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Optical-period bunch trains to resonantly excite TV/m wakefields in the quasi-nonlinear regime and the E-317 experiment at FACET-II[1]
PRATIK MANWANI, NATHAN MAJERNIK, University of California, Los Angeles, MONIKA YADAV, University of Liverpool and UCLA, CLAIRE HANSEL, JAMES ROSENZWEIG, University of California, Los Angeles — Periodic electron bunch trains can be used to resonantly excite plasmas in the quasi-nonlinear (QNL) regime. This excitation can produce plasma blowout conditions using very low emittance beams despite having a small charge per bunch. The resulting plasma density perturbation is extremely nonlinear locally but preserves the resonant response of the plasma electrons at the plasma frequency. Such a resonant bunch train can be produced via inverse free electron laser (IFEL) bunching, creating microbunches spaced at the laser wavelength. To match the resonance condition of a laser with a period of a few microns, a high plasma density is employed, resulting in extremely large wakefield amplitudes, near 1 TV/m. The plasma response, beam evolution including density modulation, and various instabilities resulting from such an interaction have been investigated using particle-in-cell (PIC) simulations. This scenario corresponds to a planned experiment, E-317, at SLAC's FACET-II facility.

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