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Direct Laser Acceleration in a Flying Focus[1] D.W. RAMSEY, J.P. PALASTRO, D.H. FROULA, Laboratory for Laser Energetics, U. of Rochester — A planar laser pulse propagating in vacuum imparts no net energy to an electron. At its rising edge, the pulse ponderomotively accelerates the electron in the direction of propagation, but as the pulse overtakes and outruns the electron, its trailing edge imparts an equal and opposite ponderomotive impulse, bringing the electron to rest. Planar-like "flying" focus pulses can break the symmetry of this fundamental laser–matter interaction, imparting net energy to an electron. The flying focus—a moving focal point resulting from a chirped laser pulse focused by a chromatic lens—creates an intensity peak that can travel at any velocity. When this velocity is sufficiently slow, the electron gains enough momentum during its initial ponderomotive acceleration to outrun the intensity peak. Here we will present theory and simulations describing the energy gain and dynamics of electrons accelerated by flying focus laser pulses.

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