An isolated short attosecond pulse produced by using intense few-cycle chirped laser and an ultraviolet attosecond pulse

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Synopsis An efficient method to generate a short attosecond(as) pulse is presented by using an intense few-cycle chirped infrared(IR) laser in combination with an ultraviolet (UV) attosecond pulse. We show that high-order harmonic generation (HHG) plateau near the cutoff is enhanced by one order of magnitude compared with the chirped laser case and the HHG supercontinuum spectrum is generated by adding a UV attosecond pulse to the few-cycle chirped IR laser at a proper time. By enhancing the long quantum path and suppressing the short one corresponding to one major return, an isolated 57-as pulse with a bandwidth of 62 eV is obtained directly.

Attosecond extreme ultraviolet(xuv) pulse allows one to trace and probe ultrafast processes in atoms and molecules in real time. Thus much attempt has been made to obtain attosecond pulses in recent years [1, 2, 3, 4]. So far the HHG is the most promising way to generate attosecond pulses. Because it is very difficult to extract an isolated pulse from an attosecond pulse train, a great deal of effort has been devoted to produce an isolated attosecond pulse. One can obtain an isolated attosecond pulse by using a few-cycle laser [1], polarization gating technique [4], double optical gating [5]. Control of quantum paths is another fascinating way to produce an isolated broadband ultrashort attosecond pulse.

Based on the work of Carrera *et al.* [6], we propose a method to produce a short isolated broadband attosecond pulse by using an intense few-cycle chirped IR laser in combination with a UV attosecond controlling pulse. By enhancing the long quantum path and suppressing the short one correspond to one major return, an isolated 57-as pulse with a bandwidth of 62eV is obtained directly.

Fig.1. shows an isolated 57-as pulse with a bandwidth of 62 eV generated in a chirped IR laser in combination with a UV controlling pulse by superposing the harmonics from 60 ω_{IR} to 100 ω_{IR}. One can clearly see that the isolated attosecond pulse is very regular and the satellite peaks can be neglected.

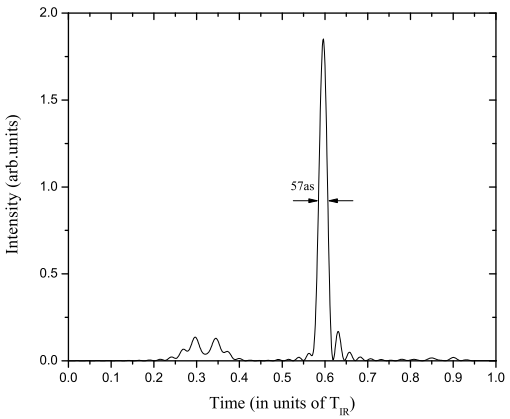

Fig. 1. The attosecond pulse of hydrogen atom in the chirped IR laser in combination with a UV pulse

References

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