Abstract Submitted
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Discrete Variational Approach for Modeling Laser-Plasma Interactions[1] J. PAXON REYES, B.A. SHADWICK, University of Nebraska - Lincoln — The traditional approach for fluid models of laser-plasma interactions begins by approximating fields and derivatives on a grid in space and time, leading to difference equations that are manipulated to create a time-advance algorithm. In contrast, by introducing the spatial discretization at the level of the action, the resulting Euler-Lagrange equations have particular differencing approximations that will exactly satisfy discrete versions of the relevant conservation laws. For example, applying a spatial discretization in the Lagrangian density leads to continuous-time, discrete-space equations and exact energy conservation regardless of the spatial grid resolution. We compare the results of two discrete variational methods using the variational principles from Chen and Sudan [1] and Brizard [2]. Since the fluid system conserves energy and momentum, the relative errors in these conserved quantities are well-motivated physically as figures of merit for a particular method.

[1] X. L. Chen and R. N. Sudan, Phys. Fluids B, **5**, 1336 (1993).
[2] Alain J. Brizard, Phys. Plasmas, **5**, 1110 (1998).

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