A Hybrid Vlasov Fokker-Planck Code for Laboratory Astrophysics

Applications

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Laser produced plasma experiments could be used to investigate the phenomena of astrophysical relevance. The high densities and velocities generated in the laboratory provide ideal conditions to investigate weakly collisional or collisionless plasma physics. Numerical simulations play a vital role in this effort, providing predictions in the developmental stage, and assisting the interpretation of results. To this end, we are currently developing a new hybrid simulation code designed to explore the complex interaction between fast moving plasmas and their self-generated electromagnetic fields including an effectively arbitrary level of collisionality.

This hybrid code solves the Vlasov-Fokker-Planck equation for the ions while the electrons are treated as a charge neutralizing fluid. This can accurately model non-Maxwellian ion distributions, covering both high frequency and hydrodynamic timescale phenomena, and can provide a reliable description for plasmas both in the collisionless and weakly collisional regimes. We will present some validation tests for the code to show that it can accurately model the key processes.