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Focusing and reduction of correlated energy spread of chirped electron beams in passive plasma lens

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For the next generation of the particle accelerators, including laser wakefield acceleration (LWFA), application of plasma based focusing of electron beams is an area of active research. This approach will pave a path for the miniaturization of the beam transportation line in particle accelerators. In the context of LWFA scheme, this approach will open the opportunity to realize an extremely small setups of multi-GeV and bright source of electron beams. We will present numerical results of passive plasma lens of an electron beam via self-consistent and relativistic particle-in-cell (PIC) simulations. The focusing of an electron beam by a passive plasma lens is a non-linear and dynamic process, which strongly depends on the space charge induced evacuation of the plasma electrons in the vicinity of the propagating electron beam. An initially negative energy chirp is essential in suppressing the unwanted growth in the relative energy spread of the electron beam during the passive lensing. A passive plasma element is useful for both a single as well as multi-stage laser wakefield acceleration configuration.

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