

2D PIC Simulations of Collective Thomson Scattering for Power Laser Experiments

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We conducted 2D PIC simulations of collective Thomson scattering, aiming to capture the nonequilibrium plasma in the shock transition region through Thomson scattering diagnostics in magnetized plasma shock experiments driven by high-power lasers. In the simulation, the shock transition region is modeled as a localized beam-plasma system, into which a probe laser beam is injected. We analyze the characteristics of the resulting two-dimensional scattered light spectrum. Since experimental constraints require placing the detector at an angle of -90 degrees relative to the probe beam, we discuss the features of the scattered light spectrum under various beam conditions for this detection geometry. Additionally, we attempt to reproduce the experimental data obtained in 2024.

Keywords: collective Thomson scattering, multi-dimensional PIC simulation, beam-plasma system, power laser experiment