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# Transversely pumped laser driven particle accelerator

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We present a new acceleration scheme capable of accelerating electrons and ions in an underdense plasma. Transversely Pumped Acceleration (TPA) uses multiple arrays of counter-propagating laser beamlets that focus onto a central acceleration axis. Tuning the injection timing and the spacing between the adjacent beamlets allows for precise control over the position and velocity of the intersection point of the counter-propagating beam arrays, resulting in an accelerating structure that propagates orthogonal to the direction of laser propagation. We present the theory that sets the injection timing of the incoming pulses to accelerate electrons and ions with a tunable phase velocity plasma wave. Simulation results are also presented which demonstrate 1.2 GeV proton beams accelerated in 3.6 mm of plasma and electron acceleration gradients on the order of 1 TeV/m in a scheme that circumvents dephasing. This work has potential applications as a compact accelerator for medical physics and high energy physics colliders.

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