From all optical guiding and GeV beams to kiloHertz Laser-Plasma acceleration

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In this talk, we will review recent research activities on laser wakefield acceleration at LOA. We will first focus on explaining how the use of a new piece of optics, the axiparabola [1], has allowed us to achieve high intensity guiding over 15 mm, resulting in high quality GeV beams [2]. The axiparabola also holds the potential of controlling the velocity of energy deposition in the plasma, thereby permitting control over the phase velocity of the plasma wave and enabling, in principle, phase-locked acceleration [3]. We will also review recent results on kiloHertz laser wakefield acceleration in which a few millijoule near-single laser pulse is used to drive a wakefield in a high density plasma, resulting in electron acceleration [4] up to 10 MeV. We will show how we have achieved stable beams at kHz over more than 5 hours of operation [5]. In addition, we will explain how the Carrier Envelope Phase (CEP) can have a significant effect on the wakefield. We will highlight recent results on the first observation of CEP effects in a laser wakefield accelerator [6]. Finally, we will conclude with future plans: with the LAPLACE project, LOA is trying to build a new facility putting together high repetition rate and high energy lasers in order to further develop further the engineering and application aspects of LWFA.

References

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