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Acceleration of overdense plasmas using colliding laser pulses
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— Most conventional laser-plasma acceleration schemes involve underdense plasmas. Using PIC simulations we demonstrate a radically different concept involving overdense plasmas. When a thin slab of overdense electron-positron plasma is irradiated with ultra-intense linearly polarized laser pulses from both sides, the slab is compressed to less than two relativistic skin-depths so that the laser pulses are transmitted. The transmitted pulses then capture and continuously accelerate a fraction of the particles via comoving Lorentz forces as the laser pulses are slowed by plasma loading. The maximum Lorentz factor grows as a power-law in time and the asymptotic momentum distribution forms a power law of slope close to –1. The highest energy particles are narrowly beamed, providing strong energy-angle selectivity. For 1 micron laser and 1.e21 Wcm^{-2} intensity, the maximum energy exceeds GeV in a ps. We will also discuss applications of this concept to electron-ion plasma slabs.

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