The Nature of Gravity and Time

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Abstract-Any two masses will experience gravitational attraction between them that draws them together. In an energy-conserving universe as they accelerate towards each other building up kinetic energy there must be some other energy system losing mass/energy to balance that increase in kinetic energy of the two objects. This paper examines the phenomenon of gravity and develops a model, then looks at the implications of that model. It then examines the redshift in the Universe and shows that the two appear to be identical effects, with one along the spatial axes, and the other along the time axis.

Keywords- *Einstein, Relativit, Gravity, Red-shift, Time's Arrow*

I. INTRODUCTION

When there is a dilated part of the Universe, caused by the presence of matter, that dilation is a distortion of spacetime that attracts other matter towards it, creating gravity. Equally, Einstein showed that the Universe is dilating over time, and because matter is attracted to dilated spacetime it will also be attracted towards that future dilation, creating "time's arrow", the unidirectional flow of matter into future time.

II. A MODEL FOR GRAVITY

It is received wisdom that mass is inviolate and never changes even when falling into a gravitational well. However, consider a closed system where two masses fall towards each other from a great distance. In an energy conserving universe, the mass-energy of the closed system must be a constant. Since there is only mass and kinetic energy in the closed system it follows that as the kinetic energy builds up mass is diminished as spacetime dilates; every particle has a reduced mass as seen from the outer universe, but retains its normal mass as perceived by an observer local to it in that same dilated spacetime.

Logically, therefore, there must be an effective reduction of mass, as seen from the greater universe, when two objects approach each other and thus increase the local spacetime dilation. The energy balance of the universe requires that the more dilated space that results as a result of the increased mass concentration when the two original masses come together, reduces the effective mass as seen from the greater universe outside that dilation. Gravitational attraction is driven by this diminution in effective mass.

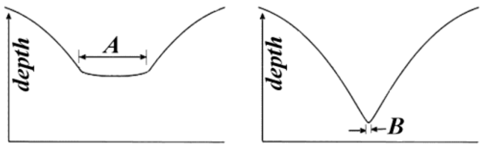

Figure 1. Depression of spacetime depth by mass

However, once we accept this proposition, we have to reconsider Einstein's concept that if enough mass comes together space would be breached to create a singularity. He envisaged a linear process whereby adding mass upon mass together resulted eventually in too much mass for local space to support, creating a singularity. From the above we can see that such a linear process violates the Principle of Conservation of Energy. This leads us to consider an alternative solution based on the fact that a local observer sees the same nature of space around him no matter how deep his gravitational well.

Spacetime "depth" is thinned by the presence of mass and this thinning produces temporal and spatial dilation in the region. Where there is an agglomeration of matter, the depth to which spacetime is thinned is dependent on the total mass involved and its mass distribution. Fig. 1 shows the effects on spacetime of a mass in a large volume at "A", leading to a low mass density and in a low volume at "B" with a high mass density.

As can be seen, far from the mass the curves are similar, and as we approach the central mass from the left or right of Fig. 1 spacetime is depressed along similar curves. However, as we approach to inside the radius of mass "A" the curve shallows and spacetime is not too compressed. However, for "B" the curve continues on until we reach the limits of the mass radius of "B", and only then shallows out.

Spacetime appears the same wherever we are and to a local observer there is no change regardless of the local dilation of spacetime as seen from elsewhere in the universe. This is a crucial point, and needs exploring in depth. Let us postulate that spacetime has a finite 'depth', and the shallower the depth the greater the spacetime dilation. Then if we take a large mass that distorts spacetime resulting in a spacetime depth thinned by (say) 40%, and then we take another identical mass with identical volume and add it to the first (assuming that the

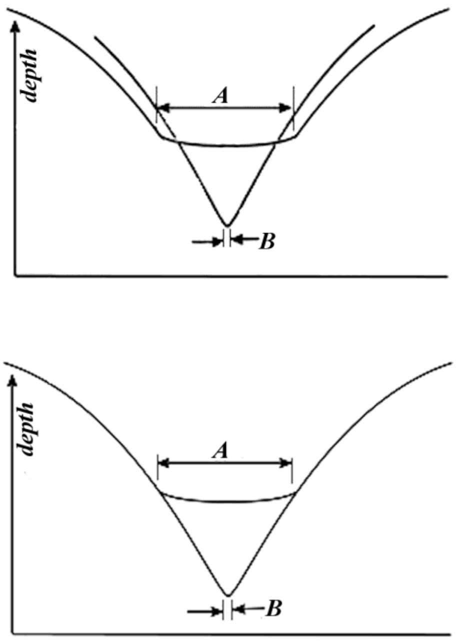

Figure 3. What if mass was constant?

compound mass occupies the same volume as the original mass), what will be the result? Since spacetime always behaves the same to a local observer, regardless of where that observer is, the new mass must reduce the local spacetime depth by 40% (leaving 60%) of its local value. However, from the viewpoint of a remote observer, having seen the effect of the first mass in that space reduce the depth by 40%, the combined compression is to 100% x $(1\text{-}0.4)^2$ of the original depth with which we started. Hence from the viewpoint of a remote observer, if we put together 'n' identical masses that separately reduce the residual depth of spacetime by 40% whilst keeping the same volume, the residual spacetime depth is $(1.0\text{-}0.4)^n$ which becomes tiny as 'n' increases but can never reach zero. This means that singularities cannot occur as spacetime cannot be breached, because spacetime is everywhere the same to a local observer. If we take Fig. 1 and make the mass at 'A' and at 'B' identical, with 'A' a more diffuse mass, the higher concentration at 'B' will lead to a greater spacetime depth at a distance, as shown in Fig. 2. Hence the collapse of the Sun at the end of its life into a white dwarf will pulse out a gravitational step wave.

There is an important corollary to this. If one could simply add two 40% (or any other value) masses and they simply added their effects to produce an 80% mass (20% residual depth) in local spacetime there would be no gravitational attraction as there would be no energy mechanism involved to create the attraction – all the original mass is still perceived by the rest of the universe, as shown in Fig. 3 where we have two identical masses, 'A' being diffuse and 'B' being compact. At a distance there would be no variation in the gravitational field from masses coalescing because of this, so there would be no possibility of gravitational waves. Spacetime could be breached by a singularity and gravitational attraction would not exist.

Returning to the model of effective mass reduction causing gravitational attraction, consider two masses in terms of how much they distort spacetime, one by 'x' (giving a residual dilated spacetime depth of (1-x) and the other by 'y' giving a residual dilated spacetime depth of (1-y), where 'x' and 'y' must lie between the values of 0 and 1. When they are brought together the dilation in spacetime in terms of our masses may be given by

$$\begin{aligned} Dilation &= (1-x)(1-y) \\ &= 1-x-y+xy \end{aligned}$$

(1-x-y) is simply the addition of both masses' effect on space when they are widely separated. If there was no change when they were brought together there would be no attractive forces. However, we find that the distortion in spacetime has an additional 'xy' component that offsets part of the distortion, an effective diminution of mass to the greater universe when they come together. This is the source of gravitational attraction as that mass diminution leads to attractive forces that are proportional to the product of the two masses. The potential gravitational energy then becomes G.x.y/r, where 'r' is the separation between the masses and 'G' is some gravitational constant (this constant must include a mass to energy conversion for both masses). Then the force between the two bodies is the derivative, namely $G.x.y/r^2$. This reduction in effective mass as perceived by the larger universe creates the attractive force that is gravity.

Rather than matter being directly attracted to other matter, matter creates a spacetime dilation around itself, and other matter is attracted to that region of dilated space by a diminution of mass, creating gravity.

Because spacetime always looks the same to a local observer, gravitational forces must occur when masses approach each other because there is an effective diminution of mass perceived by the greater universe by the resulting increase in the dilation of spacetime. Spacetime cannot be breached to create a singularity - singularities and gravitational attraction are mutually exclusive in an energy-conserving universe. A quasar would be the likely result of a massive infall of matter rather than a black hole, as the event radius cannot exist in this model of gravity.

III. Redshift

In 1917 Einstein developed equations that described an ever-expanding universe before the red-shift of the Universe was discovered. He showed that it is an inherent property of the Universe that it will continually expand at a faster and faster rate as time goes by. Later on, in 1927, after the expansion of the universe was actually discovered, Georges Lemaitre proposed the "Big Bang" theory to account for that expansion, ignoring Einstein's findings. To be fair, Einstein, not knowing about the red shift, had added a completely arbitrary "Cosmological Constant" to force his equation to yield a static Universe, something he later counted as his most serious mistake.

The Big Bang theory states that at some distant point in the past a massive explosion occurred that still drives the expansion of the Universe. There are two problems with that theory:-

1) *First, there must have been massive energy involved in the explosion to create our current Universe, and that is deemed to have come from a time when the Universe must have had very different properties to today. Mainly, that mass/energy was not conserved but was created out of nothing during the explosion. At the end of the Big Bang, for no accountable reason, the Universe changed into the energy-conserving Universe which we have today. This change in the properties of the Universe is not understood.*
2) *Second, now that the explosion is far in the past, the expansion of the Universe should have nothing to drive it any more, so the rate of expansion should be slowing down as a result of gravitational attraction. However, in 1998 two separate projects – The Supernova Cosmology Project and The High-Z Supernova Research Team – examined distant type 1a supernovae which have a near-standard intrinsic brightness so that the brightness we see on Earth can be used to measure their distance from us. By measuring the red shift and comparing it with that distance we can see how the Universe expands over time. The results clearly show that the rate of expansion is increasing, which means that if the redshift is caused by an explosion, that explosion is still continuing. In other words, we should be living in a Universe in which mass/energy is not conserved but is still being created out of nothing. All the available evidence contradicts this, seriously weakening the theory.*

Einstein's relativistic expanding Universe, on the other hand, fits the evidence. It predicts that the Universe will continuously expand in an ever-faster way, so that the rate of expansion of the Universe is always increasing, as found by the Supernova Cosmology Project and The High-Z Supernova Research Team. This expansion is in fact a relativistic dilation. Our measurements indicate that the Universe doubles in size every seven billion years or so. This dilation affects both space and time, and just as space doubles in size over that period, so time doubles in size, slowing down by a factor of two.

Everything is relative to the local observer's present, so if there was a hypothetical observer external to the Universe whose timescale was constant throughout time, and he perceived the Universe's year today as being one of his years long, he would see the Universe's year as being only half of his years long seven billion years ago. However, seven billion years ago a local observer would perceive the year as being one year long because he is also part of the dilation of spacetime. The local observer will always see his present in the same light, no-matter where on the time axis he may be. If the local observer went back in time another seven billion of the Universe's years he would still perceive his year as being of the same length, with all Universal constants the same. Hence the Universe always looks the same age to a local observer no-matter where he is on the Universe's timeline. However, the virtual external observer will place the universe as being 14 billion years old, counting the length of the year as being that at the point at which we are taking the measurement. A younger Universe will have shorter years when measured by the virtual external observer, but there will always be the same number of them to get back to the external start of the Universe. Thus, the Universe has an external start point, but no internal start point. The external age of the Universe is 14 billion of our current years old at the point of measurement, the internal age is infinite.

Matter is being accelerated along the time axis from a dense universe to a more dilated one. Just as matter is accelerated along spatial axes towards regions of greater dilation, so matter perceives a positive attraction towards that more dilated future. If the resultant acceleration towards the future is associated with a temporal equivalent of kinetic energy, as seems likely, then matter accelerating along the time axis builds up that temporal kinetic energy in exchange for a diminution in mass in that dilated future time, and the Universe is fully mass/energy conserving. That attraction of matter towards the future dilated Universe creates "time's arrow".

IV. Conclusions

Gravity and Time's arrow are generated in the same way, namely by the dilation of spacetime. The former is the spatial effect called gravity, the latter is the temporal equivalent, known as "time's arrow". Matter has temporal inertia and its temporal kinetic energy increases over time as it is accelerated faster and faster into the future.