Electron heat transport in plasmas through Molecular Dynamics and Particle-In-Cell simulations

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Understanding electron heat transport in Inertial Confinement Fusion (ICF) plasmas is both a challenging and essential task, as it plays a crucial role in transferring laser energy to the fusion capsule. In this study, we investigate electron heat transport properties using two simulation approaches: Particle-In-Cell (PIC) simulations with the SMILEI code [1], which are based on a kinetic closure using the Vlasov-Landau equation to model plasma behavior, and classical Molecular Dynamics (MD) simulations using the Bingo-TCP code [2], which solve the full N-body problem. This preliminary work focuses on heat transport in the Spitzer-Härm regime [3], where the thermal transport coefficient κ is determined through spectral analysis of the temperature profile evolution in both PIC and MD simulations. This study serves as an initial step toward other tasks, such as the reconstruction of the complete generalized Ohm's law, and should be extended to the non-local regime, where additional effects can limit heat transport efficiency. Furthermore, we will account for the effects of an external magnetic field in the MD simulations [4] to guide our research toward Magneto-Inertial Fusion (MIF) experiments.

References

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