

RESULTS OF THE ENERGY DOUBLER EXPERIMENT AT SLAC

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Abstract

The costs and the time scales of colliders intended to reach the energy frontier are such that it is important to explore new methods of accelerating particles to high energies. Plasma-based accelerators are particularly attractive because they are capable of producing accelerating fields that are orders of magnitude larger than those used in conventional colliders. In these accelerators a drive beam, either laser or particle, produces a plasma wave (wakefield) that accelerates charged particles. The ultimate utility of plasma accelerators will depend on sustaining ultra-high accelerating fields over a substantial length to achieve a significant energy gain. More than 42 GeV energy gain was achieved in an 85 cm long plasma wakefield accelerator driven by a 42 GeV electron drive beam at the Stanford Linear Accelerator Center (SLAC). Most of the beam electrons lose energy to the plasma wave, but some electrons in the back of the same beam pulse are accelerated with a field of ~ 52 GV/m. This effectively doubles their energy, producing the energy gain of the 3 km long SLAC accelerator in less than a metre for a small fraction of the electrons in the injected bunch.

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