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Direct Laser Acceleration of Electrons in a Laser Wakefield Accelerator with Ionization Injection JESSICA SHAW, NUNO LEMOS, KENNETH MARSH, University of California Los Angeles Depart of Electrical Engineering, FRANK TSUNG, University of California Los Angeles Department of Physics and Astronomy, NAVID VAFAEI-NAJAFABADI, University of California Los Angeles Depart of Electrical Engineering, WARREN MORI, University of California Los Angeles Department of Physics and Astronomy, CHAN JOSHI, University of California Los Angeles Depart of Electrical Engineering — We show through experiments and supporting simulations the role of direct laser acceleration (DLA) of electrons in a plasma accelerator when ionization injection of electrons is employed to inject charge into the laser-produced wake. If the laser pulse is intense enough to expel most of the plasma electrons but is nevertheless long enough to overlap the electrons trapped in the first accelerating potential well (bucket) of the wakefield, then the betatron oscillations of the electrons in the plane of the laser polarization in the presence of an ion column can lead to an energy transfer from the laser pulse to the electrons. By measuring the electron properties over a range of laser and plasma parameters, we show that DLA can be a major contributor to the maximum electron energy and that the energy gain due to DLA can exceed that due to laser wakefield acceleration for certain laser and plasma parameters.

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