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Wavefront Reconstruction as a Gateway to Precision Science at EuPRAXIA

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Recent advances in laser technology have significantly propelled the development of Laser Plasma Accelerators (LPAs). However, a critical factor influencing the quality and performance of the plasma-target interaction is the spatial structure of the laser pulse, especially its wavefront. To address this, we present, in collaboration with Dynamic Optics, an optimization software capable of real-time wavefront correction and enhancement, ensuring the highest achievable peak intensity at the laser focus. This capability is essential for maximizing the efficiency and stability of the laser-target interaction that ultimately unlocks a range of scientific and technological opportunities. LPAs with an active wavefront correction can support cutting-edge research in ultrafast phenomena, solid-state physics, and nonlinear optics. Most notably, they offer a transformative pathway for next-generation medical applications such as FLASH radiotherapy.

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