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Control of second harmonic generation using counterpropagating light[1]

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The main challenge for conversion efficiency of nonlinear frequency conversion processes like second harmonic generation is the chromatic dispersion of the nonlinear medium. The phase mismatch between the different frequencies is typically corrected by exploiting birefringence or through construction of layered nonlinear media to achieve quasi-phase matching. An all-optical method of quasi-phase matching using counterpropagating light has recently been demonstrated for high-order harmonic generation. Sequences of counterpropagating pulses are used to interfere with the harmonic generation process periodically, correcting the phase mismatch and boosting efficiency. The correction is achieved by a microscopic disruption of the phase-matching conditions caused locally by each counterpropagating pulse. We have extended the application of this mechanism to second-harmonic generation, and show an explicit measurement of this microscopic phase disruption for the first time. Numerical simulations reproduce the features of the observed disruption and indicate pathways for implementing in situ probing and quasi-phase matching of second-harmonic generation with counterpropagating fields.

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