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Expansion of Non-Quasi-Neutral Limited Plasmas Driven by Two-Temperature Electron Clouds MASAKATSU MURAKAMI, Institute of Laser Engineering, Osaka University, JAVIER HONRUBIA, ETSI Aeronauticos, Universidad Politecnica de Madrid — Fast heating of an isolated solid mass, under irradiation of ultra-intense ultra-short laser pulse, to averaged temperatures of order of keV is theoretically studied. Achievable maximum ion temperatures are determined as a consequence of the interplay of the electron-to-ion energy deposition and nonrelativistic plasma expansion, where fast ion emission plays an important role in the energy balance. To describe the plasma expansion, we develop a self-similar solution, in which the plasma is composed of three fluids, i.e., ions and two-temperature electrons. Under the condition of isothermal electron expansion in cylindrical geometry, such a fluid system, self-consistently incorporated with the Poisson equation, is fully solved. The charge separation and resultant accelerated ion population due to the induced electrostatic field are quantitatively presented. The analytical model is compared with two-dimensional hydrodynamic simulations to provide practical working windows for the target and laser parameters for the fast heating.

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