

Momentum is not what you think

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We update Newton's first law of motion and Weak Equivalence in light of General Relativity

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I. INTRODUCTION

Newton's first law of motion and "Weak Equivalence" are two of the least satisfying concepts in Physics. This is not because they are untrue, but because they come with no explanation. This paper intends to explain these concepts in terms of cause and effect.

The weak equivalence principal states that gravitational mass is equal to momentum mass. While it is not totally clear what this statement means, we intend to use General Relativity to show exactly what this statement means and to show why it is true.

II. GRAVITY WAVES

One of the main (in my opinion) differences between Newtonian Gravity and General Relativity is Einstein's prediction of gravity waves. Let's take a look at how gravity waves might play in updating these Principals. We start by defining some terms. Let E_w be the work performed on the mass to accelerate it and build momentum. E_k is the kinetic energy of mass after acceleration. And here is the new term, E_g is the energy of gravity wave produced during the acceleration of the mass.

We have always assumed that the kinetic energy built up in the mass is equal to the work performed accelerating the mass through a distance i.e. $E_k = E_w$. Now, due to general relativity, we also know that the gravitational wave energy exists and is not zero i.e. $E_g > 0$.

$$E_w = E_k + E_g \quad (1)$$

We see from equation (1) that we now have a small problem since the equation no longer balances. One of our assumptions is false and it is easy to see which one. Not all of the work energy can go into the kinetic energy term. How much of the Work goes to the kinetic energy and how much goes into wave energy?

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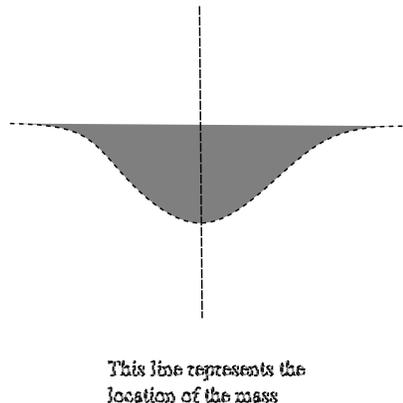


FIG. 1. Gravity Field Of Mass.

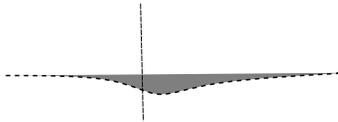
Some people have suggested that the work energy is divided between the gravity wave and kinetic energy. We propose a test to decide what is real and what is illusion. Suppose we ask a simple question: which is real: the wave energy or the kinetic energy of the mass? While it may be that mass is required to create a gravity wave, LIGO has shown that gravity waves exist separate from mass. On the other hand, it seems unlikely the mass can be in motion without generating a gravity wave. We conclude that gravity waves are real and the kinetic energy of the mass is an illusion.

III. GRAVITY WAVES CREATE MOMENTUM

Someone will work out the mathematics, but we are too old for that. We prefer to draw some simple pictures. In the figure (1) we see the gravity field of the mass centered on the location of the mass. We also see In the figure (2) the gravity field of the gravity wave slightly ahead of the mass in the direction of movement. The two gravity fields combined show a gravity field which is no longer aligned with the mass as seen in the figure (3). The mass naturally falls into the deeper gravity field resulting in movement of the mass.

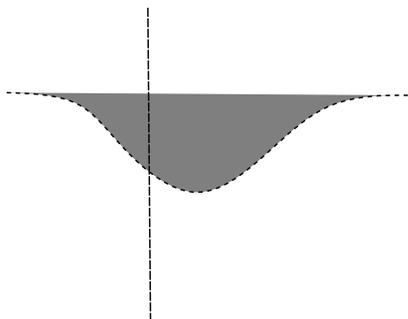
IV. ENERGY MUMENTUM TENSOR

I have always had issues with the Energy-Momentum Tensor. It just seemed like we were mixing Apples and Oranges. Now it is clear that this tensor mixes mass and gravity in a most natural way. It is also clear to us that mass and gravity are the only types of energy involved in the calculation of gravitational forces.



This line represents the location of the mass

FIG. 2. Gravity Field Of Wave.



This line represents the location of the mass

FIG. 3. Combined Gravity Field.

V. CONCLUSIONS

In this paper we have shown that momentum is the result of mass falling into its own gravity wave. We have shown that not only is momentum mass equal to gravity mass, but they are in fact the same entity. Mass at rest tends to remain at rest because it is sitting at the bottom of its own gravity well. Mass in motion tends to stay in motion because mass likes to surf its own gravity wave. We have also shown that the Energy-Momentum Tensor makes more sense now in light of this understanding.

VI. BIBLIOGRAPHY

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