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Waveform optimization for enhancing high-harmonic yield by synthesizing two or three-color laser fields.[1] CHENG JIN, Department of Physics, Kansas State University, GUOLI WANG, College of Physics and Electronic Engineering, Northwest Normal University, China, HUI WEI, ANH-THU LE, C.D. LIN, Department of Physics, Kansas State University — High-order harmonics (HH) extending to the X-ray region generated in a gas medium by intense lasers offer the potential for providing tabletop broadband light sources but so far are limited by their low conversion efficiency. We show that HH yield can be enhanced by one to two orders of magnitude if the laser's waveform is optimized by synthesizing two- or three-color fields compared to a sinusoidal wave without an increase in the total laser power. The optimization procedure carried out by genetic algorithm is designed to take into account of macroscopic propagation effects. The HH thus generated are also favorably phase-matched so that radiation is efficiently built up in the gas medium. In addition, we demonstrate the generation of a single-attosecond pulse by synthesizing three incommensurate lasers while the harmonic yield is optimized as well. Our results, combined with the emerging intense high-repetition MHz lasers, promise to increase harmonic yields by several orders to make HH feasible in the near future as general bright tabletop light sources.

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