Relativistic effects in plasma produced with sub-nanosecond 3-TW laser

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This contribution deals with observations of relativistic electrons produced in a laser plasma interaction experiment at the PALS laser system operated at the Institute of Plasma Physics in Prague, Czechia. The PALS laser is a near-infrared 3-TW iodine laser designed to deliver irradiance on target of 10^{16} Wcm^{-2} in ≈300 ps pulses at the wavelength of 1.315 μm. Plastic and metallic foils of 50 – 500 μm in thickness were irradiated with $I\lambda^2 \approx 5\times10^{16}$ W cm^{-2} μm^2. Under these conditions we have observed relativistic electrons expanding into the vacuum with maximum energy going beyond 4 MeV in the backward direction, i.e. against of the focused laser beam. The relativistically accelerated forward electrons passing through foil targets were directly observed around the normal of the rear target surface. The applied laser intensity was increased by the self-focusing above the relativistic threshold. Our experiments have shown that the experimental conditions may be appropriate for thermal and relativistic self-focusing. The application of a unique femtosecond interferometry technic [1] allowed us to observe bunches of trapped electrons occurring in the plasma expanding against the focused laser beam.

[1] T. Pisarczyk, et al., Phys. Plasmas 21, 012708 (2014).