Resummations in Strong-Field QED

G Torgrimsson[1]

[1] *Theoretical Physics, Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany*
Contact Email: greger.torgrimsson@umu.se

In this talk, I will present some recent results and methods based on resummation methods. The focus is on resummations of expansions in α and/or χ.

The $\chi \ll 1$ expansion is typically asymptotic. Such series can be resummed with standard Borel-Padé (-conformal) methods. In [1,2] I applied these methods to nonlinear trident, double Compton and photon trident. I also showed that more recent resummation methods could be much better. For example, the method in [3] allows one to incorporate the leading $\chi \gg 1$ scaling into the resummation of the $\chi \ll 1$ series. In [1] I obtained resummations that include an arbitrary number of terms from both the $\chi \ll 1$ and $\chi \gg 1$ series. This gives faster convergence and resummations that work for any value of χ.

In [4] I found a new way to obtain radiation reaction to all orders in α. This is based on our Mueller-matrix approach [5, 6], where higher-order diagrams are approximated by sequences of $\mathcal{O}(\alpha)$ Mueller matrices for the tree processes $e^{\pm} \to e^{\pm} + \gamma$ and $\gamma \to e^{+} + e^{-}$, and the loops $\gamma \to \gamma$ and $e^{\pm} \to e^{\pm}$. This works for arbitrary spin and polarization, and as long as the pulse is sufficiently long, even if a_0 is not large. In [4] I showed that the α expansion could be resummed either 1) directly from the start into a new matrix integrodifferential equation, or 2) by first calculating the first, *e.g.* 10 orders ($\mathcal{O}(\alpha)$ to $\mathcal{O}(\alpha^{10})$) separately and then resuming them using Padé approximants. 2) can be much faster than 1). One way to obtain each order in α for 2) is to make an expansion in $\chi \ll 1$: The asymptotic χ expansion of $\mathcal{O}(\alpha)$ is used to obtain the χ expansion of $\mathcal{O}(\alpha^2)$, which is used to obtain the χ expansion of $\mathcal{O}(\alpha^3)$ and so on. Afterwards, each of these expansions in χ is resumed, and then the α expansion is resummed. In [7] I used this method for a circularly polarized field with $a_0 = 1$.

References

[1] G Torgrimsson, Phys. Rev. D **102**, 116008 (2020); arXiv:2010.02128 (2020)

[2] Gtorgrimsson, Phys. Rev. D **102**, 096008 (2020); arXiv:2007.08492 (2020)

[3] G Álvarez and H J Silverstone, J. Phys. Comm. **1**, 025005 (2017); arXiv:1706.00329 (20217)

[4] G Torgrimsson, arXiv:2102.11346 (2021)

[5] V Dinu and G Torgrimsson, Phys. Rev. D **102**, 016018 (2020); arXiv:1912.11015 (20219)

[6] G Torgrimsson, New J. Phys. **23**, 065001 (2021); arXiv:2012.12701 (2020)

[7] G Torgrimsson, arXiv:2105.02220 (2021)