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Electron injection and emittance control by transverse colliding pulses in a laser-plasma accelerator MIN CHEN, ERIC ESAREY, CARL SCHROEDER, CAMERON GEDDES, STEPAN BULANOV, CARLO BENEDETTI, LULE YU, SERGEI RYKOVANOV, WIM LEEMANS, LBNL, ESTELLE CORMIER, DAVID BRUHWILER, Tech-X — By using two colliding laser pulses propagating transversely to the wake, electron injection and emittance can be controlled in a laser plasma accelerator. A beam with extremely small emittance is obtained when position of the colliding pulses is close to the density peak of the wake. Electrons near the axis are accelerated by the colliding pulses and become trapped in the second bucket of the wake. Ionization is used to increase the final injection charge. Simulations show that the transverse momentum spread can be as small as 0.04mc, which is orders of magnitude smaller than typical laser injection schemes in plasma accelerators. For pulses with different frequencies, transverse beat waves can be used to generate asymmetric injection, which can increase the betatron radiation. Supported by DOE HEP DE-AC02-05CH11231, by DOE NNSA DNN, DE-SC0004441 and DE-FC02-07ER41499, and by the COMPASS SciDAC project.

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