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Seeded FEL lasing of the COXINEL beamline driven by the HZDR plasma accelerator

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Laser Plasma Accelerators (LPAs), harnessing gigavolt-per-centimeter accelerating fields, can generate high peak current, low emittance and GeV class electron beams paving the way for the realization of future compact free-electron lasers (FELs). Here, we report on the commissioning of the COXINEL beamline driven by the HZDR plasma accelerator and experimental demonstration of FEL lasing at 270 nm in a seeded configuration[1]. Control over the radiation wavelength is achieved with an improved bandwidth stability. Furthermore, the appearance of interference fringes, resulting from the interaction between the phase-locked emitted radiation and the seed, confirms longitudinal coherence, representing a key feature of such a seeded FEL. These results are cross-checked with simulations, ELEGANT for beam optics and GENESIS for FEL radiation. We anticipate a navigable pathway toward smaller-scale free-electron lasers at extreme ultra-violet wavelengths.

[1] M. Labat, A. Irman, et al, Nat. Photonics 17, 150(2023)

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