

New Class of the Local Constant Field Approximation Violation in Ultrashort Laser Pulse

Q Z LV¹, E RAICHER², C H KEITEL¹, AND K Z HATSAGORTSYAN¹

¹*Theoretical Quantum Dynamics and Quantum Electrodynamics, Max Planck Institute for Nuclear Physics, Heidelberg, Germany*

²*Applied physics department, SOREQ Nuclear Research Center, Yavne, Israel*
Contact Email: qingzheng.lyu@mpi-hd.mpg.de

The local constant field approximation (LCFA) is widely used in the study of QED effects in laser-matter interactions, with the justification that the classical strong-field parameter of the impinging laser beam is large. Here, the failure of this conjecture is demonstrated for an electron colliding with an ultrashort laser pulse due to a new class of LCFA violation in which electrons turn sharply and leave the radiation formation zone much earlier than in the LCFA estimation [1]. In contrast to previous observations of LCFA violation resulting in new low-harmonic peaks in the spectrum, here deviations from LCFA results are seen across the whole spectrum. This new class can also appear in more general background fields, which will indicate different features in the emission spectra [2,3]. These results indicate the necessity of amending laser-plasma kinetic simulations in multiple beam laser configurations.

References

- [1] Q Z Lv, E Raicher, C H Keitel and K Z Hatsagortsyan, Phys. Rev. Res. **3**, 013214 (2021)
- [2] Q Z Lv, E Raicher, C H Keitel and K. Z Hatsagortsyan, New J. Phys. **23**, 065005 (2021)
- [3] Q Z Lv, E Raicher, C H Keitel and K Z Hatsagortsyan, Phys. Rev. Lett. **128**, 024801 (2022)