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Compact, all-optical positron production and collection scheme

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We discuss a compact, laser-plasma-based scheme for the generation of positron beams suitable to be implemented in an all-optical setup. A laser-plasma-accelerated electron beam hits a solid target producing electron-positron pairs via bremsstrahlung. The back of the target serves as a plasma mirror to in-couple a laser pulse into a plasma stage located right after the mirror where the laser drives a plasma wave (or wakefield). By properly choosing the delay between the laser and the electron beam the positrons produced in the target can be trapped in the wakefield, where they are focused and accelerated during the transport, resulting in a collimated beam. This approach minimizes the ballistic propagation time and enhances the trapping efficiency. The system can be used as an injector of positron beams and has potential applications in the development of a future, compact, plasma-based electron-positron linear collider. After injection, positrons can be accelerated to high energies in a plasma (e.g., using a plasma column) for applications to plasma-based colliders.

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