Suppressing Chirp of THz pulses by using an optical fiber as a pulse stretcher for chirped pulse beating

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Difference frequency generation with chirped laser pulse pairs is one of the techniques to generate tunable narrow-band terahertz (THz) pulses [1]. It has been observed that the nonlinear chirp of the laser pulse caused by the pulse stretcher results in the linear chirp of the THz pulses. Recently, Kamada et al. have derived the relationship between the Taylor coefficients of the spectral phase of the pulse stretcher and the chirp of THz pulse. Based on this theory, they have also demonstrated generation of tunable narrow-band THz pulse with suppressed chirp by using grating pair as a pulse stretcher [2]. However, the chirp of THz pulse has a lower limit that is independent of the grating parameters.

Here we show that it is possible to beat this lower limit by using a single-mode optical fiber as a pulse stretcher. We extend Kamada’s theory to a commercial single-mode optical fiber and show that the chirp of THz pulse is smaller than the lower limit for the grating pair case. Based on this theory, we perform an experiment with the setup shown in Fig. 1 and demonstrate suppression of chirp of THz pulse.


Fig. 1: Schematic of narrow-band THz pulse generation by chirped-pulse beating using an optical fiber as a pulse stretcher.