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Colorado State University

Phase and Amplitude Light Pulse Shaping Using a One-Dimensional Phase Mask

A great many applications – ranging from simple dispersion control to carefully shaped laser pulses used for coherent control of quantum dynamics, femtosecond microscopy and spectroscopy, nonlinear fiber optics, high harmonic generation, etc. – require programmable ultrafast optical pulse shapers. While many applications utilize spectral phase-only shaping for simplicity, control over amplitude is also required to access a complete range of temporal shapes; for example, square and sinc pulses. Although independent phase and amplitude control has been achieved using two liquid crystal spatial light modulators (LC-SLMs) arrays, the use of two modulators doubles the circuitry, increases the bulk and requires accurate alignment of the two modulators. Additionally, the requirement for two polarizers increases losses and dispersion.

Researchers in the Department of Electrical & Computer Engineering at Colorado State University have devised a system offering simultaneous amplitude and phase control of ultrafast laser pulses using a single, linear (one-dimensional) LC-SLM. Amplitude shaping is accomplished by over-sampling a high-frequency phase grating onto the modulator and diffracting away selected frequencies in a controllable manner, while spectral phase control is imparted by adding an appropriate slow phase bias to the modulator. The close pixel spacing, large number of pixels, and small footprint of the reflective SLM (employed with an angular wavelength dispersive element in a folded Martinez stretcher) allow the apparatus to be simple and compact. In addition, the high reflectivity of the spatial light modulator results in a highly efficient pulse shaper when either a prism or diffractive grating is used for the angular dispersive element.

ID: CSURF 08-072

Patent Information
US 7,576,907—issued.

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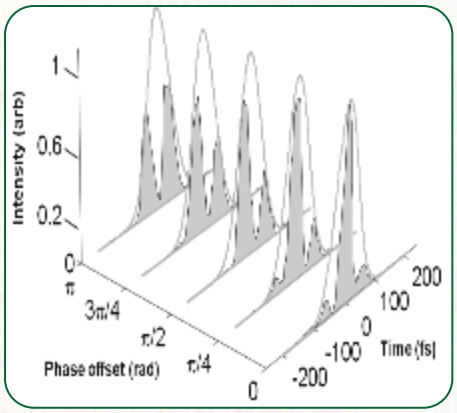
Features and Benefits

- Independent phase and amplitude control allows for efficient shaping of ultrafast optical pulses.
- Suitable for femtosecond spectroscopy, nonlinear fiber optics, high harmonic generation & more.
- Requires a single liquid crystal spatial light modulator (other systems use two).
- Simple and compact apparatus.



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