AVERAGED MOTION OF ELECTRON IN THE FIELD OF the LASER PULSE PROPAGATING ALONG THE CONSTANT MAGNETIC FIELD

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In the given paper the averaged equations of motion of the relativistic electron in the laser femtosecond pulse, propagating along the magnetic field, are obtained. Averaging is performed by the method of Bogoljubov [1] with the help of expansions over the small parameter of the paraxial approximation [2]:

 $μ=a/z\_{R}≡2/ka\ll 1.$ (1)

Here, *а* is the dimension of the laser beam at the focal plane, $z\_{R}=ka^{2}/2$ is the Rayleigh length, $k=2π/λ=ω/c$ is the wave number. It is noted that averaging over the fast oscillations of intense laser radiation is possible when the parameter $g=eE/ωm\_{e}c ≅1$. Laser radiation is considered in the form the Gaussian beams of the arbitrary mode and polarization. The form of the pulse is also arbitrary. It is supposed that the pulse dimension is of order *а.* In such a case corrections of the first order to the transverse components of the vectors of the laser radiation play the important role [2]. Periodical corrections to the smoothed dynamical variables are calculated and the law of the particle motion in the frame, moving with the averaged velocity, is found. It is shown that in the transverse plane the trajectory of the particle is, in general, elliptic whose parameters are defined by polarization of radiation. In the direction of the pulse propagation the particle experienced oscillations with the wave frequency, twice frequency and the combined frequencies. It is shown that in the transverse plane an electron turns velocity, which depends on the intensity and polarization of radiation. It is also shown that in the direction of the pulse propagation the averaged force appears in the first approximation whereas in the case of rather small intensity of the wave its averaged action is effect of second order. The obtained force is proportional to the intensity of radiation and caused by the pulse character of radiation. Analogical expression for the force of first approximation has been obtained in [3] by the other method.

References

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