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Direct Comparison of Full-Scale Vlasov-Fokker-Planck and Classical Modeling of Megagauss Magnetic Field Generation in Plasma Near Hohlraum Walls From Nanosecond Laser Pulses[1] ARCHIS JOGLEKAR, ALEXANDER THOMAS, Univ of Michigan - Ann Arbor, MARTIN READ, ROBERT KINGHAM, Imperial College — Here, we present 2D numerical modeling of near critical density plasma using a fully implicit Vlasov-Fokker-Planck (VFP) code, IMPACTA, with the addition of a ray tracing package. In certain situations, such as those at the critical surface at the walls of a hohlraum, magnetic fields are generated through the crossed temperature and electron density gradients. Modeling shows 0.3 MG fields and the strong heating also results in magnetization of the plasma up to $\omega\tau \sim 5$. In the case without magnetic field generation, the heat flows from the laser heating region are isotropic. Including magnetic fields causes the heat flow to form jets along the wall due to the Righi-Leduc effect. The heating of the wall region causes steeper temperature gradients. This serves as a positive feedback mechanism for the field generation rate resulting in nearly twice the amount of field generated in comparison to the case without magnetic fields over 1 ns. The heat conduction, field generation, and the calculation of other transport quantities, is performed ab-initio due to the nature of the VFP equation set. In order to determine the importance of the kinetic effects from IMPACTA, we perform direct comparison with a classical (Braginskii) transport code with hydrodynamic motion (CTC+).

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