

The Nature of Gravity

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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 there must be some energy system losing mass/energy to balance the increase in kinetic energy of the two objects. Now it is received wisdom that mass is inviolate and never changes even when falling into a gravitational well, but the increase in kinetic energies of two bodies falling together under gravitational attraction would then violate the Principle of Conservation of Energy, as the only possible source of mass/energy is a reduction in the effective combined mass as two objects come together. 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 dilating space reduces the effective mass as seen from the greater universe outside that dilation. 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, but from the previous sentences 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.

The nature of gravitational mass

Spacetime 'depth' is thinned by the presence of mass and this thinning produces time 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. Figure 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:-

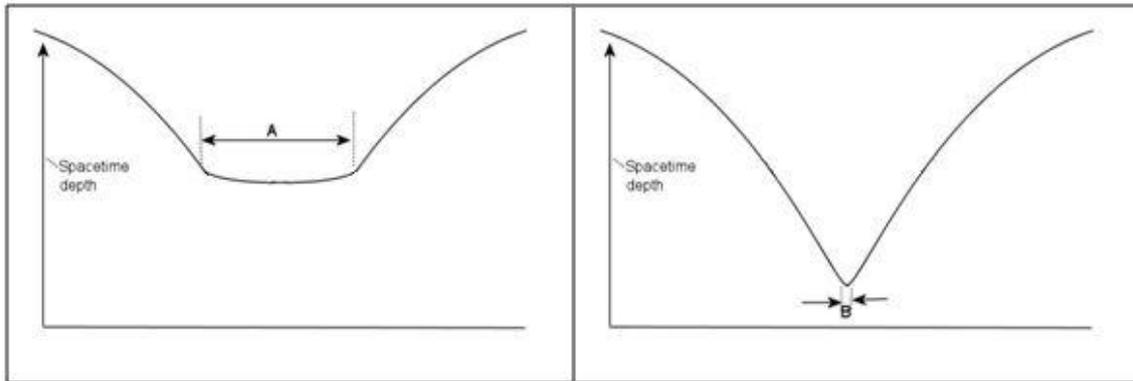


Figure 1

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 Figure 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 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 assume spacetime has a finite 'depth'. Then if we take an immense mass that distorts spacetime resulting in a spacetime depth thinned to (say) 50%, and then we take another identical mass with identical volume and add it to the first (assuming that the compound mass occupies the same volume), 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 to 50% 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 to 50%, the combined compression is to 25% of the original depth with which we started. Hence from the viewpoint of a remote observer, if we put together 'n' identical 50% masses of the same volume, that when they come together they compress to take up that same volume, the residual spacetime depth is $(0.5)^n$ which becomes tiny as 'n' increases but can never reach zero. This means that singularities cannot occur as spacetime cannot be breached, *all because spacetime is everywhere the same to a local observer*. So if we take Figure 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 smaller dilation at a distance, as shown in Figure 2:-

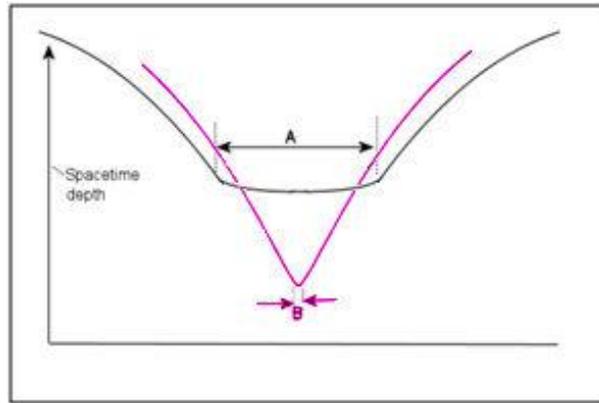


Figure 2

There is an important side effect to this. If one could simply add two 50% (or any other value) masses and they simply added their effects to produce 0% 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 Figure 3 where we have two identical masses, ‘A’ being diffuse and ‘B’ being compact:-

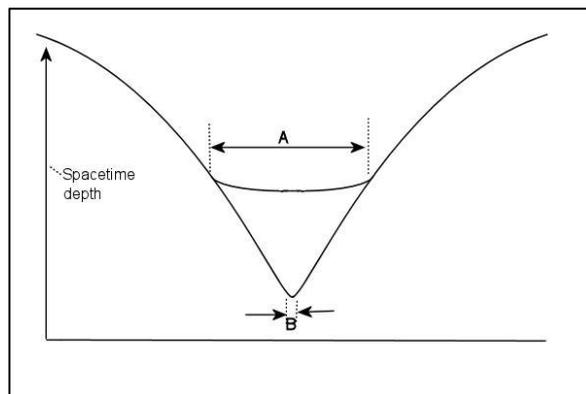


Figure 3

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.

Let us now take two identical masses that each thin space by 50%. Let us assume that a distant observer perceives a loss in the effective mass when the masses are brought together because instead of seeing double the 50% mass they will perceive only $(100\% - 25\%) = 75\%$ of it, a loss of 25. This is a lower mass-energy configuration than having the two masses distantly separated which in turn means that mass is lost to the larger universe when the masses come together and hence that reduction in the mass-energy configuration creates attractive forces that pull the masses together, from the equation $F = dW/dl$ (Force ‘F’ = rate of change of mass-energy ‘W’ by distance ‘l’). This concept means that the effects of masses coalescing could be detected far from the masses by the reduction in the effective mass and two large masses in elliptical orbit around each other would produce a periodic fluctuation in their distant gravitational fields.

Consider two masses in terms of how much they distort spacetime, one by 'x' (giving a dilated spacetime of (1-x)) and the other by 'y' giving a dilated spacetime of (1-y), where 'x' and 'y' must lie between the values of 0 and 1. When they are brought together the distortion in spacetime may be given by:-

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

(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. But we find that the distortion in spacetime has an additional 'xy' component that offsets part of the distortion, an effective loss of mass to the greater universe when they come together. This is the source of gravitational attraction as the mass loss leads to attractive forces that are proportional to the product of the two masses. The potential gravitational energy becomes $G.x.y/r$, where 'r' is the separation between the masses and 'G' is some gravitational constant. Then the force between the two bodies is the derivative, namely $G.x.y/r^2$. The reduction in effective mass as perceived by the larger universe creates the attractive force that is gravity. Without this mass loss gravitational attraction would violate the Principle of Conservation of Energy as there would be no driving energy to the attraction. Thus there are attractive forces between them that exchange some of the total mass for kinetic energy as they come together, in the same way that the electric fields of the proton and electron partially cancel as they come together, reducing the total energy and thus creating the electrostatic attractive force between them.

In conclusion

In conclusion, because spacetime always looks the same to a local observer:-

- Gravitational forces must occur when masses approach each other *because* there is an effective loss 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 seems a more likely result of a massive infall of matter.