The Gravitational Wave and the Einstein Equation

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Abstract

It is exciting that the gravitational wave has been confirmed, according to the announcement of LIGO. Perhaps, this is the time for physicists to fix the Einstein equation for the gravitational wave and the nonexistence of the dynamic solution. These two problems are inextricably related. As a first step, theorists should improve their pure mathematics beyond Einstein on non-linear mathematics and related physical considerations. Then, it is time to rectify the Einstein equation that has no gravitational wave solution which Einstein has recognized, and no dynamic solution that Einstein failed to see. Moreover, in view of the far distance of the sources, it is very questionable that the experimentalists can determine they are black holes, which actually also have no theoretical basis.

KEYWORDS

anti-gravity coupling; gravitational radiation; principle of causality.

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The LIGO announced that gravitational wave has been detected [1]. Congratulations to those who work hard for this achievement. In this announcement, it is claimed that Einstein's prediction on the gravitational wave has been fulfilled. However, this is not an accurate story of Einstein on this subject. Although, based on the linearization of his equation, Einstein had predicted the existence of the gravitational wave, later he was also the first to discover that his non-linear field equation has no gravitational wave solution [2, 3].

In fact, Einstein concluded his talk on gravitational waves at Princeton University by saying [4] "If you ask me whether there are gravitational waves or not, I must answer that I do not know. But it is a highly interesting problem." Thus, Einstein's last words on this subject was that "I do not know." Obviously, Einstein was puzzled by why his linearized equation predicted the existence of the gravitational solutions, but his non-linear Einstein equation rejects such a claim. The reason is that Einstein did not know that linearization is not valid for the dynamic case although linearization is valid for the static case [5]. Einstein implicitly, but incorrectly assumed that linearization was always valid to obtain an approximate solution for the nonlinear field equation [5]. Here, we would clarify these facts.

However, these facts are absent from the announcement, if not intended omissions, this would probably indicate that those working on the gravitational waves, do not fully understand Einstein's theory. In particular, they probably do not know that the linearized equation is a valid linearization of the Lorentz- Levy- Einstein equation [6],

$$G_{\mu\nu} \equiv R_{\mu\nu} - \frac{1}{2} g_{\mu\nu}R = - K \,[T(m)_{\mu\nu} - t(g)_{\mu\nu}], \tag{1}$$

where $t(g)_{\mu\nu}$ is the energy-stress tensors for gravity and is of the first order in K. However, it is not a valid linear-ization of the Einstein equation [5], which has no bounded dynamic solution [7, 8].

From Eq. (1), it is clear that the Einstein equation,

$$G_{\mu\nu} \equiv R_{\mu\nu} - \frac{1}{2} g_{\mu\nu}R = - K \,T(m)_{\mu\nu} \,, \tag{2}$$

does not have a dynamic solution is due a violation of the principle of causality, when $t(g)_{\mu\nu}$ absent from the source. Moreover, although Einstein realized that his equation does not have the gravitational wave solution, he did not see that the problem of the gravitational wave and the non-existence of the dynamic solution of his equation are inextricably related.

Historically, Einstein & Rosen [2] could be considered as the first to discover the non-existence of wave solutions, but editors of the Physical Review found that the singularities they discovered are removable [9]. This led to a self-deceptive satisfaction that hindered progress in physics [10]. Due to some elementary errors in mathematics [11, 12][3)], Christodoulou & Klainerman [13] claimed to have constructed dynamic solutions for the Einstein equation. Moreover, the editors of journals such as the Physical Review D, the Royal Society Proceedings A and etc. did not identify the violation of physical principles such as the principle of causality [14-16].

A root of these problems is due to that physical space-time coordinates are ambiguous in Einstein's theory. (Such an ambiguity is a consequence of Einstein's theoretical errors on measurements [17, 18]. The correct criticisms of Whitehead [19] and Zhou [20] were not accepted since they do not provide a solid theoretical foundation for general relativity to explain impressive observational confirmations. Although the physical meaning of the space-time coordinates has been

clarified recently [17, 21, 22], the existing conceptual problems still seem to grasp many theorists. Fortunately, the analysis on plane-waves initiated by Liu & Zhou [23] would give a simple illustration of the non-existence of the wave solution.

It is hoped that the confirmation of the gravitational wave would give an added impetus for recognizing the severe problems in theories of gravitational waves and the non-existence of dynamic solutions. Since Einstein's puzzle is due to his inadequacy in non-nonlinear mathematics, as a first step, theorists should improve their understanding in non-linear mathematics. Moreover, it is urgently needed to investigate what is the exact equation for the gravitational wave and the dynamic solutions since the Lorentz-Levy-Einstein equation is only approximately valid. Moreover, since the Einstein equation is not valid for the dynamic case, there is no theoretical basis for the existence of a black hole. In view of that the source of the gravitational wave is so far away, it is questionable that the experimentalist can determine the sources are black holes.

Currently, the mathematics of many physicists are so poor that they do not even aware that there is a problem in Einstein's theory on the gravitational wave [4]. This is due to that well-known theorists such as the Wheeler School, the Wald School and etc. all made errors in this issue [24, 25]. The Wheeler School made the invalid claim on the existence of gravitational wave solutions because they have made crucial errors in undergraduate calculus [24]. Wald has claimed the existence of the second order solutions, but has never provided one [25]. Christodoulou & Klainerman [13] actually have not completed the construction of any dynamic solutions [11]..

In view of that, according to Dr. D. Kulp, there is no editor in American Physical Society (APS), who has a background in pure mathematics, it is hoped that APS does not take long to recognize these problems. An urgent tasks is to find the exact equation for the wave solutions and the dynamic solutions.

ACKNOWLEDGMENTS

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