Abstract Submitted
for the DPP17 Meeting of
The American Physical Society

A fully implicit, conservative, hybrid kinetic-ion fluid-electron algorithm ADAM STANIER, LUIS CHACON, GUANGYE CHEN, Los Alamos Natl Lab — The hybrid model with full-orbit kinetic ions and fluid electrons is a promising approach to describe a wide range of space and laboratory plasmas [e.g. 1]. Explicit hybrid algorithms typically use a predictor-corrector method with sub-cycling or a semi-implicit field solve to deal with the strict Whistler-wave CFL condition. However, these do not conserve momentum or energy, and are susceptible to numerical instability. While fully implicit methods have been recently explored [2,3] to step over such timescales in a stable manner, these studies have not considered conservation properties. Here, we present a novel particle-based non-linear hybrid algorithm that features discrete conservation of mass, momentum, energy and the solenoidal condition of the magnetic field. The scheme combines fully implicit time advance with orbit-averaging of the ion particles and the flexibility of conservative smoothing to reduce numerical noise. We verify the algorithm for a number of test problems and demonstrate the unique conservation properties.

1. A. Stanier, et. al., *Phys. Plasmas* **24**, 022124 (2017).
2. B. Sturdevant, et. al., *J. Comput. Phys.* **316**, 519 (2016).
3. J. Cheng, et. al., *J. Comput. Phys.* **245**, 364 (2013).

Adam Stanier
Los Alamos Natl Lab

Date submitted: 13 Jul 2017 Electronic form version 1.4