Abstract Submitted
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A JFNK-based implicit moment algorithm for self-consistent, multi-scale, plasma simulation DANA KNOLL, LANL, WILLIAM TAITANO, University of Idaho, LUIS CHACON, ORNL — Jacobian-Free-Newton-Krylov method (JFNK) is an advanced non-linear algorithm that allows solution to a coupled systems of non-linear equations [1]. In [2] we have put forward a JFNK-based implicit, consistent, time integration algorithm and demonstrated it's ability to efficiently step over electron time scales, while retaining electron kinetic effects on the ion time scale. Here we extend this work by investigating a JFNK- based implicit-moments approach for the purpose of consistent scale-bridging between the fluid description and kinetic description in order to resolve the transition region. Our preliminary results, based on a reformulated Poisson's equation (RPE) [3], allows solution to the Vlasov-Poisson system for varying grid resolutions. In the limit of local coarse grid size (grid spacing large compared to Debye length), the RPE represents an electric field based on the moment system, while in the limit of local grid spacing resolving the Debye length, the RPE represents an electric field based on the standard Poisson equation. The technique allows smooth transition between the two regimes, consistently, in one simulation. [1] D.A. Knoll and D.E. Keyes,J. Comput. Phys., vol. 193 (2004) [2] W.T. Taitano, Masters Thesis, Nuclear Engineering, University of Idaho (2010) [3] R. Belaouar, N.Crouseilles and P. Degond,J. Sci. Comput., vol. 41 (2009)

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