

$$E=mc^2$$

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Abstract

The paper aims to partially fulfill the unified theory proposed in the work “Map of Physics under Yin Yang Theory” by clarify what are the perspectives of mass-energy and the method used to define $E=mc^2$. The proposed unified theory is a map inspired by the book “The Grand Design”, excerpt: “-----M-theory is not a theory in the usual sense. It is a whole family of different theories, each of which is a good description of observations only in some range of physical situations. It is a bit like a map. As is well known, one cannot show the whole of the earth's surface on a single map. -----”

Keywords: Yin Yang, Equivalence of mass and energy, Unified theory, $E=mc^2$

1. Introduction

The work "Map of Physics under Yin Yang Theory" [1] firstly described the physical phenomena are actually the perspectives of motion- rest of the Yin Yang theory, then by further extend the perspectives of motion- rest we shall obtain perspectives of interval and quantum: Einstein's space-time and mass-energy. The work also successfully demonstrated the special theory of relativity with a simple and easy to understand mathematical model, thus explained the space and time are relative to each other. The purpose of this article is to clarify what are the perspectives of mass-energy and the method used to define $E=mc^2$ in order to lay the foundation for the later explanation on the characteristics of force illustrated in Figure 1.

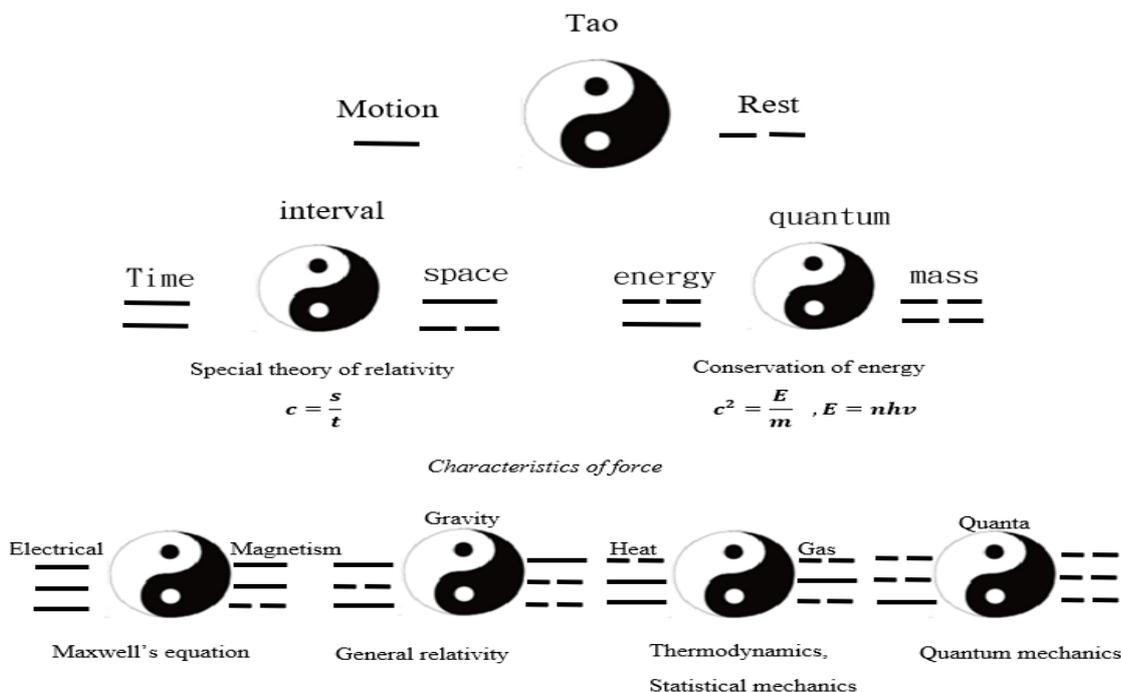


Figure 1. map of physics proposed in “Map of Physics under Yin Yang Theory”(a proposed unified theory)

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2. Interval and Quantum

Based on the wave-particle duality of light, there are perspectives of interval and quantum. From ‘Map of Physics under Yin Yang Theory’, interval defined as below:

- Space, s: There is one unit interval of space when light moves one unit interval of time.
- Time, t: There is one unit interval of time when light moves one unit interval of space.

"Unit interval: "—" **【2】** , the points at front and back of this mathematical geometry concept have no size. Space and time have directional properties, so they are vectors(Figure 2.)



Figure 2. unit interval of space-time-figure from ‘Map of Physics under Yin Yang Theory’

Light could change the state of electron, means light carried energy. According to Einstein, the energy of light is discretized, and a discrete unit energy of light is called a quantum.

Planck-Einstein relation:

$$E = nhv$$

- E*=total energy
- n*=total of quantum(+ve integer)
- h*=Planck’s constant
- v*=frequency of light

2.1. Mass-Energy Equivalent

The intensity of light is determined by the total quantum per unit interval. The speed of light is the same measured in any coordinate system. The matter we could saw and touched isthe manifestation of light energy in another form. It composed by quanta occupy a certain area in space, this means matter has a size and it is in rest relative to onescordinate system. We distinguished a quantum in ‘rest’relative to a coordinate system as a matter or particle with a rest mass **m₀**. Light always move with constant speed, no acceleration and will not stop; the disappearance of light is due to the energy conversion that occurs when light interact with electron. The above explains the equivalence of mass and energy; To use mathematicsto formulate what has been discussed:

$$c^2 = \frac{E}{m}$$

- C²***=square of speed of light (scalar)
- E***=total energy
- m***=total mass

To summarize, light moves for unit(s) of interval hastotal energy **E**; based on the equivalence of mass and energy, the total energy**E** is equal to a relative total mass **m**, and the ratio between them is always equal to 1(One).

Till now we could use figure 3 to conclude what has been demonstrated about the mass-energy equivalent:

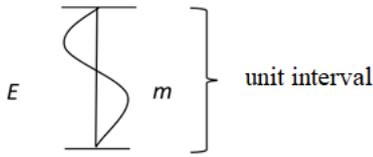


Figure 3. light frequency equal to 1, unit interval has 1 cycle of wave

3. Mass of a Particle in Motion

Let us discuss a particle in motion relative to onescordinate system:

Total energy of the said particle is equal to intrinsic energy ('rest' quanta) plus the kinetic energy of that particle. Kinetics energy could be considered as a type of energy in secondary level, it is the energy carried by a 'rest' quanta (a particle with rest mass) when it's in motion. Based on the equivalence of mass and energy, Total mass \mathbf{m} of a particle is equal to its rest mass \mathbf{m}_0 plus the mass increased caused by its motion. Mass increased due to the increased of the particle speed, the relation of mass \mathbf{m} of a particle moves in speed \mathbf{v} with rest mass \mathbf{m}_0 as below:

$$m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}}$$

The derivation of the above equation is excerpted from Feynman Lectures on Physics[3]:

$$\begin{aligned} \frac{dE}{dt} &= \mathbf{F} \cdot \mathbf{v} \\ \frac{d(m c^2)}{dt} &= \mathbf{v} \cdot \frac{d(m v)}{dt} \\ c^2(2m) \frac{dm}{dt} &= 2m v \frac{d(m v)}{dt} \\ c^2 \frac{dm^2}{dt} &= \frac{d(m^2 v^2)}{dt} \\ m^2 c^2 &= m^2 v^2 + C \end{aligned}$$

$v=0$, m equal to m_0

$$\begin{aligned} m_0^2 c^2 &= 0 + C \\ m^2 c^2 &= m^2 v^2 + m_0^2 c^2 \\ m^2 \left(1 - \frac{v^2}{c^2}\right) &= m_0^2 \\ m &= \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}} \end{aligned}$$

4. Conclusion

The perspectives of mass and energy has been clarified and the equation $\mathbf{E}=\mathbf{m}c^2$ has been defined in this paper; the papershowed Einstein's space-time and mass-energy in fact are the perspectives developed and extended by Yin Yang theory. The interaction of the perspectives and concepts developed could best summarized in the figure. 4 below.

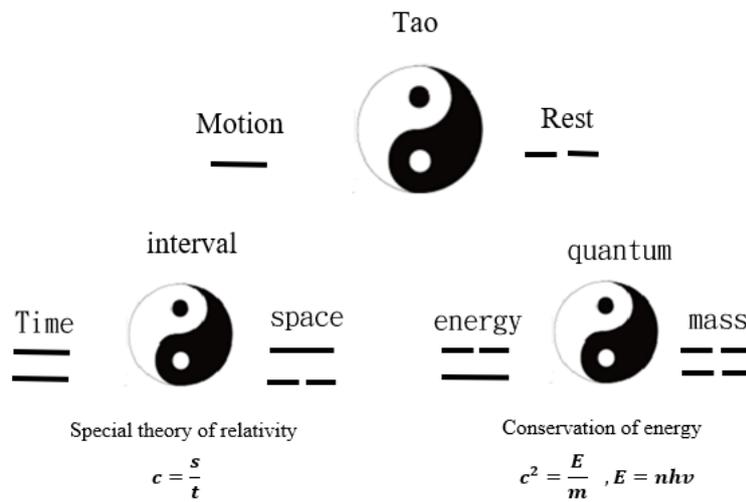


Figure 4. conclusion of the paper

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