EFFECT OF PREPULSE ON FAST ELECTRON LATERAL TRANSPORT AT THE TARGET SURFACE IRRADIATED BY INTENSE FEMTOSECOND LASER PULSES

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The effects of preplasma on lateral fast electron transport at front target surface irradiated by ultraintense (>10^{18} W/cm^2) laser pulses are experimentally investigated. A spherically bent quartz crystal is used to record two-dimensional spatially resolved K_α x-ray emission resulting from fast electron transport. A large (~ 600 μm in diameter) annular K_α halo structure surrounding a central spot is observed when a preplasma is presented. Furthermore, the halo size increases with the preplasma scale length, and it finally vanishes when the scale length is sufficiently large. Moreover, an obvious reduction of the K_α yield measured by a single photon counting charge-coupled device (CCD) is observed for a large preplasma scale length. Specially designed step-like target is used to identify the possible electron transport mechanisms resulting in the experimental observations. It is believed that the halo of the K_α x-ray emission is mainly generated by the out-going fast electrons laterally diffused in the self-generated magnetic and electrostatic fields in the preplasma. This understanding is supported by the simulated fast electron trajectories in specified magnetic and electrostatic fields using a two-dimensional numerical model.