Extended Locally Monochromatic Approximation of SFQED Processes

N Larin[1,2,3] and D Seipt[1,2,3]

[1] *GSI Helmholtzzentrum für Schwerionenforschung GmbH, Planckstraße 1, 64291, Darmstadt, Germany. Contact Phone: +49 6159-71-0*
[2] *Helmholtz Institut Jena, Fröbelstieg 3, 07743, Jena, Germany. Contact Phone: +49 3641 947-601*
[3] *Institute of Optics and Quantum Electronic, Max-Wien-Platz 1, 07743, Jena, Germany. Contact Phone: +49 3641 9-47201*
Contact Email: nikita.larin@uni-jena.de

Strong field QED (SFQED) probability rates in the locally monochromatic approximation (LMA) have become an indispensable tool for simulations of processes like gamma-ray emission or electron-positron pair production in laser-particle collisions. The two key ideas behind the LMA are the separation of motion into the fast quiver component and the slow ponderomotive drift, with the subsequent averaging over the cycle-scale. The latter is necessary to obtain a positive-definite probability rate, as we explicitly demonstrate in a new derivation of the LMA. Within our new approach, we are able to obtain the LMA probability rates consistently and unambiguously for arbitrarily polarized plane wave backgrounds. In addition, we developed a method to restore the background bandwidth effects that are lost during the LMA derivation. The bandwidth-restored result we refer to as the LMA$^+$ and demonstrate that it agrees with the full SFQED predictions better than the standard LMA. Using LMA$^+$, we address previously inaccessible observables and formulate a new limitation on the applicability of LMA$^+$.