Axiparabola : a long focal depth, high resolution mirror for broadband high intensity lasers

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Abstract :
In Laser-Plasma Accelerators (LPA), an ultra-short laser pulse is focused in a plasma to generate a plasma wave. The electromagnetic fields amplitude generated by this plasma wave are 3 orders of magnitudes higher than those created in classical accelerators. However, for reaching higher energies, the electron beam has to experience these fields on large distances. This remains an issue in LPA due mainly to three phenomenons : pump depletion, laser diffraction and electron dephasing. We propose a new optical method that could overcome these limits, it is called axiparabola [5]. This optical element will be used to create a plasma channel, which will act as waveguide for the laser beam [3, 4]. It was inspired by an already existing optical element called axicon [1, 2]. It produces a long focal line by refracting the rays on a different focal position according to their impinging location on the incident surface of the axicon. The axiparabola exploits the same concept, but it uses a reflective component instead of a refractive one.

References :