Full Ultrashort Pulse Characterization Using Single-Beam Nonlinear Ellipse Rotation Measurements in Thick Samples

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Recently, we developed a new method for measuring the ultrashort pulse properties using thick nonlinear samples and the nonlinear ellipse rotation (NER) signal [1]. Using thick and highly dispersive samples with well-known second-order dispersion, the pulse width and chirp can be found from the NER signal changes as an ultrashort pulse propagates along the sample. The NER signal, inversely proportional to the pulse width, increases (decreases) as the pulse gets shorter (longer). Due to the simplicity, absence of phase matching issues, single-beam configuration, *etc.*, our method is promising to be used for ultrashort pulse characterization and, in addition, where other methods do not work. To operate, our original method requires measuring the pulse bandwidth using an appropriate spectrometer. However, determining the correct Fourier Transform-Limited (FTL) pulse bandwidth is not always straightforward. Sometimes, the laser bandwidth measured with a spectrometer may not correspond to that of the FTL pulse. On the other hand, it is not easy to measure the laser bandwidth in certain spectral regions, such as the mid-infrared region, due to the absence of an appropriate spectrometer. Nevertheless, we have systematically observed that our proposed method determines the correct ultrashort pulse properties if two or more distinct dispersive samples are measured at same laser beam conditions. In other words, in the worst case scenario, no spectrometer is required for the laser bandwidth determination. To test our proposal, we characterized ultrashort pulses from an amplified Ti:sapphire laser using highly dispersive and thick nonlinear glass samples such as: SF6, SF66 and LaSF-N30.

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References

[1] R M Moysés, E C Barbano and L Misoguti, J. Opt. Soc. Am. B **40**, 1518 (2023)