On the physical reality of Tachyons

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Abstract: In 1962, Sudarshen and his coworkers proposed a hypothesis that particles whose rest mass is imaginary can travel by birth faster than light. After that several thousands of papers on tachyons have been written, hundreds of Ph.Ds were minted out and a remarkable number of conferences have been conducted. But till this date, either the existence or the generation of tachyons has not been confirmed. In this work, the author attempts to show that the chances for faster than light velocity phenomena is not bright.

1. Introduction

Developed and published in 1905 by Albert Einstein, it deals with the measurement of physical

quantities by observers who are in uniform motion with respect to each other. This theory

describes the motion of particles moving at any speed, even close to the speed of light. The

theory proposes that the measured speed of light is a constant even if the source or observer of

the light is moving. To put in another words special relativity is a physical theory based on the

assumption that the speed of light in a vacuum is a constant and the assumption that the laws of

physics are invariant in all inertial systems. Also, it explains relative motion in terms of space

and time It states that laws of nature are the same for all observers regardless of how they move.

Also, it describes that space and time are connected and no longer individually absolute. Special

relativity theory scattered the foundations of Newtonian mechanics and the theory was

experimentally verified. The variance of mass with velocity, time dilation , length contraction

and the equivalence of mass and energy are the four important findings of special relativity

theory. In this letter, we study and discuss mass – velocity equation.

2. Results

Einstein's variance of mass with velocity equation is given by, $m = m_0 / (1 - v^2/c^2)^{1/2}$ (1)

     Where m = moving mass, m_0 = rest mass,

     v = velocity of the object, c = light velocity

Squaring (1), $m^2 = m_0^2 / (1 - v^2 / c^2)$

i.e $m^2 (1 - v^2 / c^2) = m_0^2$

i.e $m^2 (c^2 - v^2) / c^2 = m_0^2$

i. e $m^2 (c^2 - v^2) = m_0^2 c^2$ (1a)

Let us assume $v = c + a$ (2)

and m_0 = where i is imaginary unit   (3)

Putting (2) and (3) in (1a), and replacing i^2 by -1 we get that,

$m^2 (a^2 + 2ca) = c^2$ (3a)

i.e $a^2 + 2ca - c^2 / m^2 = 0$ (4)

(4) is quadratic in c.

Therefore , $c = -2a +$ or $- [4a^2 + 4a^2 / m^2]^{1/2}$

     i . e $c = -2a +$ or $- 2a [1 + 1/ m^2]^{1/2}$

          $- 2/ m^2$

Multiplying by $- 2/ m^2$, $2c / m^2 = 2 a +$ or $-2a [1 + 1/ m^2]^{1/2}$

i , e $c / m^2 = a +$ or $-a [1 + 1/ m^2]^{1/2}$

i . e $c / m^2 - a = +$ or $-a [1 + 1/ m^2]^{1/2}$

Dividing by a , $c / m^2 a - 1 = +$ or $- [1 + 1/ m^2]^{1/2}$ (5)

Let us once again assume that $nc^2 = v^2$ (6)

Putting (6) in (1a) and replacing $m_0^2 [i^2]$ by $- 1$, $m^2 (n - 1) = 1$

i. e $m^2 n - m^2 = 1$ i.. e $m^2 n = m^2 + 1$, i. e $n = 1 + 1/m^2$ (7)

Applying (7) in (6) , $v^2/c^2 = 1 + 1/m^2$ (8)

Assuming (8) in (5), , $c/m^2 a + 1 = +$ or $- [v^2/c^2]\frac{1}{2}$

i. e   , $c/m^2 a + 1 = +$ or $- [v/c]$ (8a)

Putting (2) in RHS, and choosing positive value, $c/m^2 a + 1 = 1 + a/c$

i . e $c/m^2 a = a/c$

Multiplying both sides by c/a we obtain that $c^2/m^2 a^2 = 1$ (9)

i. e $c^2 = m^2 a^2$ (10)

Putting (10) in (4) we have, $2ca = 0$ (11)

Since c is the light velocity, we obtain that $a = 0$ (12)

Putting (2) in RHS of (8a) and taking negative value, $c/m^2 a + 2 + a/c = 0$

Multiplying through out by c/a , $c^2/m^2 a^2 + 2c/a + 1 = 0$

Applying (3a) in the first factor, $2c/a + 1 + 2c/a + 1 = 0$

i. e $2c/a + 1 = 0$

Multiplying by" a "we get that $2c + a = 0$

Assuming (2) we obtain that , $v + c = 0$, i.e $v = -c$ (13)

3. Discussion

Needless to say , both (12) and (13) are contradictions. These negative results establish once and

for all that our assumption that the rest mass is imaginary and velocity v is greater than light

velocity c in Einstein's variance of mass with velocity equation is NOT acceptable.

Consequently this makes us to arrive at a conclusion that Sudarshen's tachyon hypothesis is

inapplicable. The square root of two [2] is always irrational, the polynomial quadratic equation

cannot have more than two roots, there is no general solution formula for fifth degree algebraic

equation, trisecting the given general angle without using the protractor is not possible, squaring

the circle, duplicating the cube and to draw a regular heptagon are impossible. Similarly, the algebra of Einstein's variance of mass with velocity equation does not permit the existence of tachyons.

4. Conclusion

Einstein also thought over about his mass – velocity variance formula for a long time and very politely concluded, " For velocities that are greater than light , our deliberations become meaning less." Sudarshen's tachyon hypothesis is only a mathematical trick. Iff the tachyons are consistent, the author would be the first person on earth to welcome it. But unfortunately our findings are not in favor of tachyons. So, we can conclude that according to Einstein's special relativity theory either the existence or the generation of tachyons is highly impossible.

References

[1] Bilanuik, O.M.P., V.K. Deshpande and E.C.G. Sudarshan, Am. J. Physics, 30, (1962), 718-   723

[2]   Arons M.E. and Sudarshan E.C.G. Phys. Rev. 173, (1968) ,   1622.

[3]   Dhar J and Sudarshan E.C.G., Phys. Rev., 174 (1968), 1808.