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Energy Compression and Stabilization of Laser-Plasma Accelerators

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Laser-plasma accelerators (LPAs) outperform current radiofrequency technology in acceleration strength by orders of magnitude. Yet, enabling them to deliver competitive beam quality for demanding applications, particularly in terms of energy spread and stability, remains a major challenge. Here, we report on a recently published method that combines bunch decompression and active plasma dechirping for drastically improving the energy profile and stability of beams from LPAs. Realistic start-to-end simulations demonstrate the potential of these post-acceleration phase-space manipulations for simultaneously reducing an initial energy spread and energy jitter of $\sim 1-2\%$ to $\sim 0.1\%$, closing the beam-quality gap to conventional acceleration schemes.

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