On radiative losses during motion of electron in the field of the powerful laser radiation

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At the motion of the relativistic charged particle in the field of powerful electromagnetic radiation forces of radiative friction can play significant role. Such a problem was discussed in the papers [1,2] where waves of special forms were considered.

The given paper is devoted to the investigation of the motion of relativistic electron in the field of the powerful impulse laser radiation which considered in the form of the Gaussian beam of the basic mode of circular polarization. Radiative forces are taken into account. The ratio of the amplitude of the oscillatory velocity of the particle to the speed of light in the vacuum can be of order unity. Ultrashort laser impulse is considered in the parabolic approximation. Corrections of the first order to the vectors of the field, which arise at the expansion Maxwell equations over the small parameter – the ratio of the waist to the Raileigh length, are taken into account [3]. The form of the impulse is not specified but impulse should be smoothed enough and its length should exceed the wave length. It is supposed that the impulse is propagating along the external constant magnetic field. Radiative force is considered in the classic form [4]. Averaged relativistic equations of motion of electron with help of averaging over fast oscillations of the laser radiation are obtained. In this case the frequency of the laser radiation is much more than the cyclotron frequency. It is shown that with taking into account corrections of the first order to the field vectors the averaged force in the direction of the impulse propagation arise. This force depends on the impulse character of radiation and is proportional to the intensity, but not to the gradient as in the case of the Miller’s force. It is shown also that radiative losses are not significant in the transversal plane but may considerable act on the longitudinal motion of electron.

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References

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