Eq. (21) is the probability of the emission of two photons per unit time with azimuthal angles lying within the limits $|\sigma| \leq \Delta \sigma / 2$. The contribution from the coherent term to the integral emission probability is of order $\chi^2$.

LITERATURE CITED


INDEX OF A GRAVITATIONAL WAVE

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The problem of the interaction of a gravitational wave with an elastic body, taking account of the secondary gravitational radiation by the vibrating particles of the body, is solved on the basis of a theory of elasticity in the general theory of relativity (GTR) constructed by the author.

In a previous paper [1] we constructed in GTR a theory of elasticity on the basis of a gravitoinertial reference system, introduced earlier by us [2]. This theory has been applied in [3] to the analysis of the interaction of a weak gravitational wave with an elastic body.

The phenomenon of the retardation of a gravitational wave upon its passage through an elastic body with whose particles it interacts is investigated in this paper, which is a continuation of the cycle. We will use the notation and equations from the preceding paper [3].

Assuming that the cause of the retardation here is in reality the same as for electromagnetic waves propagating in a continuous medium, we will use methods well known from electrodynamics [4, 5] in solving this problem.

Let us place a flat elastic plate of thickness $\Delta z$ (Fig. 1): $\Delta z \ll s / \omega$ on the z axis on the propagation path of the gravitational wave discussed in the preceding article [3]. The gravitational wave to the left of the plate consists of the incident wave $G_1$ and a reflected one. We will neglect reflection in this problem. The field to

the right of the plate consists of a gravitational wave which has passed through the plate $G_3$ and a "secondary" gravitational wave $G_4$ emitted by the plate particles in forced vibration.

If the plate had no effect at all on the gravitational wave, then the wave on the right would be propagated according to the law

$$ G_a = G_0 e^{i \omega (z/c - t)} $$

(1)

But if it passed through the plate with a speed less than the speed of light by a factor of $n$, then

$$ G_a = G_0 e^{i \omega (z/c - t)} \left[ 1 - \frac{i \omega (n-1) \Delta z}{c} \right] $$

(2)

The first term is simply the wave which has passed through the plate without retardation -- $G_3$, and the second term should be equal to the gravitational field generated by the plate particles in forced vibration -- $G_4$.

Let us calculate the field $G_4$. First of all, one should refine what characteristic of the field we have in mind. It is possible to use as a characteristic of the field the force acting on a unit test mass, as in electrodynamics, and it is possible to characterize the field by a curvature tensor, but we will use the metric tensor as the characteristic of the field. All these definitions lead in this problem to one and the same result, since not the absolute value of the field but only its variation is important to us.

The vibrations of the particles of an elastic body are described by Eqs. (13) from [1], which we will rewrite in the approximate and simplified form

$$ q_1 \approx \frac{1}{2} \Delta x e^{i \omega (z - c t)} = \frac{1}{2} \Delta x, \quad q_2 \approx -\frac{1}{2} \Delta y. $$

(3)

Let us again assume that the infinite elastic plate of thickness $2L = \Delta z$ consists of independent quadrupole oscillators with dimensions

$$ x, y \approx \frac{s}{\omega}. $$

(4)

We will calculate the secondary gravitational radiation of a single such oscillator.

Let us introduce the polar coordinates

$$ x = \rho \cos \varphi, \quad y = \rho \sin \varphi $$

(5)

(we will denote the density of the masses by the letter $\mu$).

If the origin of coordinates is located at the center of the oscillator, then the tensor of the moment of inertia can be calculated from the equations

$$ I_{\mu \nu} = \mu \Delta x \int J_{\mu \nu}, dV, $$

$$ J_{\mu \nu} = (x_1, x_2) \delta_{\mu \nu} - x_\mu x_\nu. $$

(6)

(7)

The coordinates of the elementary masses are written with (3) taken into account as

$$ x_i = x + \frac{1}{2} \Delta x = \left(1 + \frac{1}{2} A\right) \rho \cos \varphi, \quad y_i = \left(1 - \frac{1}{2} A\right) \rho \sin \varphi. $$

(8)

Taking (8) into account, the tensor (7) is written as

$$ J_{xx} = \rho^2 \sin^2 \varphi (1 + A), \quad J_{xy} = \left(1 - \frac{1}{2} A\right) \rho \sin \varphi, \quad J_{yy} = \rho^2 \cos^2 \varphi (1 + A), $$

$$ J_{zz} = \rho^2 (1 + A), \quad J = J_{xx} + J_{yy} + J_{zz} = 2 \rho^2 (1 + A). $$

(9)