24 December 2024 ·
Qeios

Peer Review

Review of: "On the Mass of (Gravitational) Potential Energy"

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Although thinking about fundamental questions in physics and metaphysics is respectable and valuable, as presented by every thinking person, same as the present work, answers and statements possibly can be true or some parts false. The correctness of them could be determined just by experiments, observations, or the logic of common sense. However, dear author, I read your paper and the comments of reviewers and found some criticisms. To improve the present version of your paper, my comments may be useful as follows.

Sincerely yours,

Hossein Ghaffarnejad

By according to Einstein's mass-energy equivalence, you present a question as: Does potential energy have mass? And if so, where is that mass located?

I suggest changing it to: Does potential energy have equivalence mass? In the latter case, this question has no physical importance. Because, if we assume the energies of every shape are masses, then we will have some criticisms:

For instance, if electric potential energy, which comes from electric force and so its source, say the electric charge, while the gravitational potential energy comes from gravitational force or its source (the mass). In this case, is the electric potential energy the gravitational potential energy? If they are the same? If we say yes, then we must have the statement that their sources are the same, i.e., the electric charge is the mass, while this statement is wrong, and we have objects in nature that are charge-less but have mass. Thus, we should say no, but they are two different energies which come from different properties of a physical object. By according to this comment, the second question above for the position of the mass of potential energies (with every form which may have) has no meaning in my opinion. In other words, it is well known by Faraday in the 18th century that every

 doi.org/10.32388/WY0OHU

electric charge presents an electric field around it, and it fills throughout the space (time). It is valid for other potential energies, for instance, the gravitational potential energies too. It is formulated well by the divergence theorem (Gauss's law). In other words, the field and its source are dual perspectives of (inherently unknown) physical objects. We know that physics as a science only follows the interaction between objects and does not know about their essence.

Thus, we must think just of one of them when we study the physics of the system under consideration, i.e., the source or the corresponding field. In other words, the interaction of a physical object with other ones is permissible just by itself or its field, which are filled throughout space-time. Furthermore, quantum physics gives us an important phenomenon, which is entanglement between the observer and the observable phenomena. In the latter case, we must use both of them as a single object when we want to use the divergence theorem. This statement is the same for interacting objects at the quantum level, in my opinion. The best physical interpretation for such an interacting system is the use of holographic theory according to the nonlocal quantum potential of Bohm's deterministic quantum theory.

My second comment is for the sentence which is given in the introduction as the Einstein's mass-energy equivalence is dedicated just to the (rest) mass (comoving mass) while the mass parameter in the equation E=mc^2 is related to the relativistic mass containing the moving gamma factor (1-v^2/c^2)^(-1/2).

I have a criticism of the originality of `mass` if we consider a quantum perspective for the description of phenomena. In the latter view, matter is a collection of elementary particles with the smallest masses. For instance, the rest mass of an electron is on the order of 10^(-31) Kg. Thus, it is suitable that we give not `originality` to the electron mass, but we should give it to its quantum wave coming from the electric or nuclear fields of subatomic particles. Particularly, if we regard the deterministic Bohm`s quantum theory, where the originality is related to its nonlocal quantum potential, then in this sense, the locality of objects will not have meaning. Hence, in the classical regimes, it should be dedicated the originality of the variations of the (nonlocal) potential energies to `energy storage` throughout space-time and not to an increasing mass in a specific place.

I have a comment on the hypothetical and objective reality presented by Hecht in the paper. It is obvious that there are some phenomena in nature that are not easily observed by laboratory tools. For instance, the world after death. In fact, what is the difference between a dead person and a live one? Who can find a solution in a laboratory? Only some people who are in a coma (or who have been made

doi.org/10.32388/WY00HU

to undergo hypnotism) can tell news that they traveled alone to those worlds after regaining consciousness.

Furthermore, I have another criticism of equation (10) and the relativistic energy, which is given in the sentences below this equation. In fact, the formula E=mc^2 is produced from the Lorentz symmetry of Minkowski space-time. In other words, it is a Lorentz invariance scalar, while the exponential term defined by Hight h is not a Lorentz invariance quantity, and so logically, this equation is not correct.

Declarations

Potential competing interests: No potential competing interests to declare.