

## **20-fs Pulse Shaping with a 512-element Phase-only Liquid Crystal Modulator**

*Haifeng Wang, Zheng Zheng, D.E. Leaird, and Prof. A.M. Weiner*

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Femtosecond laser pulse shaping techniques using programmable spatial light modulators (SLMs) have become a powerful tool for ultrafast scientific studies as well as in applications such as optical communications [1,2]. The performance parameters of the optical modulator, including the space-bandwidth product, speed and insertion loss, can have a significant impact on the capability of the pulse shaper. Liquid crystal modulators (LCMs) are currently the most widely used SLMs in femtosecond pulse shapers. However, previous devices were limited to 128 pixels, which puts constraints on the spectral resolution and the temporal window that could be realized by the pulse shapers. Here we report experiments, performed in the 20-fs regime, which, for the first time, demonstrate pulse shaping using a 512-element phase-only LCM [3]. Our LCM is based on an advanced liquid crystal modulator array technology that was previously developed by the Raytheon Company for beam steering in laser radar applications. Our results show the potential of using such devices for high-accuracy pulse shaping with significantly improved spectral resolution and temporal window.

In addition to basic pulse shaping studies, we also characterized the low intensity replica pulses known to occur from pixellated SLMs. Our investigation shows that a subtle nonlinear spatial dispersion within the pulse shaper has a profound effect on the character of the replica pulses and may dramatically reduce their (already low) peak intensity. This modification of the form of the replica pulses, which we have identified for the first time, is especially significant due to the wide optical bandwidth and the large number of LCM pixels. Our findings may also impact the design of SLMS for laser radar applications.

### References

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