ION ACCELERATION AND PLASMA JET FORMATION IN THE INTERACTION OF A CIRCULARLY POLARIZED LASER BEAM NORMALLY INCIDENT ON AN OVERDENSE PLASMA: A VLASOV CODE SIMULATION

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A one-dimensional Eulerian Vlasov code [1] is used to study numerically the acceleration of ions and the formation of a plasma jet due to the interaction of a high intensity circularly polarized laser beam normally incident on the surface of an overdense plasma. The one-dimensional relativistic Vlasov-Maxwell equations are solved numerically for both electrons and ions. The laser wavelength λ is greater than the initial scale length L_{edge} of the plasma density gradient at the plasma surface $(\lambda > L_{edge})$. The plasma density is $n = 100\, n_{cr}$. The normalized amplitude of the vector potential of the incident high intensity laser radiation is $a_0 = 25/\sqrt{2}$, where $2a_0^2 = I\lambda^2 / 1.368x10^{18}$ and I is the intensity in W/cm^2 and λ is the wavelength in microns. The laser beam interacts with the electrons at the plasma surface via its ponderomotive pressure, producing a sharp density gradient at the target surface, which gives rise to a charge separation and an electric field which accelerates the ions and leads to the formation of a plasma jet. Two cases are studied: the case of a constant intensity laser beam, and the case of a laser pulse of Gaussian shape. The results show important differences in the phase-space structures for the electrons and ions between these two cases. The low noise level of the Vlasov code allows a good representation of the phase-space structure of the electrons and ions

References

[1] M. Shoucri, B. Afeyan Laser Part. Beams 28, 129 (2010)

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