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Fully Implicit Energy and Charge Conserving, Discretely Consistent Moment System for Vlasov-Ampere System WILLIAM TAITANO, DANA KNOLL, Los Alamos National Laboratory, LUIS CHACON, GUANGYE CHEN, Oak Ridge National Laboratory, BILL DAUGHTON, Los Alamos National Laboratory, LOS ALAMOS NATIONAL LABORATORY COLLABORATION, OAK RIDGE NATIONAL LABORATORY COLLABORATION — [1][2] pioneered the implicit moment method (IMM) for kinetic plasma simulation. In the classic IMM approach, upon convergence of the discrete kinetic and fluid moment system within a timestep, a discretization truncation inconsistency between the two systems can exist. Additionally, when using the total stress tensor from the kinetic system as closure for the moment system, the stiff hyperbolic waves are not effectively decoupled from the kinetic system and accelerated in the moment system. In this presentation, we advance the original IMM approach by 1) addressing the discrete truncation consistency between the kinetic and moment system, and 2) improve the IMM approach by introducing the idea of density normalized stress tensor to efficiently isolate and implicitly step over the stiff hyperbolic isothermal wave in the moment system. We will present the significance of these improvements on the IMM method by discussing energy conservation and nonlinear convergence rate of the method for a multiscale two species ion acoustic shockwave problem. Additional results of the method accelerated via Anderson acceleration will be presented.

[1] R.J. Mason, J. Comp. Phys., 1981. [2] J.U. Brackbill et al. J. Comp. Phys., 1982. [3] W.T. Taitano et al. SISC, 2012 in review.

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