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Quasi-phasematched laser wakefield acceleration[1] J.P. PALASTRO, S.J. YOON, University of Marlyand, College Park, D.F. GORDON, Naval Research Laboratory, H.M. MILCHBERG, University of Marlyand, College Park — A plasma wakefield driven by a laser pulse can accelerate electrons to GeV energies over centimeter length scales. The energy gain in laser wakefield acceleration (LWFA) is ultimately limited by dephasing, occurring when accelerated electrons outrun the accelerating phase of the wakefield. We apply quasi-phasematching, enabled by corrugated plasma channels, to overcome this limitation. An electrostatic wave driven in an axially periodic plasma is composed of spatial harmonics whose associated phase velocities can be tuned through the modulation period. By matching the modulation period to the dephasing length, a relativistic electron can remain in phase with a spatial harmonic and undergo linear energy gain over several dephasing lengths. Theory and simulations are presented showing that at weakly relativistic laser intensities of $\sim 10^{17}$ W/cm^2 and modest pulse energies of $\sim$2 mJ quasi-phasematched LWFA results in energy gains in excess of 100 MeV larger than standard LWFA with identical parameters.

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John Palastro
University of Marlyand, College Park

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