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Few cycle radiation pulses from strongly compressed electron beams

Sunday 7 May 2023 16:00 (2 hours)

The ongoing Plasma-driven Attosecond X-ray source experiment (PAX) at FACET-II aims to produce coherent soft X-ray pulses of attosecond duration using a Plasma Wakefield Accelerator [1]. These kinds of X-ray pulses can be used to study chemical processes where attosecond-scale electron motion is important. For this first stage of the experiment, PAX plans to demonstrate that <100 nm bunch length electron beams can be generated using the 10 GeV beam accelerated in the FACET-II linac and using the plasma cell to give it a percent-per-micron chirp. The strongly chirped beam is then compressed in a weak chicane to sub-100nm length, producing CSR in the final chicane magnet at wavelengths as low as 10s of nm. In this contribution we describe the results expected from this initial setup, as well as future iterations of the experiment in which we plan to use short undulators to drive coherent harmonic generation to produce attosecond, terawatt X-ray pulses down to 1-2 nm.
In addition to PAX, a similar ongoing experiment at the XLEAP beamline at LCLS-II plans to demonstrate GW-scale attosecond pulses at UV wavelengths. We discuss tapering strategies which enable precise tuning of the XUV bandwidth and the generation of few-cycle micron wavelength pulses in this experiment which can be used for time-synchronized attosecond pump-probe experiments.

[1] C. Emma, X.Xu et al APL Photonics 6, 076107 (2021)

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Footnotes

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Authors: MARINELLI, Agostino (SLAC National Accelerator Laboratory); EMMA, Claudio (SLAC National Accelerator Laboratory); MORGAN, Jenny (SLAC National Accelerator Laboratory); TANG, Jingyi (Stanford University); LARSEN, Kirk (SLAC National Accelerator Laboratory); HESSAMI, Rafi (Particle Beam Physics Lab (PBPL)); ROBLES, River (Stanford University); ZHANG, Zhen (SLAC National Accelerator Laboratory)

Presenter: HESSAMI, Rafi (Particle Beam Physics Lab (PBPL))

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