Abstract Submitted
for the DPP07 Meeting of
The American Physical Society

Ten-Moment Equations For Fluid Modelling of Plasmas AMMAR HAKIM, Tech-X Corporation — High-order moment fluid equations for simulation of plasmas are presented. The ten–moment equations are a two–fluid model in which time dependent equations are used to advance the pressure tensor. With the inclusion of the full pressure tensor Finite Larmor Radius (FLR) effects are captured. In the absence of collisions, the solution the ten–moment equations can be considered as exact solutions to the Vlasov equation with special initial conditions on the particle distribution function. Collisional effects are included using two different methods. In the first method, the BGK form of the collisional operator is used and in the second, a linearized form of the Coulomb collision operator is used. The dispersion relation of the equation system, both with and without collisions, is presented. In the collisionless case it is shown that, in addition to the usual two–fluid waves, electron Bernstein waves are captured correctly. In the case in which collisions are included, collisional damping rates for the pressure tensor to isotropy are computed. Numerical solution to a few illustrative problems are presented. In the first, solutions to Riemann problems for the ten–moment equations is presented. These differ significantly from the two–fluid and ideal MHD Reimann solutions. Reconnection rate for a fast magentic reconnection problem is computed and compared to kinetic and other fluid models. The stability of a g-mode in a slab plasma is presented.

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Date submitted: 20 Jul 2007 Electronic form version 1.4