Numerical analysis of spectron phase peculiarities

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Abstract: We use the concept of Dispersive Fourier Transformation to study the phase of spectron pulses. In our numerical experiments we use various pulses with initial spectral phase or strong self-phase modulation at the entrance of dispersive medium for the generation of spectron pulses. The results of our studies can be prospective for a pulse spectral phase measurement, and for the femtosecond pulse complete characterization, alternatively to the spectral interferometry or other techniques.

The spectron pulse is generated, when the pulse propagates through a long dispersive medium with 2nd order of dispersion, resulting in its intensity envelope mimicking its spectrum. Thus, the spectron pulse is generated in the far zone of dispersion. The spectron shaping is studied in the scope of the dispersive Fourier transformation (DFT) [1,2] or the real-time Fourier transformation methods [3,4].

The objectives of our research are the study of spectron's amplitude and phase peculiarities. Particularly, we test whether the DFT method, along with the amplitude imaging the spectrum, works also for the phase, i.e. to find conditions under which the temporal phase of the spectron pulse images the initial spectral phase. In our numerical study, we first examined the phase of spectron pulses generated from various input pulses (Fig. 1).

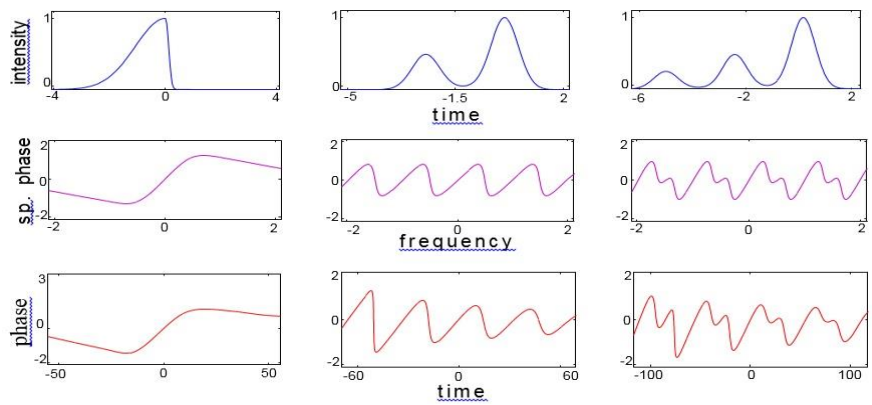

Fig. 1. Spectron phase of the following pulses (from left to right): asymmetric, two-peak, three-peak. From top to bottom are the initial pulse, spectral phase, and temporal phase of the spectron.

Afterwards, we examined the peculiarities of spectron generation from pulses with initial spectral phase. For this we gave sinusoidal spectral phase to Gaussian pulse. Thereafter, we took a two-peak pulse with strong self-phase modulation at the input of dispersive medium. The research has shown that for the asymmetric and multiple peak pulses the requested dispersion for the phase mimicking is the same as for the amplitude to mimic the spectrum. For the pulses with initial spectral phase, the request of dispersion for the phase-mimicking is less strict than for the spectron generation. The opposite of that has been observed for the pulses with strong self-phase modulation.

References

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