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Quasi Phase Matching and In-situ Probing of High Harmonic Generation in a Hollow Waveguide Using Counterpropagating Light
RICHARD L. SANDBERG, AMY L. LYTLE, XIAOSHI ZHANG, OREN COHEN, HENRY C. KAPTEYN, MARGARET M. MURNANE, University of Colorado and JILA — We use counterpropagating light to directly observe, in-situ, the coherent buildup of high-order harmonic generation in a hollow waveguide. In this technique, the interfering beam scrambles the quantum phase of the harmonic field, thus suppressing emission from the intersecting region. We measure the phase mismatch for photon energies ($\sim$70 eV in Argon) that cannot be phase matched using conventional approaches. This information allows us to design a pulse train that implements all-optical quasi phase matching in this regime, demonstrating for the first time the use of counterpropagating laser pulses to implement quasi phase matched enhancement of high-harmonic conversion. This technique can be extended to phase match conversion even to very high photon energies.

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