

Abstract Submitted
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Emittance preservation in plasma-based accelerators with ion motion¹ CARLO BENEDETTI, CARL SCHROEDER, ERIC E. ESAREY, WIM LEEMANS, Lawrence Berkeley Natl Lab — In a plasma-accelerator-based linear collider, the density of matched, low-emittance, high-energy particle bunches required for collider applications can be orders of magnitude above the background ion density, leading to ion motion, nonlinear focusing fields, and, hence, to beam emittance growth. By analyzing the response of the background ions to an ultra-high density beam, analytical expressions, valid for nonrelativistic ion motion, are derived for the transverse wakefield and for the final (i.e., after saturation) bunch emittance. Analytical results are validated against numerical modeling. A class of initial beam distributions are derived that are equilibrium solutions, which require head-to-tail bunch shaping, enabling emittance preservation with ion motion.

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