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Acceleration of spin-polarized proton beams from a dual-laser pulse scheme

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Particle beams of high energy and spin-polarization are necessary for various experiments, i.a. in order to test the Standard Model of particle physics. Over the last few years, several setups for spin-polarized electron and proton beams from laser-plasma interaction have been proposed. We present a mechanism based on magnetic vortex acceleration, where the interaction of a single laser pulse with a plasma delivers high spin-polarization of the final beam. In our new scheme, we consider two laser pulses propagating in parallel with a carrier envelope phase difference of π , forming two separate plasma channels. Besides the proton filaments created in each channel, a third in the space between the pulses is formed. Our particle-in-cell simulations show that for a normalized laser vector potential of $a_0 = 100$ proton energies > 100 MeV can be obtained. Compared to single-pulse MVA, our scheme exhibits better spin polarization ($\sim 80\%$) of the final proton beam since the third filament is better shielded from the prevalent electromagnetic fields.

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