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Exact phase space matching for staging plasma and traditional accelerator components using longitudinally tailored plasma profiles YIPENG WU, Tsinghua University, XINLU XU, Univ of California - Los Angeles, WEI LU, Tsinghua University, WARREN MORI, Univ of California - Los Angeles, MARK HOGAN, SLAC National Accelerator Laboratory, CHAN JOSHI, Univ of California - Los Angeles — Phase space matching between two plasmaaccelerator (PA) stages and between a PA and a traditional accelerator component is a critical issue for the generation and utilization of high energy electron beams produced by plasma-based accelerators. Catastrophic emittance growth in the presence of a finite energy spread and lack of proper matching will occur as the beam propagates through different stages and components due to the drastic differences of the transverse focusing strengths. We propose using the ideal focusing forces from nonlinear wakes in longitudinally tailored plasma density profiles to provide exact phase space matching components to properly transport the beam through two such stages with negligible emittance growth. Theoretical analysis and full 3-dimensional OSIRIS particle-in-cell simulations are carried out to show how these structures may work in four different scenarios. Good agreement between theory and simulation is obtained. Work supported by NSF and DOE.

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