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Towards PWFA-X-FEL

Thursday, June 22, 2023 9:55 AM (25 minutes)

We present a blueprint for an ultra-compact X-ray free-electron laser (X-FEL) powered by plasma wakefield acceleration (PWFA). The study shows in a high-fidelity S2E simulation how to produce and preserve ultra-high 6D brightness electron beams in a plasma photocathode PWFA stage. Then, a post-plasma beam transport line captures, isolates and refocuses these electron beams into an undulator without charge and quality loss. Inside the undulator, these electron beams emit attosecond duration coherent X-ray pulses down to the sub-Angstrom wavelength after 10 m of the undulator section [1]. We conclude with ongoing efforts of the experimental ecosystem and discuss novel scientific avenues arising from ultra-compact PWFA-X-FELs.

[1] Habib, A.F. et al. Attosecond-Angstrom free-electron-laser towards the cold beam limit. Nat Commun 14, 1054 (2023).

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