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High intensity laser guiding for electron acceleration

Ultra-compact electron accelerators based on laser plasma interaction at high intensities have already demonstrated electron beams with energies up to 8 GeV. However, the beam quality is still far from the one obtained by conventional accelerators. Efficient guiding of a high intensity laser in plasmas over large distances is one of the most crucial requirements for achieving high quality beams. Guiding methods using a plasma channel generated by a high power discharge have important limitations. We are investigating alternative schemes to produce a plasma channel in a capillary tube using a laser pre-pulse and/or a low power micro-wave discharge. These investigations are performed through numerical simulations including plasma hydrodynamic, high intensity laser propagation and acceleration of injected electrons in the generated plasma wave. Results will be presented for a ten centimeter plasma accelerator stage at GeV energies.

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