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GENERATION OF ULTRAFAST SUPER-CONTINUUM LASER SOLAR SIMULATOR

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This research reveals a new laser technology, the ultrafast supercontinuum laser, to produce a high power ultrafast controllable laser solar simulator. The system output irradiance of 31.8 x 10^{15} w/cm^2 exceeds 300 Peta suns, assuming the typical sun irradiance is 0.1 w/ cm^2. In this work, ultrafast high energy laser pulses have been observed. These pulses were generated due to supercontinuum caused by self-phase modification (SPM) in neon gas filled in a one-meter hollow-fiber followed by two chirped-mirrors for dispersion compensation. The created pulses reached the transform limited of ~6 femtosecond pulse duration with high energy of sub-mJ at 1 KHz repetition rate. The characterization of ultrafast pulses in the regime of few-cycle pulses is considered using spectral phase interferometry for direct electric-field reconstruction (SPIDER). The SPIDER was used to observe precise measurements of pulse duration. The spectral bandwidth found to reach ultra-wide range from 600-950 nm. It has been found that the output pulse width is affected by the pulse duration of the injected femtosecond pulses into the optical fiber under different gas pressures. The observed results revealed that the nonlinear SPM increases the gas pressure. The obtained pulses can be used in ultrafast laser texturing for enhanced solar cell performance in future.

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