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[\[Image PDF \(1550K\)\]](#) [\[References\]](#)

Ultra-Short Ultra-High Intensity Laser-Matter Interaction

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Abstract: Recently, ultra-high intensity short pulse lasers have been developed quite successfully. They have been applied to the fields such as hard x-ray generation and high energy particle generation. The essence of such laser-produced plasmas is that the lasers can feed their ultra-high energy density into that of the electron motion in matter via the ponderomotive force. Then the electron energy is transferred into the atoms and ions which include excitation and ionization by the laser field and the electron collision. Ion acceleration occurs by the electrostatic potential formed by high energy electron bouncing in the finite size plasma. Subsequently, high flux x-ray with a few tens of MeV energy induces nuclear reactions, which open up the new fields of high energy plasma physics and applications. In this reviewed article, the basic ultra-short and high intensity laser-plasma interaction studies are introduced. These studies lead us to new attractive fields not only the practical applications but also the new aspects of the basic sciences such as control of a highly-nonlinear relativistic plasma.

Key Words: [Ultra-high field physics](#), [Ultra-short laser pulse](#), [Ultra-high intensity laser](#), [Laser-matter interaction](#), [Relativistic plasma](#), [Laser driven radiation source](#)

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