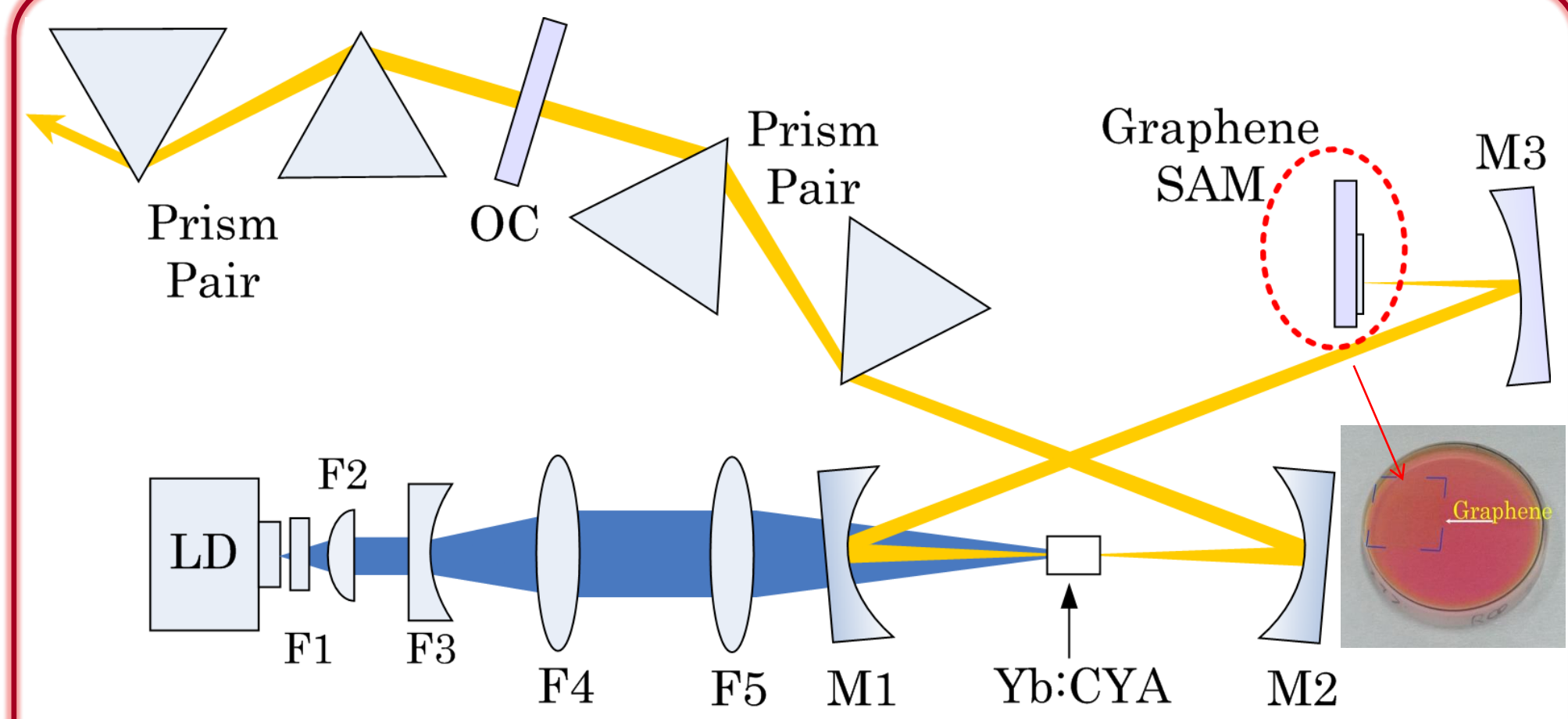


Generation of 30 fs pulses from a graphene mode-locked Yb:CaYAlO₄ laser

ABSTRACT

◆ Stable 30 fs pulses (less than 10 optical-cycle) centered at 1068 nm are demonstrated in a graphene mode-locked Yb:CaYAlO₄ (Yb:CYA) laser. The mode-locked 8.43 optical-cycle pulses have a spectral bandwidth of ~ 50 nm and a pulse repetition frequency of ~ 113.5 MHz. To our knowledge, this is the shortest pulse ever reported for graphene mode-locked lasers and solid-state lasers around 1 μm. Our experimental results demonstrate that graphene mode locking is a very promising practical technique to generate few-cycle optical pulses directly from a laser oscillator.

EXPERIMENTAL SETUP

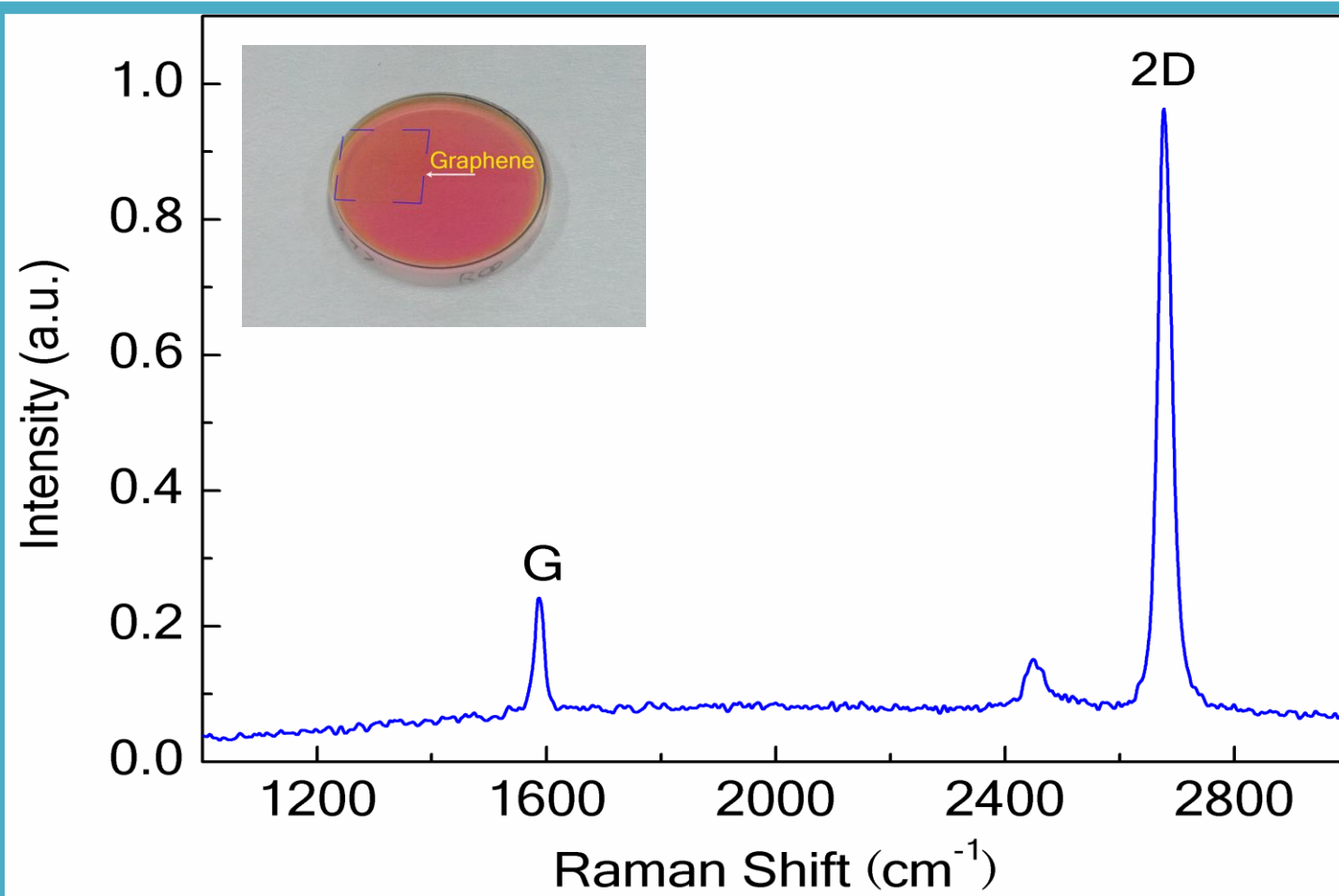


The schematic of graphene mode-locked Yb:CYA laser.

EXPERIMENTAL RESULTS

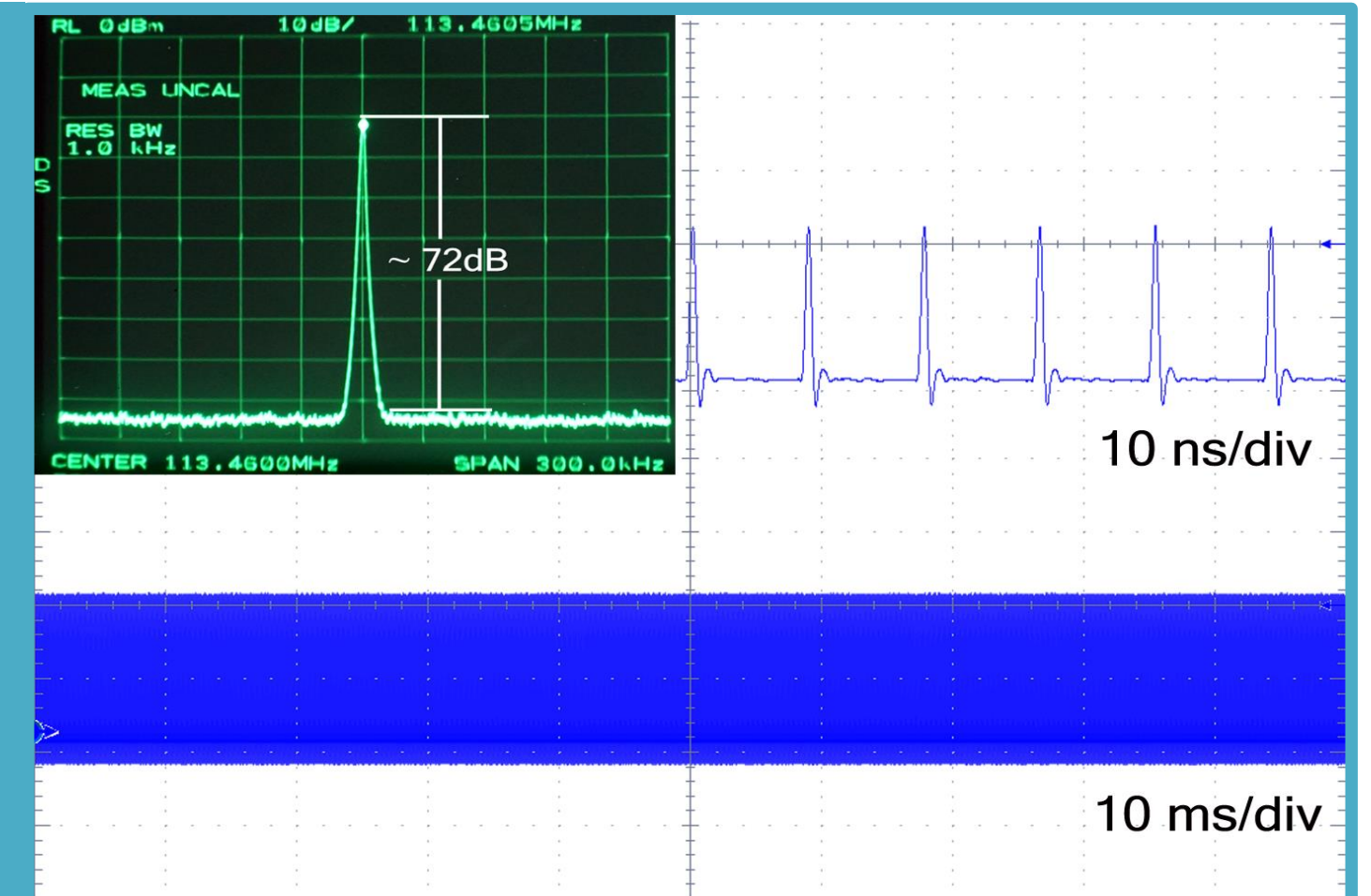
Raman spectrum of GSAM

Raman spectrum (excited by a 532 nm laser) and image of GSAM.



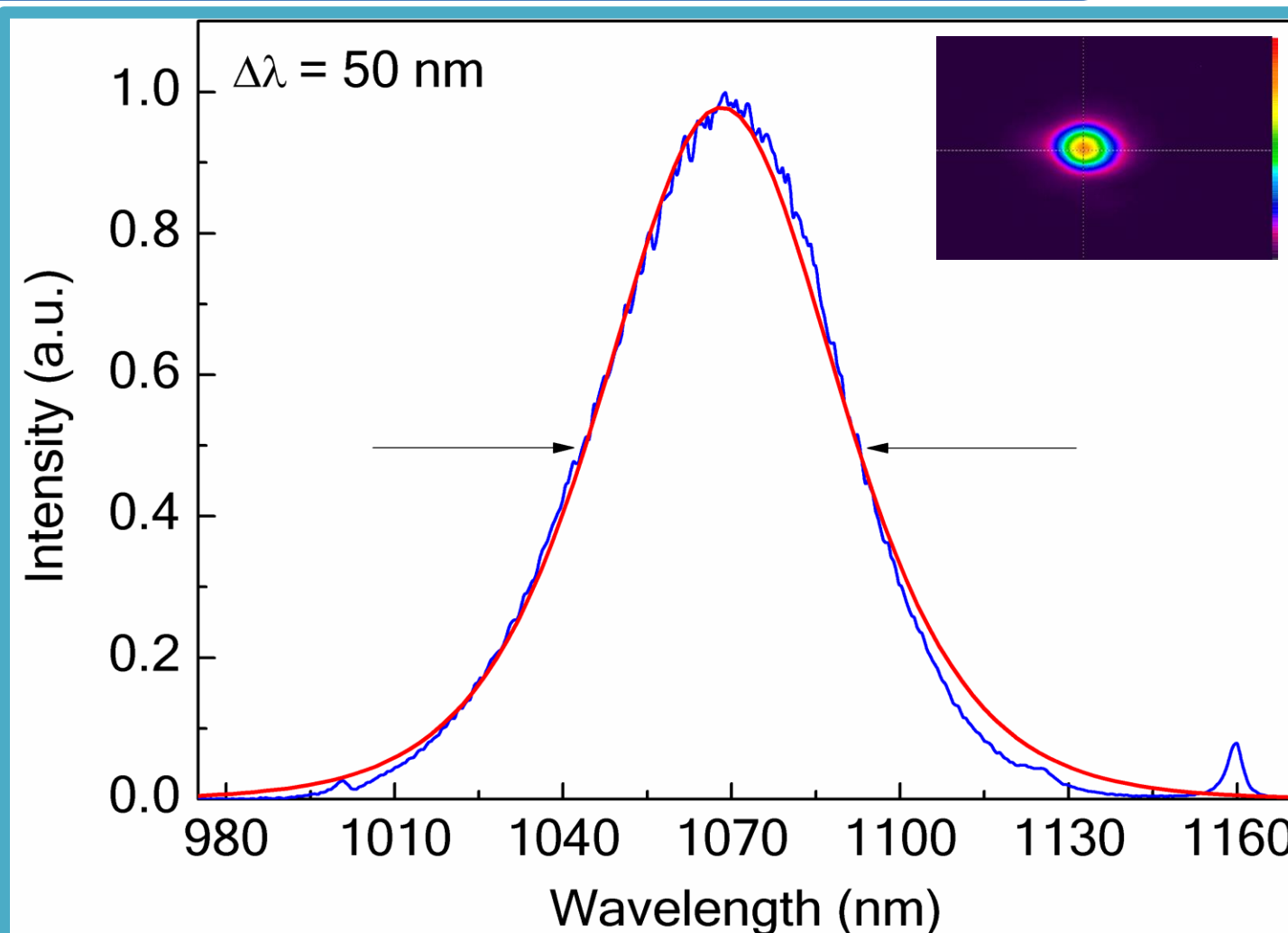
Pulse Trains and RF Spectrum

Typical mode-locked pulse trains and Radio-Frequency (RF) spectrum of mode locking.



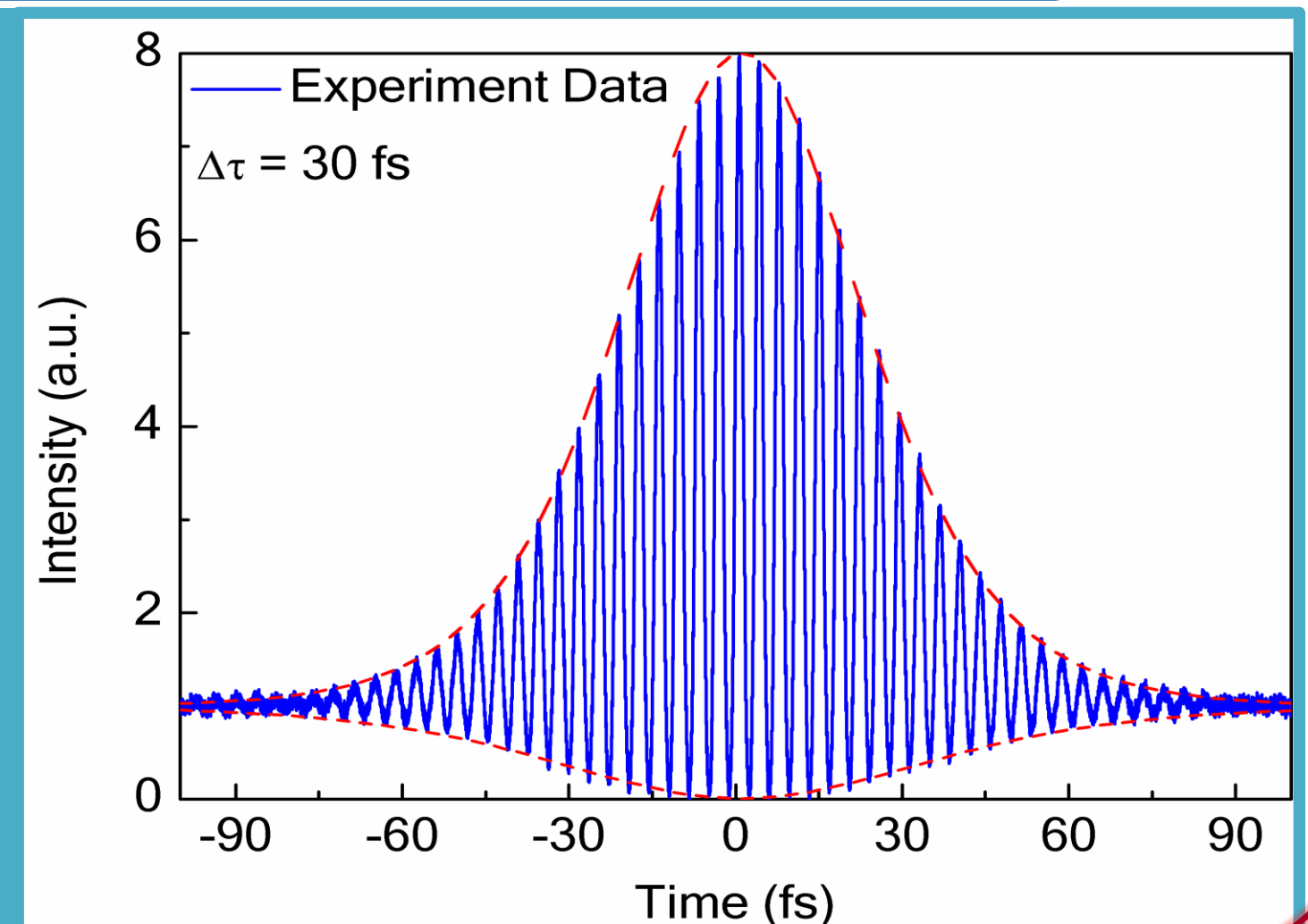
Mode-locked Spectrum

The mode-locked spectrum is centered at 1068 nm and has a sech² profile with a (FWHM) bandwidth of ~ 50 nm.



Autocorrelation Trace

Assuming a sech² pulse shape, the pulse width is 30 fs. The time-bandwidth product is calculated to be about 0.39.



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