Quasi Phase Matching and Quantum Path Control of High Harmonic Generation using Counterpropagating Light\textsuperscript{1} XIAOSHI ZHANG, AMY LYTLE, OREN COHEN, HENRY KAPTEYN, MARGARET MURNANE, JILA, UNIVERSITY OF COLORADO, BOULDER TEAM — We demonstrate the first use of a 3-pulse train of counterpropagating pulses to enhance the coherent upconversion of an intense ultrashort laser pulse into the extreme ultraviolet region of the spectrum. This all-optical quasi-phase-matching technique uses interfering beams to scramble the quantum phase of the generated high-order harmonics, to suppress emission from out-of-phase regions. A wavelength selective enhancement in the flux of up to \(\approx 300\times\) is observed at photon energies around 70 eV in Argon, that cannot otherwise be phase matched. We also show that further very large enhancements are possible, presenting a real prospect for orders-of-magnitude improvement in coherent upconversion of lasers into the soft x-ray region of the spectrum. Finally we show that by adjusting the intensity of the counterpropagating light, we can selectively enhance different electron quantum path trajectories, demonstrating attosecond time-scale coherent control of the radiating electron wavefunction.

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