Abstract Submitted
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Numerical algorithms for cold-relativistic plasma models in the presence of discontinuities[1] AMMAR HAKIM, JOHN CARY, DAVID BRUHWILER, Tech-X Corporation, Boulder CO, 80303, CAMERON GEDDES, WIM LEEMANS, ERIC ESAREY, Lawrence Berkley National Lab. — A numerical algorithm is presented to solve cold-relativistic electron fluid equations in the presence of sharp gradients and discontinuities. The intended application is to laser wakefield accelerator simulations in which the laser induces accelerating fields thousands of times those achievable in conventional RF accelerators. The relativistic cold-fluid equations are formulated as non-classical system of hyperbolic balance laws. It is shown that the flux Jacobian for this system can not be diagonalized which causes numerical difficulties when developing shock-capturing algorithms. Further, the system is shown to admit generalized delta-shock solutions, first discovered in the context of sticky-particle dynamics (Bouchut, *Ser. Adv. Math App. Sci.*, **22** (1994) pp. 171–190). A new approach, based on relaxation schemes proposed by Jin and Xin (*Comm. Pure Appl. Math.* **48** (1995) pp. 235–276) and LeVeque and Pelanti (*J. Comput. Phys.* **172** (2001) pp. 572–591) is developed to solve this system of equations. The method consists of finding an exact solution to a Riemann problem at each cell interface and coupling these to advance the solution in time. Applications to an intense laser propagating in an under-dense plasma are presented.

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