Schwinger Pair Production: Fast Switch-Off Effects Versus Dynamical Assistance

I A Aleksandrov[1], D G Sevostyanov[1], and V M Shabaev[1]

[1]*St.-Petersburg State University, 7-9 Universitetskaya Embankment, 199034, St.-Petersburg, Russia.*
Contact Phone: +7 (812) 363-66-33
Contact Email: i.aleksandrov@spbu.ru

We consider the process of vacuum pair production in strong electric fields and investigate two mechanisms of the enhancement of the total particle yield. First, we examine the dynamically assisted Schwinger effect, where pair production in a strong background is significantly stimulated by introducing a weak high-frequency pulse. Second, we study the effects of fast switch on/off of the external field. In the latter case, one may expect that large values of the adiabatic particle number at intermediate times can turn to a large final number of pairs if one properly adjusts the shape of the field profile. Here we demonstrate that the two mechanisms are closely related. We examine the onset of the enhancement in the two setups by means of three different techniques: quantum kinetic equations, locally constant field approximation, and worldline instanton approach. We reveal important similarities between the two effects confirming them by both numerical calculations and analytical estimates. Finally, we assess the experimental feasibility of the two scenarios.