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Generation and acceleration of polarised electron bunches in plasma accelerators

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Highly polarised, high current electron bunches from compact plasma accelerators are sought after for numerous applications. However, current proposals to generate these beams from plasmas suffer from intrinsic limitations to the reproducibility, charge, beam shape and final polarisation degree. We propose colliding pulse injection as a technique for the generation of highly polarised electron bunches from pre-polarised plasma targets. Using particle-in-cell simulations, we show that colliding pulse injection enables accurate control of the spin-polarisation during the trapping of electrons, enabling high-current electron bunches with high degrees of polarisation to be generated. Bayesian optimisation is employed to optimise the multi-dimensional parameter space of colliding pulse injection, demonstrating the generation of highly polarised, high-quality electron bunches employing 100-TW class laser technology. We also discuss simulations of acceleration of polarised electron bunches in scenarios relevant to future collider proposals.

Available for oral presentation in a session

Yes

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