Quantum electrodynamics cascade arising at reflection of a multipetawatt laser pulse from a solid plasma target

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Quantum electrodynamics (QED) cascade arising in a superposition of incident multipetawatt laser pulse and its reflection from a solid target were studied. It is numerically [1] shown that with normalized laser field amplitude $a_0 = eE_0/(mc\omega) = 700$, pulse duration 60 fs and density $n_e = 500\, n_{\rm cr}$ (which approximately corresponds, for example, to a diamond target; $n_{\rm cr} = m\omega^2/[4\pi e^2]$), it is possible to obtain about 10^{12} positrons in this setup.

The growth rate of the number of particles is very close to that in ideal linear-polarized standing wave [2]. Consequently, it is not necessary to use multiple laser channels to observe a QED cascade as it was suggested earlier [3, 4]. One laser channel and a reflective plasma target are sufficient, which can make the experiment more simple for a lack of necessity of operating with multiple laser pulses and its precision synchronization.

The research is supported by the Russian Science Foundation (project No. 20-12-00077).

[1] QUILL, `https://github.com/QUILL-PIC/Quill`

[2] Grismayer T, Vranic M, Martins J L, Fonseca R A and Silva L O 2017 *Phys. Rev. E* **95** 023210

[3] Gonoskov A, Bashinov A, Bastrakov S, Efimenko E, Ilderton A, Kim A, Marklund M, Meyerov I, Muraviev A and Sergeev A 2017 *Phys. Rev. X* **7** 041003

[4] Nerush E N, Iligenov R R and Kostyukov I Y 2023 *Bull. Lebedev Phys. Inst.* **50** S689–S692