Generation of XUV continuum in the plateau region of high-order harmonics driven with 7fs/800nm laser pulses

Yinghui Zheng*, Zhinan Zeng*, Hui Xiong*, Yan Peng†, Xuan Yang†, Heping Zeng†, Ruxin Li*,[1], and Zhizhan Xu*,[2]

* State Key Laboratory of High Field Laser Physics, Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Shanghai 201800, China

† Key Laboratory of Optical and Magnetic Resonance Spectroscopy of Ministry of Education, Department of Physics, East China Normal University, Shanghai 200062, China

Synopsis: We show that extreme ultraviolet (XUV) continuum in the plateau of high-order harmonics (HH) can be generated in an argon gas cell by 7fs/800nm phase-stabilized laser pulses. It is based on the successful selection of single quantum path of the returning electrons during the propagation process in the gas cell. It is promising to obtain intense isolated sub 100 attosecond pulses with subsequent amplitude and phase control of the supercontinuum ranging from plateau to the cutoff region of the HH spectrum.

Isolated attosecond pulses extracted from plateau harmonics cause matter of great concern due to its relatively high efficiency and the broad bandwidth. So far single attosecond pulse emission in the plateau region has been achieved by single-cycle linear polarized laser pulses, by a polarization gating technique and two-color field schemes. Recently, many authors put forward some robust technologies to generate isolated attosecond pulses even though a train of pulses predicted by single-atom models. In this paper, we demonstrate a new approach to generate HH continuum in the plateau using a 7fs/800nm laser pulses in the experiment, which is supported by the calculation results in our previous work [1].

Figure 1 shows the gas pressure dependence of the harmonic continuum from Ar with CEP stabilized 0.4mJ/7fs laser pulses. At a low gas pressure of 10Torr the continuum in the region from 45eV to 73eV is firstly achieved. As the backing pressure rises, the harmonics become discrete and well-resolved. Up to ~40Torr, the harmonic structures vanish and the spectra become supercontinuous over all of the recorded bandwidths from ~32eV-~73eV, including the plateau with weak modulations. When the pressure continues to increase, the spectra have clear harmonic structures again. The changing trend indicates that there is a certain optimal gas pressure to generate the supercontinuum. When gas pressure exceeds the optimal pressure, the spectra will become discrete again.

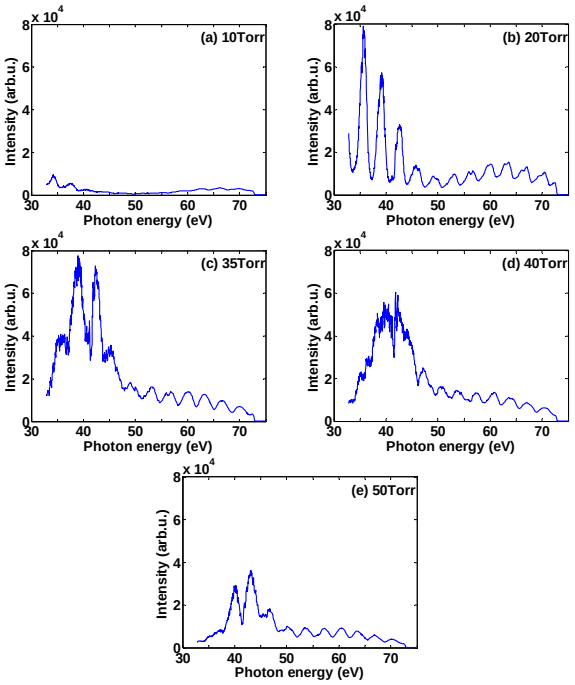

Fig. 1. Pressure dependence of the harmonic continuum from Ar with CEP stabilized 0.4mJ/7fs laser pulses.

In conclusion, a new method to obtain the HH continuum in the plateau is proposed in an argon gas cell driven by 0.4mJ/7fs laser pulses. The plateau continuum is generated by the successful selection of single quantum path of the returning electrons. It is promising to obtain isolated sub 100 attosecond pulses with subsequent amplitude and phase control of the supercontinuum ranging from plateau to the cutoff region of the HH spectrum.

References

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[1] E-mail: ruxinli@mail.shcnc.ac.cn

[2] E-mail: zzxu@mail.shcnc.ac.cn