Gravitational Wave Miracles?

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Abstract

The idea of gravitational wave (GW), suggested by Albert Einstein in 1916, still poses outstanding challenges, which have to be resolved by the theoretical physics community as soon as possible.

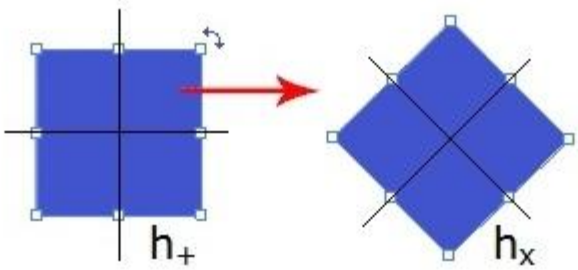
The idea of 'gravitational wave' (GW), suggested by Albert Einstein in 1916 [1], poses a number of non-trivial questions, which still have not been resolved by the theoretical physics community. We do not know how to define GWs in the full non-linear regime where the spacetime itself is dynamic [8]: 'waves with respect to what?' is the crucial question about the *boundary* of spacetime, which could be discussed only after we resolve the three issues below. Until then, I'm afraid the ideas of GW and its detection [9] will continue to look like a bunch of "miracles", which is of course totally unacceptable in science [2].

Let me begin with the critical **45° angle** between two linearly independent polarization states h_+ and h_x, which are instructed to be in "superposition" along time (**t**) read with a clock. As explained by M. Vallisneri *et al*. in [3, p. 6], "the effect of each GW polarization is to contract fractionally the proper distance along one axis, while expanding it along the other (these axes being (x; y) for h_+, and axes rotated by **45°** with respect to (x; y) for h_x)." Look also in [4, p. 33]: "A generic gravitational wave can thus be understood as a superposition of two oscillating tidal fields that propagate at the vacuum speed of light."

Q1: What phenomenon could possibly produce an **exact 45° angle** between h_+ and h_x *and* keep it **exactly** fixed **within** the "superposition" of two oscillating metric fields, in such way that the latter will *never* conflate and intermingle? What could sustain the *phases*?

The two linearly independent polarization states h_+ and h_x, each of which "has its own gravitational-wave field" [10], are "akin to "stereo sound" information" [4, p. 8], but the physical nature of such "superposition" of *metric* fields is totally unclear. It is certainly not like a superposition of two quantum states of the famous Schrödinger's cat, live cat & dead cat. According to Freeman Dyson [2, p. 8], a generic GW "may be considered to be a *coherent* superposition of a large number of gravitons." Here comes the second question.

Q2: How could these "gravitons" [10] be arranged to keep the **45° angle** between h_+ & h_x ?



Moreover, while "it would be hopeless to look for exact solutions for the gravitational waves emitted by realistic astrophysical sources" [5], we must nevertheless assume that strong GWs at the vicinity of a hypothetical "binary black-hole merger" [6] do exist, which brings us to the last question.

Q3: How could strong GWs sustain their properties of *very* weak GWs [3, 4, 9, 10] while interacting with matter and fields and other GWs, for over one billion years [7]?

We must not sweep these crucial questions under the rug: "miracles" do not exist. It is impossible to observe something that cannot exist, such as pink unicorns dancing with red herrings or some "back hole" merger [6] emitting "gravitons" by linearized GWs [2, 11]. The so-called GW150914 [7] is an insult to our intelligence.

If the reader disagrees, I suggest to consult Albert Einstein and prove that the Universe is "a spatially bounded material system" [12], and then install GW "mirrors" [9] *exactly* at null-and-spacelike infinity.

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Let us consider a spatially bounded material system, whose matter density and electromagnetic field vanish outside some region. Let $\mathcal{S}$ be the boundary surface, at rest, which encloses the entire material system. Then, by integration of the fourth equation over the domain inside $\mathcal{S}$, we get

$$-\frac{\mathrm{d}}{\mathrm{d}x^4}\int_{\mathcal{V}}\left(\mathcal{T}_4^{\,4}+t_4^{\,4}\right)\mathrm{d}V=\int_{\mathcal{S}}\left(t_4^{\,1}\cos(nx_1)+t_4^{\,2}\cos(nx_2)+t_4^{\,3}\cos(nx_3)\right)\mathrm{d}\sigma.$$

One is not entitled to define $t_4^{\,4}$ as the energy density of the gravitational field and $(t_4^{\,1},\ t_4^{\,2},\ t_4^{\,3})$ as the components of the flux of gravitational energy. But one can certainly maintain, in cases where the integral of $t_4^{\,4}$ is small compared to the integral of the matter energy density $\mathcal{T}_4^{\,4}$, that the right-hand side represents the material energy loss of the system. It was only this result that was used in this paper and in my first article on gravitational waves.

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