THE DYNAMICS OF ELECTRONS IN INTERSECTING LASER FIELDS

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The structure of the laser field at the intersection of two linearly polarized waves (parameters correspond to the experiment [1]) is considered. The phase velocity of the resultant wave depends on the angle of intersection, approaching the speed of light for small angles of intersection. The case of small angles is of interest for the analysis of electron acceleration.

It is shown that in the non-relativistic case, the trajectory of a test electron is an ellipse whose axes depend on the amplitude of the waves, the crossing angle of the waves and one of the initial spatial coordinates.

The movement and acceleration of test electronsin the relativistic case are analyzed. For intersecting plane waves in the region of constancy of sign of the longitudinal component of electric field is a rectangle. Rectangles densely cover the entire plane and move with the phase velocity along z. Rectangles with a negative sign components of electric field are the traps for electrons that have speed comparable in magnitude and direction with the phase speed. Given the time envelopes of the components of the wave causes deformation of the boundaries of the traps.

An electron with a small initial velocity (under vacuum acceleration)"rolls" (drifting) from one trap to the adjacent and not accelerating. Initial velocity relativistic electron (injected electron) moves along with the traps, picked up by them, is markedly accelerated. Thus, the calculations reveal the physical effect of electron capture between the picks of the interference pattern generated in the zone of intersection of the two waves. After the passage of the pulse the electron crashes with a certain residual speed with a predominance of transverse directions.

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References

[1] A.V.Borovskiy, A.L.Galkin, M.P.Kalashnikov. Phys. of Plasmas **22**, 043107(2015).