

Temperature effects in plasma-based positron acceleration

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Preserving the quality of a positron beam in plasma-based accelerators, where a wakefield suitable for positron transport and acceleration is generated by an electron filament, poses significant challenges. The wakefields are nonlinear in the transverse direction and non-uniform in the longitudinal direction, leading to potential degradation of the beam quality. Maintaining high beam quality is crucial for the successful application of positron beams in plasma-based colliders. In this talk, we discuss how to mitigate the positron beam quality degradation by introducing an initial background plasma temperature in acceleration concepts that rely on electron filaments. Using ultra-high-resolution simulations enabled by the novel mesh refinement algorithm in HiPACE++, we demonstrate that temperature effects play a key role in broadening the electron filament and consequently smoothing both the non-linear transverse and non-uniform longitudinal wakefields. Leveraging warm plasmas opens up promising avenues for enhancing beam quality in various plasma-based positron acceleration concepts.

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