Generation of continuum XUV radiation by CE-phase stabilized 5-fs laser pulse

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Gaining insight into the nuclear motion or electronic transitions, which falls within the attosecond (10^{-18} second) time scale, is the driving force to pursue new faster laser source. The coherence and short duration of attosecond laser pulses make it an attractive extreme ultraviolet (XUV) source in atomic, molecular, plasma, and solid state physics [1]. Our goal aims to deliver a source of isolated attosecond optical pulses with shorter and more powerful for interrogating a wide range of these fundamental electronic processes in matter evolving on a ultrafast, sub 100-as timescale.

Coherent extreme- ultraviolet (XUV) radiation was studied by interaction of Carrier-Envelope (CE) phase stabilized high energy sub-5-fs infrared (760 nm) laser pulses [2] [3][4] with neon gas at a repetition rate of 1 kHz. The CE phase is very sensitive to generation of XUV continuum spectra for few-cycle laser pulses. To investigate the dependence of the resultant XUV spectrum on CE phase of driving laser pulses, XUV spectra were recorded for different setting of CE phase. As shown in Figure 1, notably, with a change of the CE phase, the cut-off XUV spectrum gradually transform from discrete modulated harmonic peaks to continuum spectral distribution. Figure (b) shows the when the CE phase is defined as zero, a broad structureless continuum spectrum appear in the cut off region. As the CEO phase is slowly varied between zero and π, by inserting a wedge in optical path, the continuum spectrum in the cut-off region become much modulated and discrete harmonic peaks, and this modulation will become maximum when the phase is equal to $\pm\pi/2$. The broadband continuum XUV spectrum at cut-off region was demonstrated when CE phase is shift to about zero, which show generation of isolated sub-femtosecond XUV pulses. The characterization of this XUV pulse will be carried out in future experiment.

In this talk, I will present three parts as following: firstly, introduction; secondly, I will introduce the carrier-envelope (CE) phase controlled intense 5-fs laser system and experiment setup for HHG; thirdly, I will present the recent results of high harmonic generation based on this laser system as shown above.

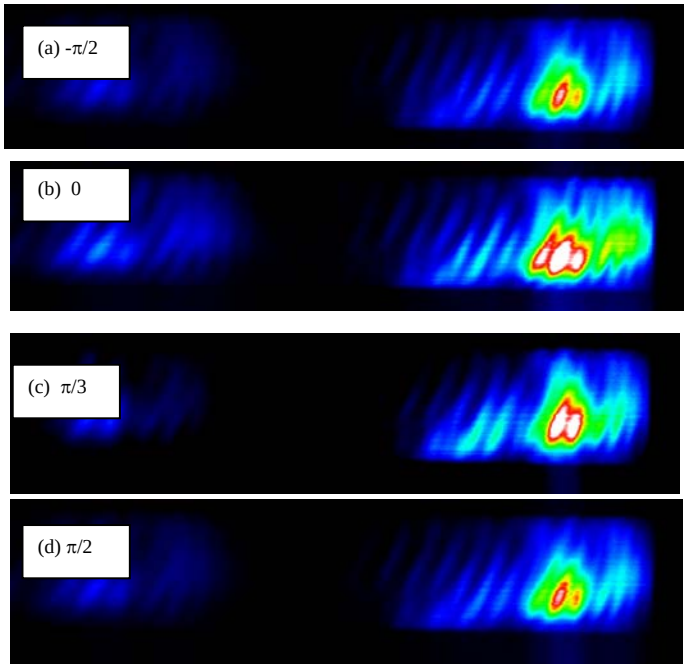

Figure 1. Measured XUV Spectrum from interaction of neon gas with CE-phase stabilized 5-fs laser pulse. (a)-(d) obtained for different CE-phase settings, by changing the insert of fused silica wedge

References

[1] P. H. Bucksbaum, Science. **317,** 766 (2007).
[2] Q Du e*t al*., Chinese Science Bulletin. **53**, 40 (2008)
[3] H. H. Han *et al.*, ACTA PHYSICS SINICA. **56**, No.5, 2756 (2007)
[4] Y. Y. Zhao *et al.,* Science in China, Series G. **37,** 123 (2007)