Can Niels Bohr's philosophy be wrong?

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Abstract

I take a very exciting and revival excurse on a hypothesis that has risen in the midst of General Relativity and Quantum field description (in the form of the electromagnetic wave). The Emeritus Dr. Cooperstock has derived the absence of energy harvesting from the gravitational waves using wave description of light, however latter MUST be seen as photon gas. Let me show this necessity in the paper. The paper explains the known result of Dr. Cooperstock, hereby defending the previous authors (which the Dr. Cooperstock criticizes). I show, that they do not contradict the Dr. Cooperstock result, but very strongly support it. Also presented my attempt to generalize the Dr. Cooperstock result to more nonlinear, more higher precision.

Keywords: Quantum Gravity, gravitational wave, electromagnetic field.

I was honored to step in correspondence with Dr. Cooperstock, the author of the "energy localization hypothesis" [1]. However, it seems to me that the authorship for this hypothesis should belong to the research duo Gertsenshtein and Pustovoit for their paper in 1963 [2]. Cooperstock criticizes the authors by saying: "It is thus evident that a gravitational field [...] does modify the electromagnetic field" (page 174 in Ref. [3]). But let me defend them. Note that my defence is not diminishing the actual result of Dr. Cooperstock, who (going a tremendously complicated way) has arrived at the same Truth as the russian duo. Even though Cooperstock's phrase on page 173 saying that "if the gravitational field generated by F_{ik} itself is neglected" is needless, we shall and can accept the facts on F_{ik} (see e.g. Ref. [4]).

In the linearized theory of gravitation (where $g_{ia} = \eta_{ia} + h'_{ia} + O(h'^2)$), Eq. (3) in Ref. [3] is given by

$$F_{ik} = (\eta_{ia} + h'_{ia})(\eta_{kb} + h'_{kb})F^{ab} = \eta_{ia}\,\eta_{kb}\,F^{ab} + O(h'F)\,. \tag{1}$$

$h'F$ is smaller than h'. Therefore, the term $O(h'F)$ stands outside of the linearized theory which means that instead of Eq. (3) in Ref. [3], in the linearized theory holds

$$F_{ik} = \eta_{ia}\,\eta_{kb}\,F^{ab}\,. \tag{2}$$

Thus, the fluctuation of metric does not influence the linearized theory.

From this one can draw the conclusion that within the linearized theory there is indeed no energy transfer from the gravitational wave to the detector. But perhaps it appears in the quadratic term $O(h'^2)$? That, as I believe, has not been derived because of the tremendous complexity of Einstein's equations. But must there be the energy transfer in linear theory or not? In other words: does the common sense tells us so or not?

The energy density of the electromagnetic wave field is $\rho = (E^2 + H^2)/(8\pi) = E^2/(4\pi)$, the energy current is $p = \rho\, c$. Taking the volume Sa the electromagnetic field occupies where S is the area of a plate (one of those in Ref. [1]) and a is the distance between the two plates, the total energy is given as conserved quantity $S\,a\,E^2 = \mathrm{const}$. Therefore,

$$p \sim \frac{1}{a} \approx \frac{1}{a_0} - \frac{1}{a_0^2}\,(a - a_0). \tag{3}$$

Under the action of a gravitational wave one has $a - a_0 \sim h'$. Therefore, in the linearized theory there must be energy transfer. Because this is not seen, General Relativity and Maxwell equation are incompatible, the reason being the absence of Quantum Gravity. This falsifies Bohr's quantum theory and gives preference to Bohm's quantum mechanics. The article “Physics and Theology” (Europhysics News 45/1 (2014)) tells us that both Bohr’s and Bohm’s theories are not excluded by empirical evidence.

I. THE DETECTOR

Continuing with a gravitational wave as expressed in Ref. [1] but considering the non-linear theory, the radiative field has nonzero components E^x and H^z. As a consequence, the antisymmetric field strength tensor F^{ik} has nonzero components $F^{xt} = -F^{tx} = E^x(t, y)$ and $F^{xy} = -F^{yx} = H^z(t, y)$ [4] while the covariant derivative vanishes,

$$F^{ik}_{;k} = F^{ik}_{,k} + \frac{(\sqrt{-g})_{,k}}{\sqrt{-g}} F^{ik} = 0. \tag{4}$$

In some coordinate system (like the one with the metric cited in Ref. [1]) we certainly have $g_{,t} \neq 0$ and $g_{,x} \neq 0$. For $i = t$ one obtains $F^{t\,x} = 0$ while for $i = y$ one has $F^{y\,x} = 0$. Thus, the field is zero, $E^x = H^z = 0$, and General Relativity has not run into compatibility with the wave description of light. Therefore, light is given by particles, photons.

II. THE FINAL

Note that Cooperstock has done the almost impossible: he derived results including the quantity $h'F$, i.e. contributions of the order $O(h'^{3/2})$, while in Ref. [2] only the first order $O(h')$ is considered. Both collaborations come to the conclusion that there is no energy transfer from the gravitational wave which I see as impossibility for Quantum Gravity.

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[4] A.P. Lightman *et al.*, “Problem Book in Relativity and Gravitation”, Princeton University Press, 1975.