

Abstract Submitted
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PIC simulations of beam energy enhancement by density gradient in a laser wakefield accelerator MIN SUP HUR, UNIST, HYYONG SUK, GIST — Using a newly developed PIC code, we revisit the problem of density tapering to prolong the dephasing length and enhance the accelerated beam energy in laser wakefield electron accelerator. In the new code, all the standard schemes of PIC's were followed. The benchmark against the well-known PIC such as XOOPIC showed excellent agreement. We investigate the density gradient effect on beam energy increasing in a bubble regime of the LWFA. The wavelength shrinkage of the wakefield by the increasing plasma density helps phase-lock the beam and the accelerating field. From a series of simulations we found that, at least for the plasma frequency of order $\omega_p/\omega \sim 0.05$, the relativistic lengthening of the plasma wavelength tends to restore the dephasing between the beam and field very quickly. Even though we observed energy enhancement from 500 MeV to 800 MeV from 3 mm propagation for a parabolically increasing density, the relativistic effects seem to put a fundamental restriction on the energy enhancement by the density gradient.

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