COHERENT CONTROL OF MULTIPHOTON DYNAMICS BY MEANS OF COMB LASER EXCITATION: MANY-MODE FLOQUET THEORETICAL APPROACH

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The development of the comb laser technology and its application to the coherent control of chemical and physical processes is a subject of much current interest and significance [1]. We introduce here the extension of the many-mode Floquet theory (MMFT) [2] for the exploration of the coherent control and enhancement of multiphoton resonance processes. We show that the comb laser–matter interaction can be exactly treated by means of the two-mode Floquet theory [3]. The theory is applied to the nonperturbative investigation of the enhancement of high-order harmonic generation (HHG) processes by means of the tuning of the comb laser parameters. We observe that the harmonic generation of the two-level system shows immense enhancement due to simultaneous multiphoton resonance processes of frequency comb structure. This enhancement is precisely controllable by tuning the pulse-to-pulse phase shift and the repetition frequency of the comb laser. This work was partially supported by the US Department of Energy and National Science Foundation.

References

[1] C. Gohle, *et al.*, Nature **436**, 234–237 (2005).

[2] S. I. Chu and D. A. Telnov, Phys. Rep. **390**, 1–131 (2004).

[3] S.-K. Son and S. I. Chu, Phys. Rev. A (submitted).