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Direct laser acceleration of positrons with intense pulses

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Plasma-based alternatives to conventional accelerators are largely investigated for electrons, whereas there are extremely few studies dedicated to positrons. Indeed, positrons are difficult to create and guide in the self-generated fields of laser-plasma interaction. Landmark studies demonstrated that positron beams created by conventional accelerators can be further accelerated in plasma wakefields.

In this work, we prove that direct laser acceleration of positrons in a plasma channel is possible.
Positrons are created through the Breit-Wheeler process as an intense pulse interacts with a relativistic electron beam propagating at 90 degrees of incidence [1]. We first evaluate precisely from theory the number of positrons created in this geometry. We then demonstrate that only a few percent of positrons are deflected by the laser in its propagation direction. Finally, we prove that positrons are guided along the channel's main axis due to a high-charge self-loaded electron beam. This proposal opens a path toward direct laser acceleration of positrons with high-intensity lasers.

[1] B. Martinez et al, arXiv:2207.08728 (2022)

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