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Einstein Enerji Denkleminin, $E = mc^2$, Newton tarzı çıkarımı

Zekai ŞEN

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This article has been submitted to several international journals,
but rejected right away without any scientific comment.

On the Newtonian Derivation for Einstein's Energy Equation, $E = mc^2$

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Abstract: Einstein proposed the special theory of relativity in 1905 including suggestion of the famous $E = mc^2$ energy equation. Since then, many researchers did not understand, but believed in it without scientific thoughts. This paper indicates that Newtonian momentum conservation principle helps simply to derive Einstein's energy equation by consideration of energy and work. Hence, Einstein's equation is derived in a simple manner without special relativity principles.

Key words: Einstein, energy, kinetic, light speed, momentum, Newton, special relativity

1. Introduction

The main philosophical issue in the interpretation of Einstein's equation is whether mass and energy are the same property of physical systems and whether there is any physical sense in the conversion of mass into energy or vice versa. There are different interpretations and arguments on this equation by different authors (Bondi and Sprungin, 1987; Flores, 1999, 2005; Lange, 2002; Krajewski, 2006). All the discussions have revolved in the framework of the special relativity, where the light velocity constancy is the fundamental assumption. Hence, interpretations of energy in velocity domains less than the light velocity may shed some light on the discussion on whether the mass and energy are converted to each other. It has been already identified that a fundamental conceptual flaw has been existing for almost the last 110 years since Einstein's first papers (Einstein 2005 a, b). The interpretation that $E = mc^2$ has the equivalence between inertial mass and any type of energy is incorrect and it is a misinterpretation (Hamdan et al., 2007). It is also stated by Kohut (2012) that Einstein´s conclusion about mass-energy relation has no validity, because of its invalid derivation.

It is suggested by Graneau and Greneau (1993, 1996) and Greneau (2005) that Einstein's energy ($E = mc^2$) is not based on the special theory of relativity but on Maxwell's electromagnetic field theory. On the other hand, it is also stated by different researchers that $E = mc^2$ is not a law of the Newtonian electrodynamics, which preceded the Maxwell-Einstein field theory. Abolishing the instantaneous matter interactions of the Newtonian physics paradigm, therefore, appears to have led to Einstein's law.

In this short paper, Newtonian kinetic momentum time variation is used to derive the same equation without special relativistic explanations.

2. Newtonian energy principle

The change in force, dF, is defined as the change of momentum in the Newtonian physics as,

$$F = \frac{d(mv)}{dt} \tag{1}$$

where mv is the momentum, m is the mass and v is the velocity of this mass. It is well known that absorbed radiation of energy is accompanied (in classical theory, in quantum theory, and in experiment) by a radiation momentum, which is the ratio of energy, E, to light velocity, c as $E/c = mc$ (Shadowitz, 1968). Planck's formula for energy is E = h where h is Planck's coefficient, ν is frequency and it describes energy equivalence on a quantum basis (Plank, 1900). Another energy equivalence formula is given by Einstein (1905a, b). In the derivation of Einstein's equation, conservation of momentum is used, and likewise, herein, the change of momentum is taken as a basic approach to this problem simply in the Newtonian physics domain. Energy transfer can be defined as work. The change in the kinetic energy of a mass is equal to the net work done on the mass. Energy is defined also as the capacity for doing work. Hence, energy change, dE, is equivalent to work change, $dE = FdL$, where dL is the distance covered for movement. After multiplying both sides of Eq. (1) by dL and considering the velocity definition as, $v = dL/dt$, leads to,

$$dE = d(mv)v \tag{2}$$

The right hand side of this expression can be expanded as,

$$dE = v^2dm+mvdv \tag{3}$$

which indicates that energy variation consists of two gradients.

1) change in mass (the first term on the right hand side is similar to Einstein's energy, $dE = c^2dm$),
2) change in velocity (the second term on

the right hand side, related to Newtonian kinetic energy change).

Classical integration of Eq. (3) leads to the following expression, which has not been seen in the literature previously.

$$E = v^2m + \frac{1}{2}mv^2 = \frac{3}{2}mv^2 \tag{4}$$

The integration is taken from zero to a constant upper limit for each variable as E, m and v. For light velocity, it yields,

$$E = \frac{3}{2}mc^2$$

which is different than Einstein's energy equation. However, philosophically and logically there is conceptual mistake in this expression, and therefore, although it is mathematically correct, but physically not valid due to the fact that continuous and simultaneous increase of velocity and mass is not realistic starting from zero.

Mass and energy are regarded as distinct properties, because in Newtonian physics and as in Eq. (3) they are distinctively measured in different units. This is due to the fact that spatial and temporal units are perceived separately, which gives rise to the perception of different mass and time properties. Eq. (3) can be expressed verbally as,

> *"Energy change is equal to the summation of a constant (velocity square, v^2, assumed constant) times change in mass plus another constant (mass, m, assumed constant) times velocity and velocity change"*

This expression includes both large scale (relativity) and ordinary scale (common sense) perceptions. To this end, the following two questions can be asked.

1) what is the energy, E_c, if the velocity (light velocity) is constant? This case corresponds to the assumption of special relativity where the velocity is assumed constant as light velocity, c, only (Einstein, 1905a,b). The answer is that the second term in Eq. (3) becomes zero because there is no velocity change, and hence, the energy remains as,

$$dE_c = c^2dm$$

This expression gives the total energy, E_c, due to mass change after integration as,

$$E_u = mc^2 \tag{5}$$

This is the most well-known Einstein's energy equation in the special theory of relativity. According to special relativity, light travels at the same speed for all inertial observers, this implies that one can select units such that spatial distances are specified by units of time (space-time concept). In such units energy and mass have the same units and they are equal numerically, which implies that mass and energy are not two distinct properties. In a way, the perception of mass and energy as distinct units is due to the fact that spatio-temporal intervals are overlooked.

2) The second question is what is the energy, E_m, if the mass is constant? In this case, the first term on the right hand side of Eq. (3) is zero and the energy expression takes the form as,

$$dE_m = mvdv \tag{6}$$

which after the integration yields the total energy due to the velocity change only as,

$$E_m = \frac{1}{2}mv^2 \tag{7}$$

This is the kinetic energy expression in the Newtonian physics domain.

After all these simple derivations, Eq. (3) obviously indicates that mass and energy are not the same as suggested by some philosophers and physicists. The same equation implies that mass and energy are distinct properties of physical systems.

3. Conclusion

Many researchers who are not specialists in relativity theory might think that Einstein's energy equation, $E = mc^2$, is very difficult to understand and derive. Its simple derivation is presented based on the Newtonian momentum conservation principle and at the end the kinetic energy expression is obtained by assumption that the mass is constant. On the other hand, Einstein's energy expression is reached by the assumption that the light velocity is constant, but the mass is variable by time.

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