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Plasma afterburners and related issues[1] CHENGKUN HUANG, UCLA, E167 COLLABORATION — In plasma wakefield acceleration experiments, the drive beam moves at the speed of light in the plasma and excites an accelerating plasma wakefield behind the driver. Therefore it is possible to use a trailing electron beam to extract energy from the plasma wave wake. Such a design, called the plasma afterburner, has been proposed to double the energy of the incoming beam train for a future linear collider. We investigate the nonlinear beam-plasma interaction in such scenario using a 3D computer modeling code, QuickPIC. We will report on the simulation results of a 1 TeV plasma afterburner design. Several issues such as efficient beam-loading and the stability of the beam in the plasma are also analyzed. The electron hosing instability in the blow-out regime of plasma wakefield acceleration is also investigated using linear perturbation theory upon the electron blow-out trajectory. The growth of the hosing instability is found to be affected by the plasma self-fields, the relativistic mass, the axial motion of plasma electrons and the position-dependent ion channel radius respectively. Therefore the hosing growth has dependence on the beam current, which is not found in the fluid theory. PIC simulations agree very well with this new theory.

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