Multiphoton intrapulse interference. IV. Ultrashort laser pulse spectral phase characterization and compensation

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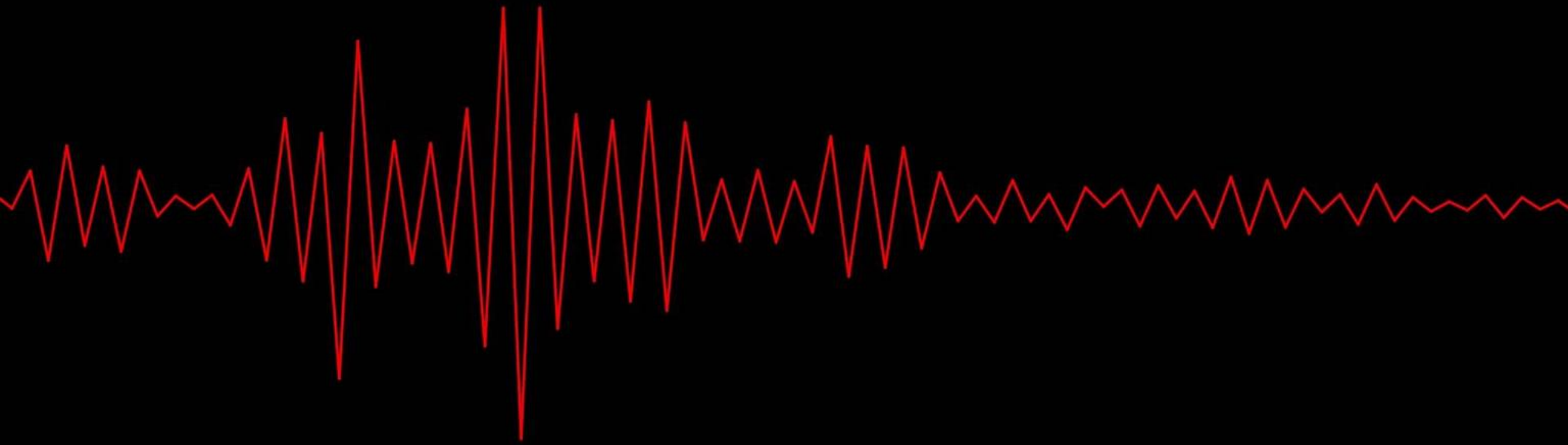

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Abstract

Multiphoton intrapulse interference. IV. Ultrashort laser pulse spectral phase characterization and compensation

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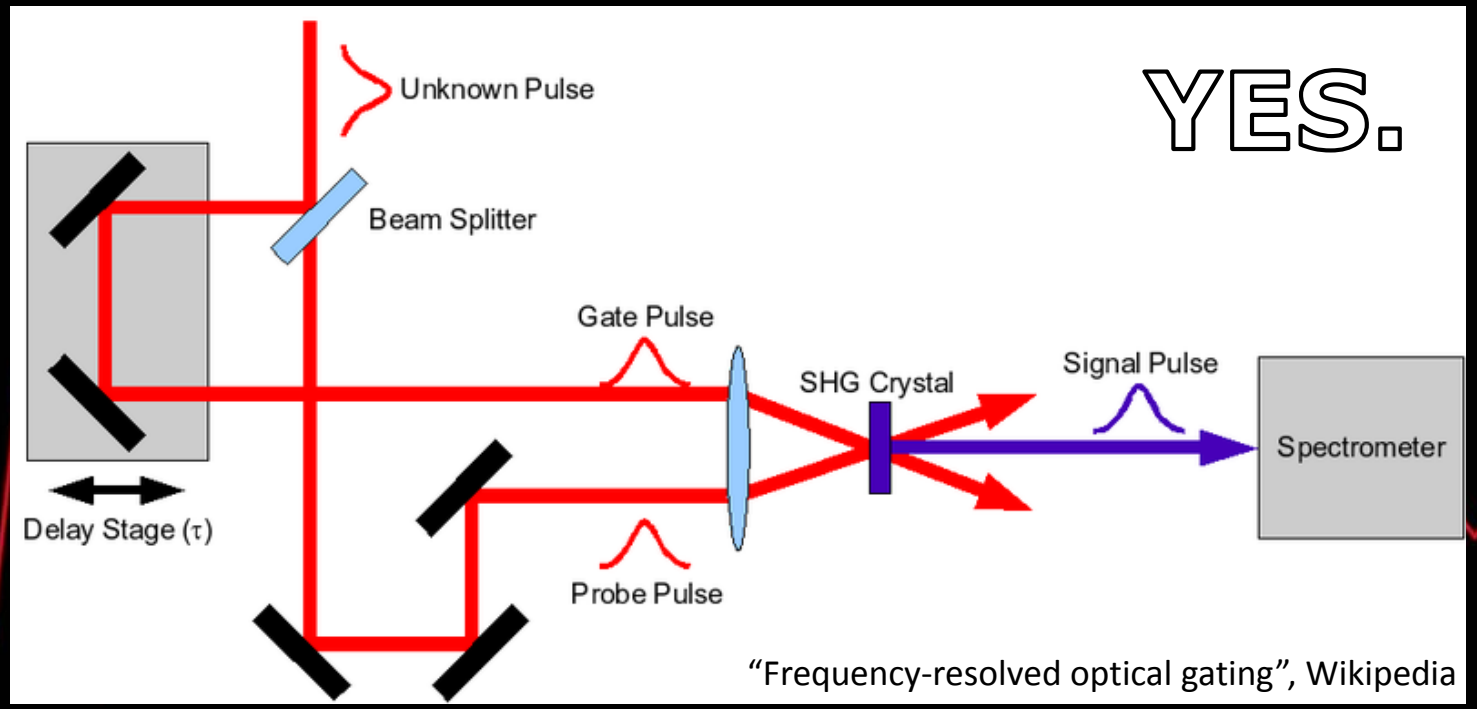
We introduce a noninterferometric single beam method to characterize and compensate the spectral phase of ultrashort femtosecond pulses accurately. The method uses a pulse shaper that scans calibrated phase functions to determine the unknown spectral phase of a pulse. The pulse shaper can then be used to synthesize arbitrary phase femtosecond pulses or it can introduce a compensating spectral phase to obtain transform-limited pulses. This method is ideally suited for the generation of tailored spectral phase functions required for coherent control experiments.

OCIS codes: 320.5540, 320.7100, 320.7110.

FROG (Frequency-resolved optical gating)



"Frequency-resolved optical gating", Wikipedia

Frequency-resolved optical gating (FROG)

: one of the most feasible tools to measure spectral phase of ultrashort pulses and reconstruct electric field (ranges from sub-fs to ns)

Pulse Shaper

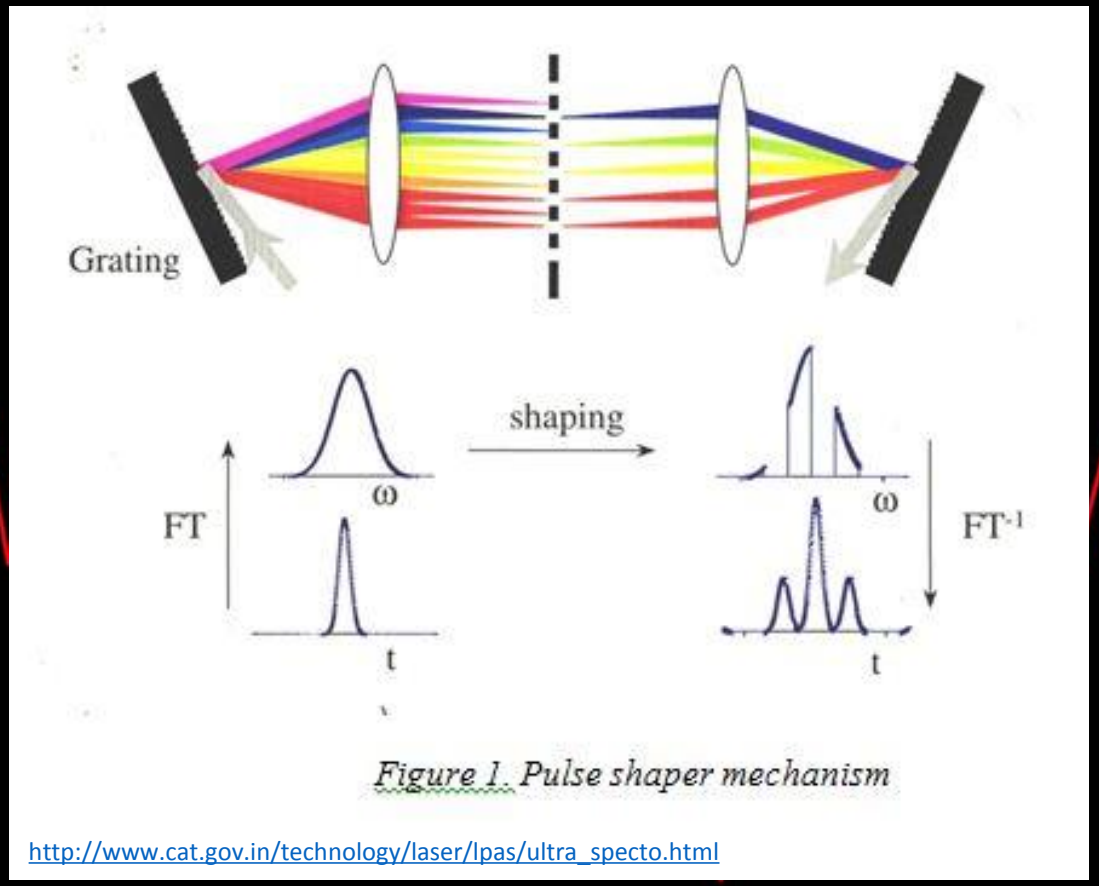


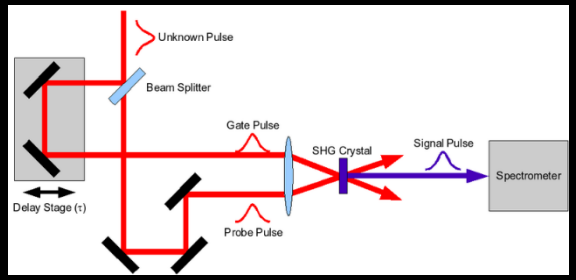
Figure 1. Pulse shaper mechanism

http://www.cat.gov.in/technology/laser/lpas/ultra_specto.html

Ideally, **phase characterization** and **pulse-shaping instruments**
can work together to produce *transform-limited(TL)* or precisely phase-shaped pulses.

MIIPS (Multiphoton intrapulse interference phase scan)

(TL) or precisely phase-shaped pulses. Attempts to merge pulse shaping and characterization have used either a genetic algorithm controlled shaper to optimize a nonlinear optical signal[8,9] or implemented time-domain interferometry with an acousto-optic programmable filter.[10] Here we present an accurate method that combines spectral phase characterization with pulse shaping in one simple setup. The method, multiphoton intrapulse interference phase scan (MIIPS), takes advantage of the influence that phase modulation has on the probability of nonlinear optical processes at specific frequencies.[11–14] This



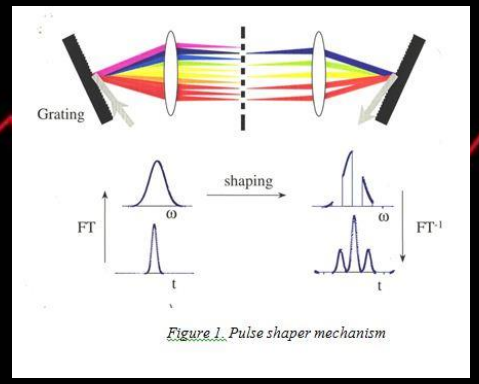


Figure 1. Pulse shaper mechanism

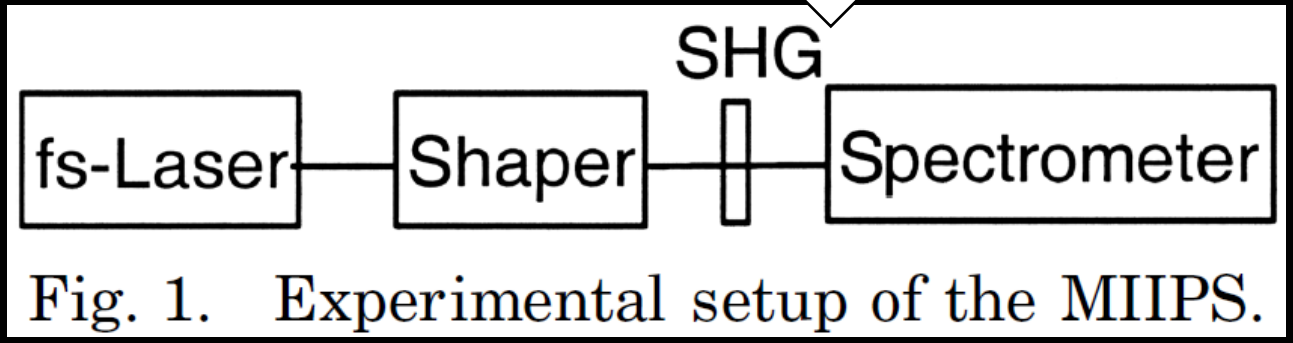


Fig. 1. Experimental setup of the MIIPS.

MIIPS: theory

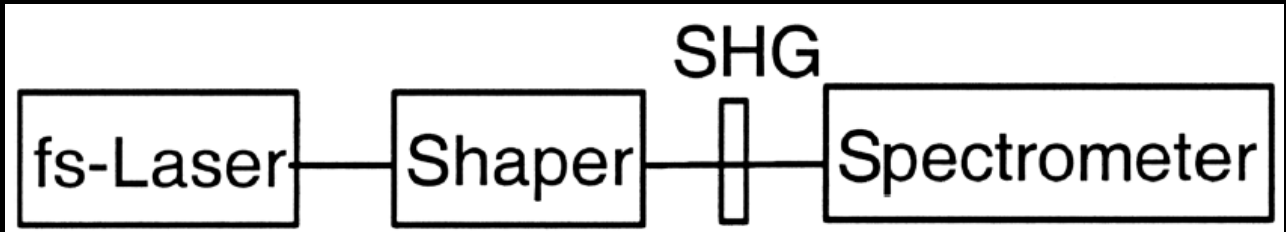
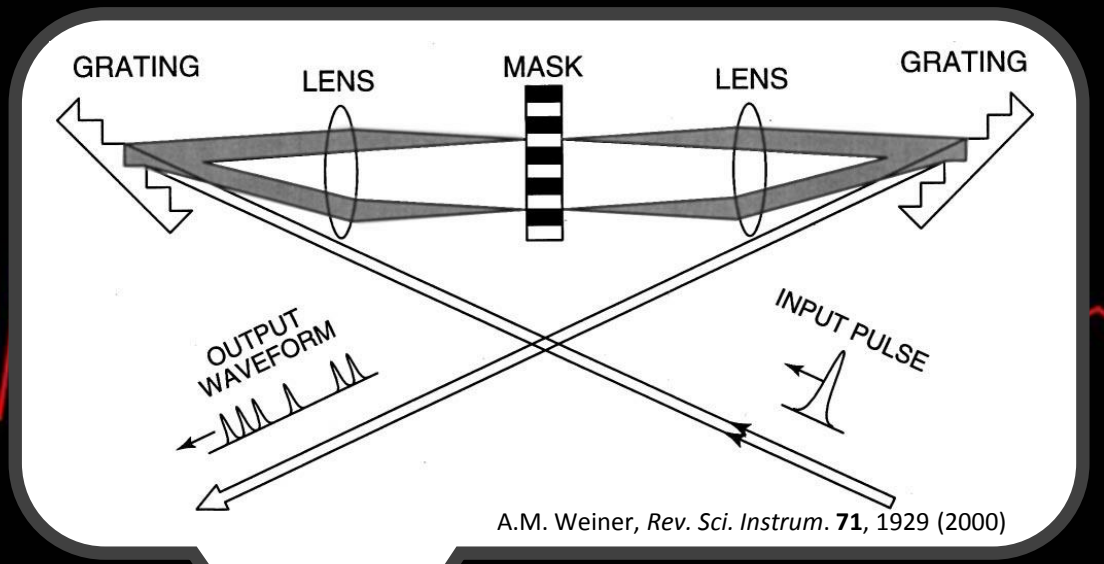


Fig. 1. Experimental setup of the MIIPS.

Experimental: setup

fs-Laser: sub-20-fs Ti:sapphire oscillator (pulse energy ~ 3nJ)
Shaper: 2 prisms, 2 cylindrical mirrors (200mm focal length), SLM with two 128 LCD elements
SHG crystal: 15-μm β-barium borate (type I)



A.M. Weiner, *Rev. Sci. Instrum*. **71**, 1929 (2000)

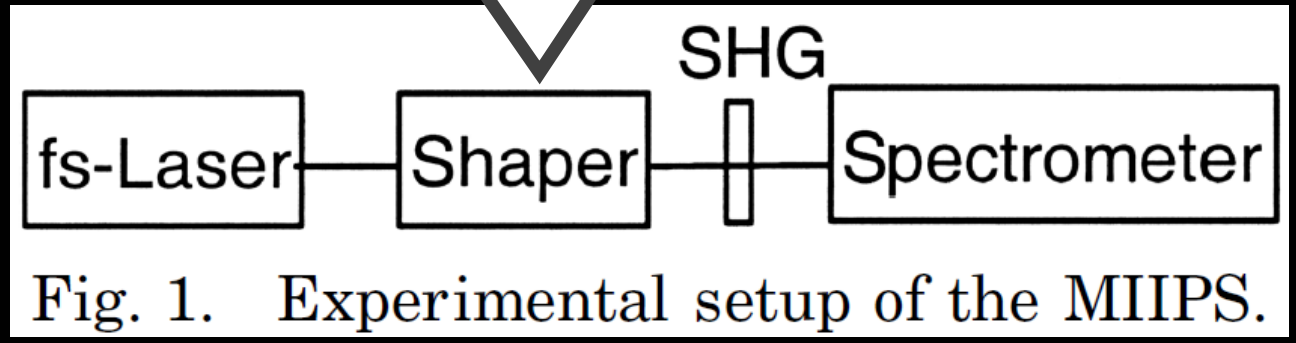


Fig. 1. Experimental setup of the MIIPS.

Experimental: result

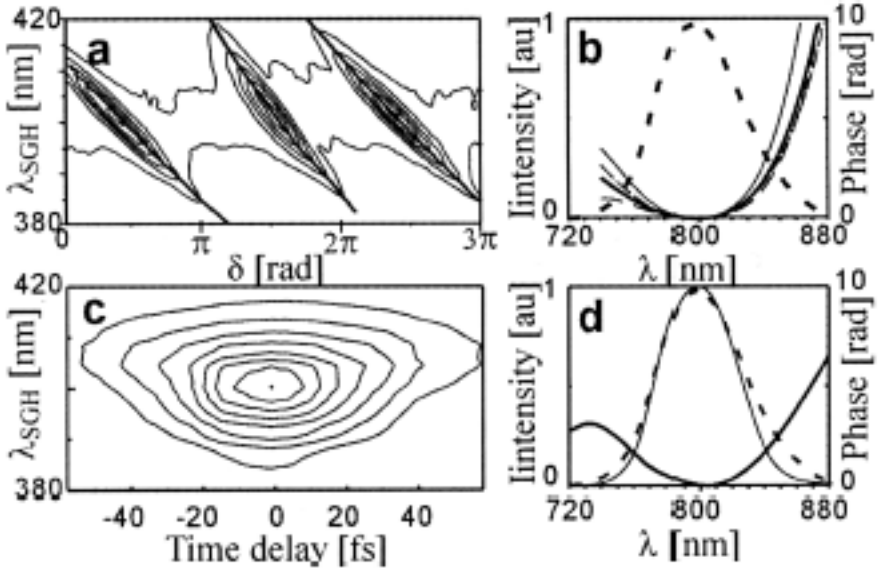


Fig. 2. a, Experimental MIIPS data obtained for phase-distorted pulses. The SHG intensity as a function of wavelength λ and reference phase position δ is given by the contours. The lines are the local maxima in the MIIPS trace. b, Measured spectral intensity (dashed) and phases retrieved after the first (thin) to final fourth iteration (thick). c, SHG FROG for the same pulses. d, Measured (dashed) and retrieved spectrum (thin) and phase (thick) from SHG FROG measurements.

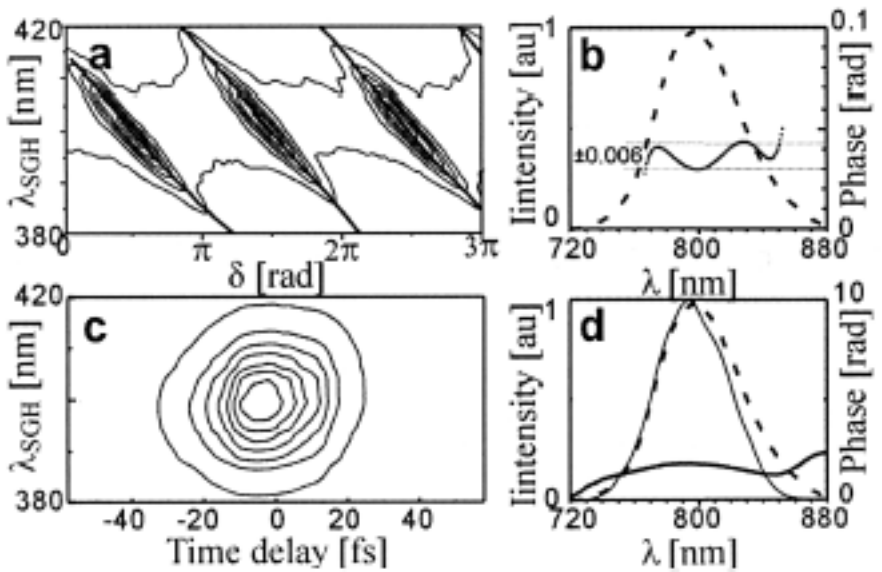


Fig. 3. a, Experimental MIIPS data obtained for phase-compensated TL pulses. b, Measured spectral

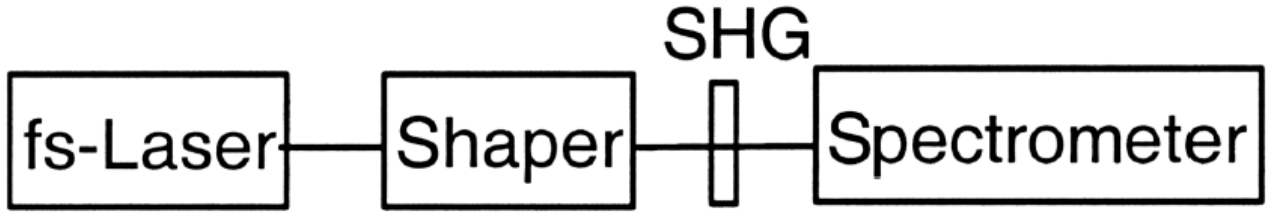


Fig. 1. Experimental setup of the MIIPS.

Conclusion

They made a non-interferometric single beam method to accurately characterize & compensate the spectral phase of ultrafast pulses.

They compared their result with FROG result, to confirm their instrument works well

It worked well and they were happy

OUR DATA: HETERODYNE-DETECTED-SUM-FREQUENCY

OUR DATA: HETERODYNE-DETECTED-SUM-FREQUENCY

OUR DATA: HETERODYNE-DETECTED-SUM-FREQUENCY