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Creation of Ultrafast Ultra-Broadband High Energy Laser Pulses

Authors : Walid Tawfik

Abstract : The interaction of high intensity ultrashort laser pulses with plasma generates many significant applications, including soft x-ray lasers, time-resolved laser induced plasma spectroscopy LIPS, and laser-driven accelerators. The development in producing of femtosecond down to ten femtosecond optical pulses has facilitates scientists with a vital tool in a variety of ultrashort phenomena, such as high field physics, femtochemistry and high harmonic generation HHG. In this research, we generate a two-octave-wide ultrashort supercontinuum pulses with an optical spectrum extending from 3.5 eV (ultraviolet) to 1.3 eV (near-infrared) using a capillary fiber filled with neon gas. These pulses are formed according to nonlinear self-phase modulation in the neon gas as a nonlinear medium. The investigations of the created pulses were made using spectral phase interferometry for direct electric-field reconstruction (SPIDER). A complete description of the output pulses was considered. The observed characterization of the produced pulses includes the beam profile, the pulse width, and the spectral bandwidth. After reaching optimization conditions, the intensity of the reconstructed pulse autocorrelation function was applied for the shorts pulse duration to achieve transform limited ultrashort pulses with durations below 6-fs energies up to 600μJ. Moreover, the effect of neon pressure variation on the pulse width was examined. The nonlinear self-phase modulation realized to be increased with the pressure of the neon gas. The observed results may lead to an advanced method to control and monitor ultrashort transit interaction in femtochemistry.

Keywords : supercontinuum, ultrafast, SPIDER, ultra-broadband
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