Is a Photon Made of Mass and Negative Mass

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Abstract

We wish to propose a configuration of a photon. This configuration has novel features which are of considerable physical implications. The potential existence of negative mass has been presented before and some of its unique attributes were discussed. Here we show that a photon is able to be made of mass and negative mass. We have emphasized the importance of an intrinsic distance between mass and negative mass inside a photon. The mass-negative mass interaction can formulate a relationship between the wavelength of a light and the intrinsic distance inside its photon. As a pair of mass and negative mass a photon can have zero active gravitational mass and positive passive gravitational mass at the same time.

Introduction

Throughout the history of the science the light phenomenon has been investigated by many people. Its makeup has also been understood in great detail. Originally Newton conceived that a photon was a particle, like ordinary matter, consisting of mass. Later on Young's experiment showed that a photon behaved like a wave. In the 19th century Maxwell speculated light was an electromagnetic wave without mass. At the turn of the 20th century Einstein proposed a photon was again a particle-like matter with a discrete energy. Furthermore in his seminal article[1] Einstein proposed a relationship between mass and energy.

From the equation of

(1) $E\sqrt{(1 - v^2/c^2)} = mc^2$

It is argued that if a particle with a positive quantity of mass moves at the speed of light *c* then the left side of the equation is zero while its energy E is finite, so the left side of the equation will be zero. Therefore the right side of the equation has to be zero too. Again since the speed of light *c* is finite so that the particle's mass has to be zero. For a particle consisting of only mass the conclusion is that the mass is zero therefore it is massless. However if we consider the possibility of the makeup of a photon consisting of both mass and negative mass[2] then it is possible the net mass on the right side of the equation is zero, and the photon is still massless.

Attributes of Negative Mass

Negative mass repels mass or negative mass.

Mass attracts mass or negative mass.

Negative mass generates a field similar to that generated by a mass. The repulsion field strength (force) upon a test mass abides by the inverse-square law.

A plural quantity of negative mass is unstable if no other forces bind them together. A single unit of negative mass is stable.

Configuration of a Photon

Assuming the smallest unit of negative mass (a Yinon) exists then a photon can have a pair of equal quantity of mass-Yinon configuration of which there is a distance separating the mass from

the Yinon. This configuration can maintain a stable intrinsic distance between the mass and the Yinon since the pair will move together toward the direction from the Yinon to the mass.

Figure 1 shows a photon consists of a Yinon and a mass. The Yinon applies a repulsion force to the mass while the mass applies an attraction force to the Yinon.

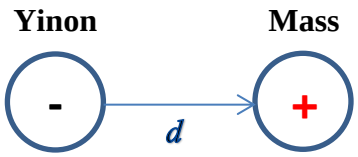

Fig.1 Configuration of a photon

Consider the pair as a whole then the pair does not have inertial mass since the mass and the Yinon cancel each other for the inertial mass. The pair's active gravitational mass is zero since the gravitational fields of mass and Yinon cancel each other, while its passive gravitational mass is positive.

Explanation of the Wavelength of a Photon

Let a photon A have an equal quantity of mass and Yinon *m*. Assuming the distance between its mass and its Yinon has a distance *d*1, then the repulsion force from its Yinon to its mass is $F = G_d \bullet m \bullet \frac{m}{d1^2}$ according to Newton's gravitational law, where G_d is the gravitational constant in small distance. The G_d could be different than the G if the small distance causes the gravitational constant to vary. The acceleration of the mass is $a = G_d \bullet \frac{m}{d1^2}$.

If we consider after the first full cycle of its associated wave a photon has reached its maximum speed at *c* then the time from a photon's creation to its maximum speed is $\frac{l1}{c}$, where *l*1 is the wavelength of the photon A. Hence equation

(2) $G_d \bullet \frac{m}{d1^2} \bullet \frac{l1}{c} = c$

Let *d*2 be the distance between the mass and the Yinon of a photon B, and *l*2 be its wavelength. Hence equation

(3) $G_d \bullet \frac{m}{d2^2} \bullet \frac{l2}{c} = c$

Let divide equation (2) by equation (3) it has equation

(4) $\frac{l1}{l2} = \frac{d1^2}{d2^2}$

It indicates that the ratio between two wavelengths of lights is equal to the ratio of the intrinsic distances between mass and Yinon of their photons. From the equation

(5) $E = h \bullet \frac{c}{l}$, where E is the energy a photon carries. We can deduce the equation

(6) $E_1 \bullet d1^2 = E_2 \bullet d2^2$

We can see the smaller the intrinsic distance *d* is the more energy E a photon has.

According to the theory of special relativity a photon cannot exceed the speed of light so it will maintain the speed of light after the initial ramp up time.

Behaviors of a Photon

Since a photon A consists of equal quantity of mass and Yinon, to an external object it does not have active gravitational mass. Let *d* denote the intrinsic distance between mass and Yinon inside the photon A. Let another photon B be placed at a distance *ab* to the photon A. If *ab* >> *d* then there are no gravitational attraction or repulsion between A and B. Therefore the two photons A and B are in a stable state. They do not collapse onto or move away from each other.

Since both mass and Yinon can have passive gravitational mass a light beam can be bent by the gravitational field caused by a big mass.

The shorter the intrinsic distance *d* is the less disturbance of the state of a pair of mass and Yinon has. Therefore, a shorter wavelength photon is less impacted by other photons. i.e., a shorter wavelength photon is more particle-like than wave-like.

If a photon's intrinsic distance between its mass and Yinon is changed to beyond a certain value then its light cannot maintain a valid physical wavelength. Therefore the light disappears.

References

1. Einstein, A. "Does the inertia of a body depend upon its energy-content?". *Annalen der Physik* **18**: 639-641 (1905).
2. Forward, R. L. "Negative matter propulsion". *Journal of Propulsion and Power* **6**: 28. doi:10.2514/3.23219 (1990).

End notes

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