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Recent progress on laser-plasma acceleration at kHz repetition rate

Monday, September 16, 2019 12:00 PM (30 minutes)

We will review our recent research activities on high-repetition rate laser-wakefield acceleration. In a recent series of experiments, we have used millijoule near-single-cycle laser pulses of 3.5 fs duration at kHz repetition rate to accelerate electrons to 5 MeV energies. The single-cycle laser pulses were able to excite nonlinear plasma wakefields and accelerate electrons to MeV energies in few tens of microns only. We will discuss the various acceleration mechanisms that allowed us to accelerate high beam-loads of tens of picoCoulomb per pulse at a kHz repetition rate.
Using near-sincle cycle laser pulses has allowed us to enter a new regime of laser plasma acceleration where carrier-envelope phase (CEP) and group velocity dispersion effects (GVD) become important. We will show the first clear experimental evidence of CEP effects on electron injection and acceleration. We will also show unique results where we compare the physics of laser-plasma interaction using laser pulses with different spectral widths (i.e. different Fourier Transform limits). These results outline the fact that for extremely short pulses < 4-fs, dispersion effects complicate the interaction and might become detrimental to electron acceleration in certain cases.

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