news article

New light from synchronized lasers

Scientists have merged pulses from two femtosecond lasers into a single, shorter pulse with the potential for speedier spectroscopy.

US researchers have successfully combined femtosecond pulses of light from two lasers to create a single, phase-coherent optical pulse. The "synthesized" light beam has a shorter pulse train than that of its parent lasers.

Jun Ye and colleagues from the University of Colorado, Boulder, in the US, exploited recent advances in femtosecond combs and ultrashort laser pulses to achieve their breakthrough, They believe that their work will advance many applications, from particle accelerators and synchrotrons to the manipulation of molecules with lasers.

Ye told *optics.org* how the researchers came up against two key barriers: "First of all the two pulsed lasers had to be synchronized so that each arrived at a target area at exactly the same time. Then they had to be phase-locked."

The researchers achieved the first step by matching the repetition rates of both lasers; "[as if] shooting two machine guns in synchronization," said Ye. For the second step, the researchers not only had to match the pulses of each laser, but also align the phases of the optical carrier waves - rapidly oscillating waves underneath the pulses that are characteristic of ultrafast lasers. Ye and colleagues managed to design a system to electronically control these elements so that pulses and carrier waves are fully synchronized.

"The ultimate goal of our research is to make an optical waveform synthesizer that can create an arbitrary optical pulse on demand," said Ye. "[But] first we need to have tighter synchronization."

The scientists expect the synchronization aspect of their technology to transfer to industrial applications immediately. "This will have an impact within a year," said Ye. "[However] the pulse synthesis part may take more time to find its way into industry. And to reach the ultimate goal of arbitrary pulse generation will take between 5 and

10 years."

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