

Einstein's Elevator

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Abstract. Simple gravitational experiments show that gravity is the acceleration of the quantum vacuum towards matter. Two diagrams presented in this paper (Fig. 1 And Fig. 2) demonstrate that the curvature of space is merely an effect of this accelerated spacetime.

"Einstein's Elevator" has provided a good straight forward description of the principle of equivalence, a cornerstone of relativity, and certainly one of the most recognized models for explaining the central idea of general relativity among physicists today. Simply stated, the experiments involve a man dropping a ball and timing a pendulum within a closed box. An identical experiment is performed by a woman in a closed box that is deep in outer space in a zero gravity environment where she is floating. Now a rope is attached to the woman's box with an unseen force pulling the box upward with acceleration equal to gravity.

The principle of equivalence asserts that both experiments are the same and that neither person can distinguish whether his or her own box is resting on Earth or accelerating in space. It is concluded therefore that the effect of gravity is reproduced by the acceleration of a reference frame, and, conversely, acceleration is imitated by gravitation [1].

Einstein's mental experiment was taken one step forward by affixing a flashlight to the wall of each box one meter above the floor. In the woman's box in space, the beam hits the opposite wall only after the floor has risen fractionally. As a result, the beam makes contact with the opposite wall at a height slightly shorter than one meter. The results should be the same in the man's box on Earth and he too should find that the beam makes contact just less than one meter. The conclusion that physicist have made from this experiment is that the light beam is deflected or *pulled* down by gravity and that the principle of equivalence predicts that light is affected by gravity.

We believe that the conclusion just drawn has some logical and conceptual problems. The very concept that the beam is pulled down by gravity reflects Newtonian and pre-relativistic views. This is not a correct concept in the spirit of relativity containing the principle of equivalence. Physicists infer from Einstein's elevator that the effects of gravity are *reproduced* by the acceleration of a reference frame, and conversely that the effect of acceleration is *imitated* by gravitation. This is not a strict converse. We believe that the effect of gravity is produced by the

acceleration of a reference frame, and, conversely, the effect of acceleration of a reference frame is produced by gravity. Our statement indicates that both phenomena are identical, but opposite, and analogous to action-reaction.

21st Century Einstein Elevator

Let us construct an experiment that takes place in deep space in a gravity free environment (see Figure 1.). There are two spacecraft (A&B) travelling close parallel paths. Vessel A is travelling with uniform motion and Vessel B is accelerating at one 'g' catching up to Vessel A where they momentarily reach an identical velocity side by side. A ball is thrown just before the laser is fired from Vessel A to the accelerating Vessel B. From the reference frame of observers onboard Vessel A, the ball and the beam of light appear to travel away from them in a straight parallel path right through the cage of Vessel B. Observers on Vessel B however witness the laser and the ball enter their spacecraft at the same time but inside Vessel B they curve downward so that the laser beam's exit is slightly lower than it's entrance. The slow moving ball is even more dramatic. It enters the vessel at the same time just below the laser beam but exits the vessel through the bottom of the vessel. The observations of the crews on the two vessels could not be more different. It should be noted that the crew on Vessel A are experiencing a zero gravity environment as it moves at a constant velocity. The crew on Vessel B is experiencing a gravitational-like force as they are pressed to the floor by their weight or inertial reaction to their one 'g' accelerating spacecraft.

In the woman's box as previously described by Einstein, we can see that the light only appears to be curved downward when in actual fact the light travels a straight line. If the light went a straight path or for that matter, a thrown ball from a tennis gun, then as far as the rest of the universe is concerned, neither the photons from the flashlight nor the ball experiences angular momentum along with centripetal or centrifugal forces. One may argue that the environment of the woman's elevator is that of an accelerated reference frame. This is certainly true of the woman and the box's structure, but is it true of the quantum vacuum within the box? Is the quantum vacuum within the box experiencing acceleration along with the elevator's structure? Or is it that a 'weird curved geometry' is generated in the box by the differential between the accelerated state of the box and the non-accelerated state of the local vacuum.

The exact same physical conditions of action-reaction exist when an experiment is performed in which Vessel B is in a stationary position hanging from a tall building on Earth (see Figure 2.). This experiment is particularly effective in describing how an object in free fall (Vessel A) although observed to be accelerating, is in fact in a state of uniform motion while an object (Vessel B) on Earth observed to be standing still is in actuality accelerating. How could this be? It can only be if the coordinates of the reference frame of the vacuum itself are accelerating towards mass.

FIGURE 1. - DRAWN IN INERTIAL REFERENCE FRAME OF VESSEL A

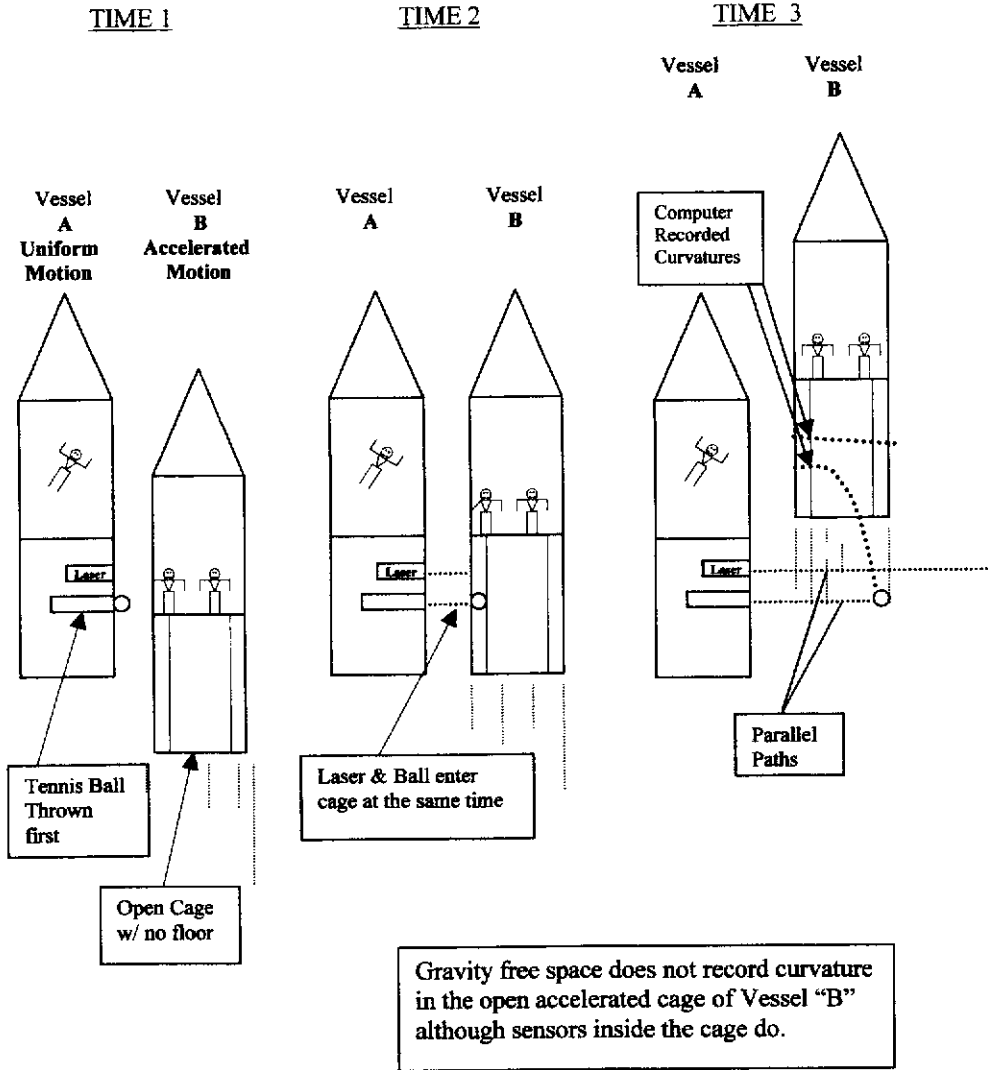
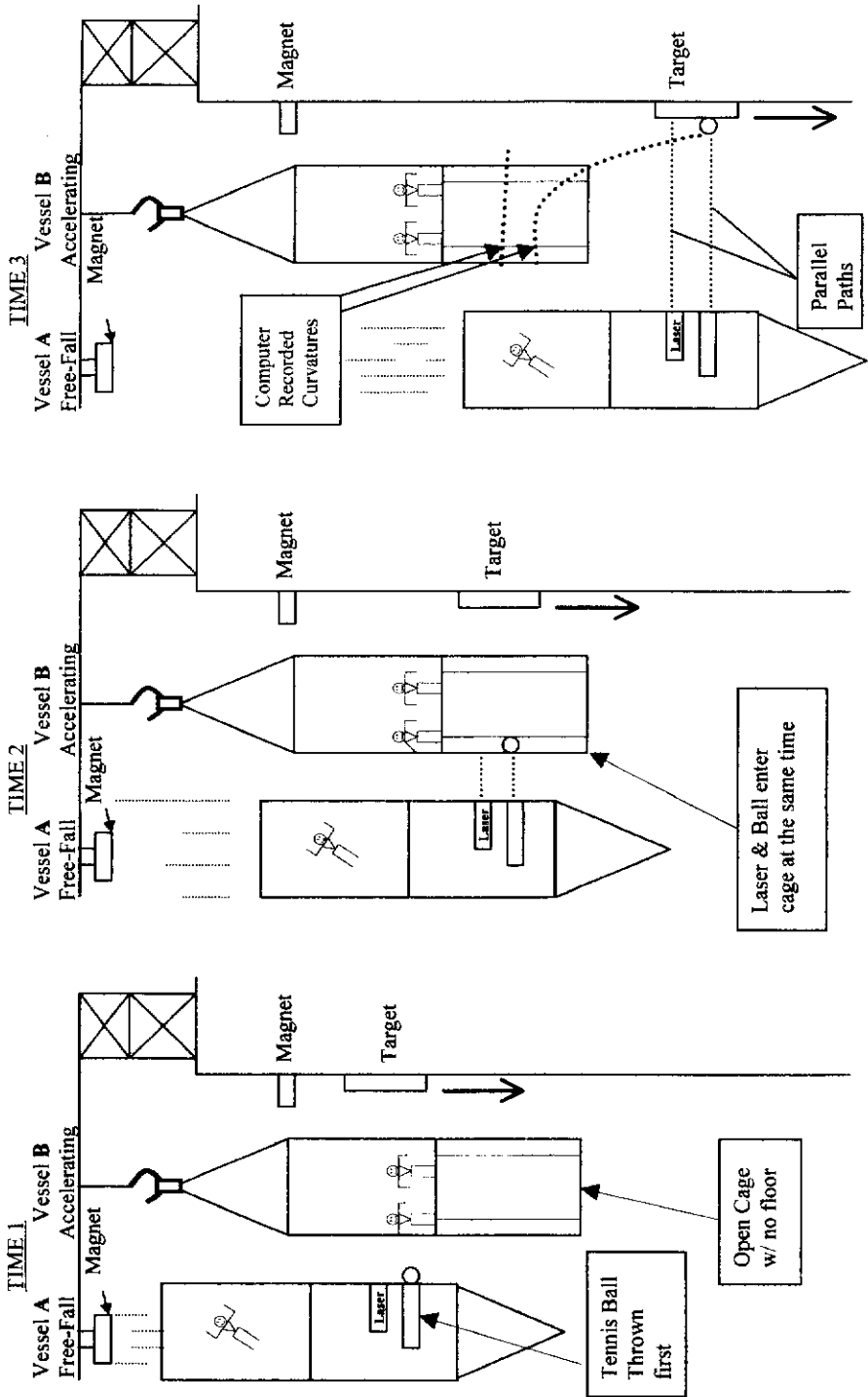


FIGURE 2. - DRAWN IN ACCELERATED FRAME OF VESSEL B



If it is universally true that every action has an equal and opposite reaction, then one should suspect that ordinary acceleration and an ordinary gravitational field (along with all inertial effects) should arise from the dichotomy of massive quantum particles and the Planck state quantum particles of the vacuum. The quantum vacuum is also a state of the background electromagnetic field and thus has physical significance.

It is *not an illusion* that the outside light or ball travels a straight path through space-time; *the illusion is* that the light or ball curves in the woman's box and in the man's box. According to the principle of equivalence, this *apparent illusion* that it curves also applies to planets travelling in elliptical paths around the sun, as opposed to travelling in straight geodesic lines. How can this be? Einstein said, "planets travel the straightest geodesic paths possible. But, according to Galilean or Einsteinian relativity, one cannot tell if one is moving at a uniform motion or standing still. Today we know that this is not strictly true. If a space ship positioned itself so that the background cosmic blackbody radiation showed no red or blue shift in any direction, then, the space ship would indeed be standing still at only *one place* in a universal reference frame.

Einstein jumped to his second conclusion, which in our opinion was an illusionary effect of his intuitive first conclusion that geometry itself was accelerating (and dismissed as a possibility). His second conclusion was: In an accelerated reference frame spacetime is curved by a massive body; furthermore, gravitational effects are regarded as arising from a curvature in spacetime which is considered somehow '*dynamical*'. In other words, this curvature produces gravity. This stands in stark contrast to Quantum Field Theory where spacetime is considered '*passive*'.

Returning to the woman's box in space in Einstein's mental experiment, we see that the light actually travels a straight path through space-time. It only *appears* to travel a curved path in the woman's box. Acceleration produces the distorted geometric environment in both the woman's and man's box. **This distorted environment in the woman's box certainly does not produce the box's acceleration.** The woman, by accelerating through space-time, observes that straight trajectories in the universe appear to curve in her reference frame. How can she tell if she actually is accelerating through space-time or whether the *real converse* is true, i.e., space-time is accelerating through her? The answer is she cannot. Both are equivalent phenomena. Accelerating at one 'g' through space or standing on the earth where space accelerates at one 'g' through you are identical phenomena, except, that one is the *action* and conversely, the other is the *reaction* respectively [2].

Quantum Physicists believe that the quantum vacuum, as a state of the electromagnetic field with ZPF, carries super-energy density of 10 to the 120th power GeV per cubic centimeter. This quantum vacuum state can also give us the geometry of a reference frame. We think that all motion is relative to this super energetic frame, which also has the dynamic ability of accelerated motion toward matter called "the gravitational field." In our opinion, the principle of equivalence should be:

"One cannot tell if one is accelerating through the quantum vacuum or if the quantum vacuum is accelerating through one".

The curvature of space is only an effect of our equivalence principle above. General relativity uses this space curvature to explain gravity - which nevertheless is macroscopically correct. But, it does not connect conceptually to mass nor to quantum theory. The equivalence principle is exact if interpreted as action-reaction; which is compatible with quantum theory.

The understanding of general relativity and quantum theory must evolve if they are ever to unify or cohere.

REFERENCES

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2. Pound, R. V., and G. A. Rebka, "Effect of gravity on nuclear resonance," *Phys. Rev. Lett.* 4, A.I.P., 1960, pp.337-341