DPP20-2020-001773

Abstract for an Invited Paper
for the DPP20 Meeting of
the American Physical Society

Measuring Attosecond Electron Pulses with Coherent Nonlinear Thomson Scattering[1]

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Attosecond-duration electron pulses can potentially enable new scientific discoveries on the frontier research area of ultrafast dynamics. However, current conventional methods for measuring attosecond-duration of electron pulses, such as coherent transition radiation and Smith-Purcell radiation, are inapplicable in the important low energy region. We show that nonlinear Thomson scattering is a robust solution to this problem, and can in principle provide even zeptosecond resolution (10^{-21} s). The pulse duration is revealed by features of the radiation spectrum due to coherent scattering by tightly bunched electrons. The limits and robustness of this method, as well as considerations for its application in realistic experimental conditions, will be discussed in detail.

[1]This material is based upon work supported by the U.S. 467 Department of Energy, High-Energy Physics, under Award 468 No. DE-SC0019421 (Controlled Injection of Electrons for 469 the Improved Performance of Laser-Wakefield 470 Acceleration), and the U.S. Department of Energy, Office 471 of Science, Basic Energy Sciences, under Award No. DE- 472 FG02-05ER15663 (Laser-Driven X-rays for Ultrafast 473 Science).