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An efficient, time-implicit, conservative solver for the multi-species fully kinetic 1D-2V VFP-Ampère system[1] STEVEN ANDERSON, WILLIAM TAITANO, LUIS CHACON, ANDREI SIMAKOV, Los Alamos National Laboratory — We discuss the extension of the fluid electron treatment in the hybrid 1D-2V Vlasov-Fokker-Planck (VFP) code iFP to a fully kinetic one. We address the numerical stiffness of kinetic electrons (owing to the presence of fast timescales associated with the plasma frequency, fast electron motion, and electron collisions) by implicit timestepping, accelerated by a multiscale moment-based preconditioner. iFP's mass, momentum, and energy conserving discretization (which is achieved through a Lagrange-multiplier-like approach by using nonlinear constraint functions) is extended to deal with charge separation, while preserving iFP's successful adaptive mesh strategy in physical and velocity space (in which the velocity space of each species is analytically rescaled and shifted by its spatially and temporally varying thermal speed and bulk flow, and a moving mesh in configuration space allows tracking features with sharp spatial gradients, such as shocks and material interfaces). We present results from several benchmark problems, and demonstrate application to a fully kinetic collisional plasma shock in planar geometry.

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