On the Existence of Negative Energy, Tachyons and Imaginary Mass

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Introduction

The existence of tachyons and negative energy still remains a problem which has not yet been clearly understood. The presence of negative energy is expected to supply unlimited energy for our daily requirements. However, more research has to be carried out in order to understand how to harness this energy. At this juncture it is wise to prove that negative energy indeed exists, in order to avoid unnecessary debate, and focus more on the future work. The quest for negative energy lies in the understanding of the gravitational force. This is as usual, since the mother nature always ties bigger things with subtle ones and vice versa, that too in a mysterious way. For example, the strongest of the five fundamental forces – the electromagnetic one – lies with very tiny electrons and protons. The feeble gravitational force is ubiquitous and controls large galaxies and the entire universe. The "time" frame, though perceptible, is still imaginary and controls all the processes occurring in the universe. Thus, the answer for many questions about negative energy is found in the gravitational force.

The equation for gravitational red-shift is given by:

$$\Delta\nu/\nu = (\nu-\nu')/\nu = [1-(\nu'/\nu)] = GM/(c^2R) = \Delta\lambda/\lambda \qquad (1)$$

$$(\nu'/\nu) = [1-GM/c^2R] \qquad (2)$$

$$h\nu'/h\nu = [1-GM/c^2R] \qquad (3)$$

$$h\nu' = h\nu\,[1-GM/c^2R] \qquad (4)$$

The total energy of a photon under gravitational field is given by:

$$E = [h\nu - GM\,h\nu/c^2R] \qquad (5)$$

For M/R ratio equal to or greater than 1.349×10^{27} kg/m, the quantity GM/R becomes equal to or greater than c^2.

When $GM/R = c^2$

$$[1-GM/c^2R] = 0 \qquad (6)$$

Applying this in equation (4), we get

$h\nu' = h\nu\,[1-GM/c^2R] = 0$ (7)

This means that no radiation can leave the star. This property is exhibited by black holes. Hence, I assume that for black holes the GM/R ratio either equals or exceeds c^2 – the square of the velocity of light. The *event horizon* for a black hole lies at the distance R from the centre of the black hole where the ratio GM/R equals 1.349×10^{27} kg/m. This distance is the critical distance for a black hole. If any object from outside the black hole reaches this boundary then it disappears. For values of R less than the critical value we have the negative energy field which falls inside the black hole. For values greater than the critical value of R we have the positive energy field which falls outside the black hole.

If GM/R is greater than c^2, making use of equation equation (4) again:

$h\nu' = h\nu\,[1-GM/c^2R]$

where $GM/R > c^2$

Then,

$h\nu' = h\nu\,(1-x)$ $[\,x = GM/c^2R;\ x > 1]$

$h\nu' = -h\nu\,(x-1)$ or, $-h\nu' = h\nu\,(x-1)$ (8)

Equation (8) implies that under the influence of gravity, photons have negative energy which is dissipated into the surrounding space of the black hole. Thus, if the existence of black hole is definite, then the existence of negative energy is also definite.

For $GM/R >> c^2$

and, since $E = mc^2$

$\exists = -h\nu' = h\nu x = h\nu\, GM/c^2R = mc^2x = GmM/R$ (9)

where $\exists$ is the negative energy and *m* is the mass of photon within the gravitational field of the black hole. The above equation demonstrates that the flow of negative energy from a black hole is directly proportional to the mass of the black hole and inversely proportional to its radius. In the above equation G is gravitational constant, which is a real positive number. The distance from the centre of the black hole is also positive. Hence the energy to be negative, the mass of the black hole and that of photon should turn out to be *imaginary.* The quantity G*m*M/R is the potential energy of mass *m* on the

surface of the black hole. Note that in the case of Earth or, Sun, this potential energy is negative; that is work has to be done to remove an object from the surface of the Earth/Sun to infinite distance. In the case of black hole, this potential energy is found to be positive, implying that if any object moves out of black hole, it will do some work on its own.

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