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Effect of target geometry on magnetic field generation and amplification in high-intensity laser–plasma interaction using 2D PIC simulation

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Abstract

The effect of target geometry on magnetic field amplification in high-intensity laser–plasma interactions is investigated using two-dimensional particle-in-cell (PIC) simulations performed with the EPOCH code. Two plasma target configurations are considered: a double-cone target and a curved-foil target, while all laser parameters, computational conditions, and plasma properties are kept the same. The temporal evolution and spatial distribution of the generated magnetic field, particle energies, and electric-field components are analyzed. The results show that the curved-foil target produces a stronger, more localized, and more temporally stable magnetic field than the double-cone target. This enhancement is associated with improved electron confinement, increased axial current density, and reduced radial electron divergence. The findings demonstrate that target geometry plays an important role in controlling current dynamics and enhancing magnetic field generation in laser–plasma interactions.

Keywords: PIC simulation, Laser–plasma interaction, Electron acceleration, Axial currents, Magnetic field generation

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