the carbon K-edge. He is the author of the book "Fundamentals of Attosecond Optics."