Broad spectral range few-cycle laser pulses characterization by using a FASI device

March 15 2021, by Zhang Nannan

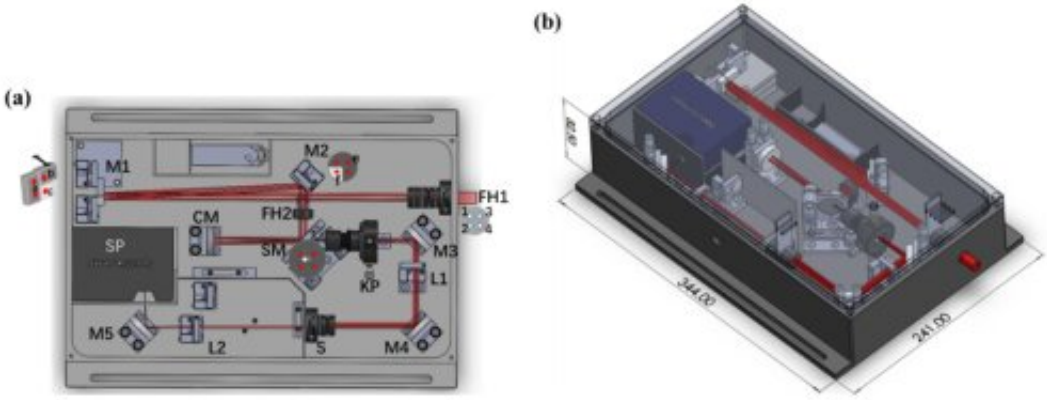

Fig. 1. the layout of the FASI device. Credit: SIOM

Researchers from the Shanghai Institute of Optics and Fine Mechanics (SIOM) of the Chinese Academy of Sciences (CAS) have developed a simple device called frequency-resolved optical gating and self-referenced spectral interferometry (FASI), which combines the frequency-resolved optical gating (FROG) and self-referenced spectral interferometry (SRSI) in a single device based on the same third-order nonlinear effect of the transient grating (TG). The result was published in Optics & Laser Technology.

FROG is the first technique that emerged to realize the full measurement of the intensity and phase of ultrashort laser pulses in 1993, and has been one of the most widely used techniques so far. And SRSI is another fresh

characterization technique with attractive capacity introduced in 2010.

However, the spectrum of the SRSI reference pulse must be wider than that of the test pulse for a correct pulse characterization, which restricts SRSI to the characterization of well compressed, or even the near Fourier-transform-limited pulses.

In this study, the researchers developed a novel simple device FASI, which combines the FROG and SRSI, and both of them are based on the third-order nonlinear effect of TG. The device can characterize few-cycle pulses with broad spectral range from ultraviolet to mid-IR (infrared ray) in single-shot mode for well compressed pulses.

Moreover, for complex or large chirped pulses, the device can also complete the characterization task by using the multi-shot TG-FROG mode.

The researchers successfully used the developed FASI device to characterize two few-cycle pulses centered at 800 nm and 1,800 nm to verify its ability. It turned out that the device is a powerful tool for ultrashort laser pulses characterization as it owns the full advantages of the SRSI method and can also characterize complex or large chirped pulses by using the multi-shot TG-FROG mode.

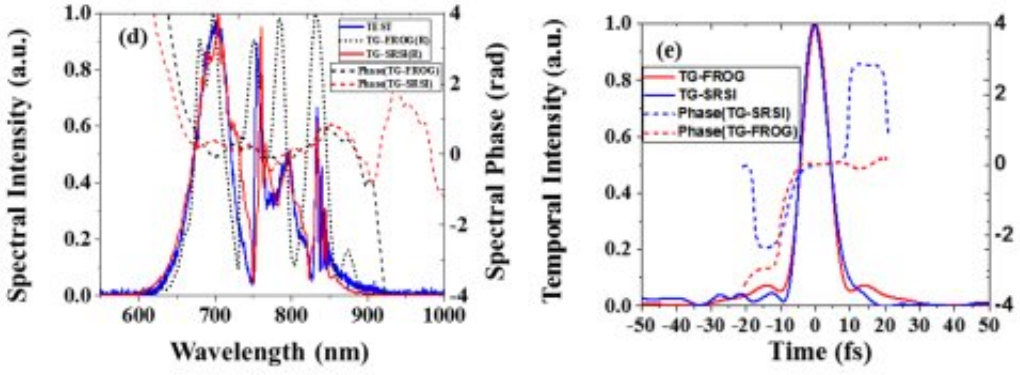

Fig. 2. the characterization results of a pulse centered at 800 nm. Credit: SIOM

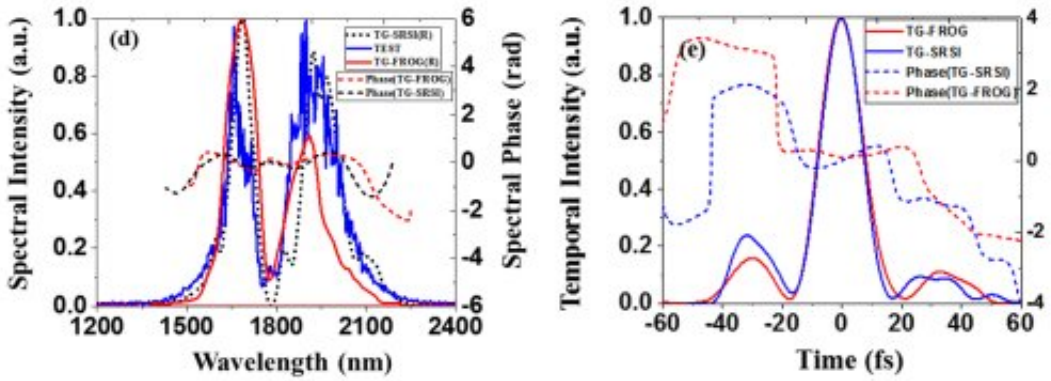

Fig. 3. the characterization results of a pulse centered at 1800 nm. Credit: SIOM

More information: Xiong Shen et al. Broad spectral range few-cycle laser pulses characterization by using a FASI device, *Optics & Laser Technology* (2020). DOI: 10.1016/j.optlastec.2020.106810

Provided by Chinese Academy of Sciences