ON THE INTEGRABILITY OF THE MOTION EQUATIONS OF A CHARGED PARTICLE IN A QUASIMONOCHROMATIC ELECTROMAGNETIC WAVE

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In paper [1] formulae determining coordinates of a charged particle in the field of a plane quasimonochromatic electromagnetic wave generally depend on the integrals

, , (1)

where  — wave phase,  и  — constants, ,  — time,  — the particle coordinate along the axis , along which the wave propagates,  — the speed of light,  — a natural number,  — some smooth function. In [1] the problem was solved in the lowest order in the parameter  in the adiabatic approximation  ( changes markedly when changing  by ). However account of all amendments in powers of  and search exactly integrable cases are of great interest. One may introduce a complex value  which is representable as function Dirichlet series

 (2)

separable into difference of two series , and the series  satisfies a simple differential equation

, (3)

here .

The function  can be represented by a series expansion. If this is the Maclaurin series, then  is expressed in terms of the incomplete gamma function. There is a similar case, when  is given by some approximating polynomial. For  in the form of a Taylor series opening brackets of  by the binomial theorem ( is a decomposition point), the integration is reduced to the previous two cases. If  is defined by a Laurent series, then in the integration of its main part the exponential integral appears, and for  given by a Dirichlet series the integration is not out of the class of elementary functions. The function  as the Fourier series expansion is also integrable in quadratures.

Consequently, the choice of representation  can lead to more or less simply computable integrals of the motion equations of a charged particle in a plane quasimonochromatic electromagnetic wave.

References

1. Andreyev S.N., Yeremeicheva Yu.I., Makarov V.P., Rukhadze A.A. "On the motion of a charged particle in a plane quasimonochromatic electromagnetic wave". Preprint of GPI, 2013, #3. (in Russian)