PAPER 3

Dark Energy and the expansion of the universe

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Abstract

This section is similar to the first but that instead of gravitation being a force of attraction, it is reversed to one of repulsion. All the same assumptions in sections 1 & 2 have to be made together with some further conjectures. The first is that since two separate particles of mass cannot occupy the same space at the same time: matter repels matter. The fact that gravitation is experienced as an attractive force is rationalised as follows. The effect that the respective masses of two stellar objects (stars, galaxies or lesser masses) will have on each other locally will act to blanket off the repulsive effect of the outer edges of the universe in all directions other than that between the two masses. Some implications of this scenario are given for Dark matter and energy.

This third paper is very speculative indeed. It is based on the fundamental assumption that like repels like, and in the same way that opposite electric charges repel, so units of mass repel each other, for the same reason at a fundamental level that two separate particles of mass at whatever microscopic scale cannot occupy the same space at the same time. Everybody is aware that gravitation is a force of attraction, but on the assumption that the universe is closed and finite, then due to a blanketing effect, gravitation could be operating repulsively on the macro astro-scale despite our contrary experience in the local small scale dimensions of our observable universe. Such assumptions would appear to allow the quandary of Mach's principle to be rationalised with gravitation, and for inertia to be presented in an altered perspective, similarly to that demonstrated above in paper 1, and such a scenario would also give a rationale of sorts to entropy in general and for the outward expansion of the universe.

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There has been some theorising that dark energy might need to be represented generally in the form of negative gravitation since the universe appears to be expanding faster than anticipated. Dutch physicist Erik Verlinde who came up with a proof in January 2010 indicating that gravitation is not a fundamental force but rather an emergent phenomenon that arises from the statistical behaviour of microscopic degrees of freedom encoded on a holographic screen. This encouraged me to reconsider some conjectures that occurred to me on the subject of Mach's Principle in the middle nineties, but dismissed as too fanciful at the time. Given this more recent information coming in from the observations of the astrophysicists, and having again been able rationalise a new framework to present a simple explanation of how Mach's principle and gravitation interact as above, the position on the relativistically vast mass close to the rim is as described in section 1 above still holds good, showing the universe with most of the matter near the outside edge expanding out at close to light velocity

If the universe is finite and bounded and most of its mass is close to the outside edge and traveling outwards at near light velocity as described above in paper 1, then this would have an interesting effect on slower moving galaxies well within the universe. As before the mass of the outer edge galaxies would be relativistically huge if they were traveling at near light velocity. If there was this repulsive effect between separate masses (galaxies, or clumps of galaxies), the repulsive force thus exercised on the interior galaxies would presumably be balanced out in accordance with the inverse square law, so their velocity would not be affected. However if there were to be some force tending to accelerate them away from their motion in a straight line, they would experience a pressure against this: inertia. As before, Mach's Principle would be endorsed.

This conjecture is confounded by the fact that a dropped weight falls to Earth rather than shooting upwards. However a simple possibility recently occurred to me which did not seem too unreasonable, and which can best be described as the possible existence of a blanketing effect. Such an effect certainly exists when a mass of conducting material is placed in the way of EM radiation. If my assumption were valid that gravitation was to act in much the same way as EM radiation, like repelling like, then there should indeed be such a blanketing effect.

To rehearse my hypothesis, if gravitation were repulsive then the very substantial quantities of matter near the periphery moving very rapidly outward and certainly well beyond the limits of visibility from Earth, would exercise a huge repulsive effect on all matter further within the universe. If the repulsive effect of just one nearby section of the universe on, say the Earth, were considered, and if the inverse square law were invoked, this would be exactly countered by the much larger section at the opposite end of the universe, albeit it so much further distant. In diagram 2B the forces from opposing sides of the universe are shown to balance out on a stellar mass two thirds of the distance from the centre. This is very similar to diagram 2 above, except that the forces are outgoing instead of the reverse. In short there would be equilibrium of all such repulsive forces assuming the matter were moving at a constant velocity rather than accelerating so that there would be an inertial effect on this interior matter if it were to be made to accelerate.

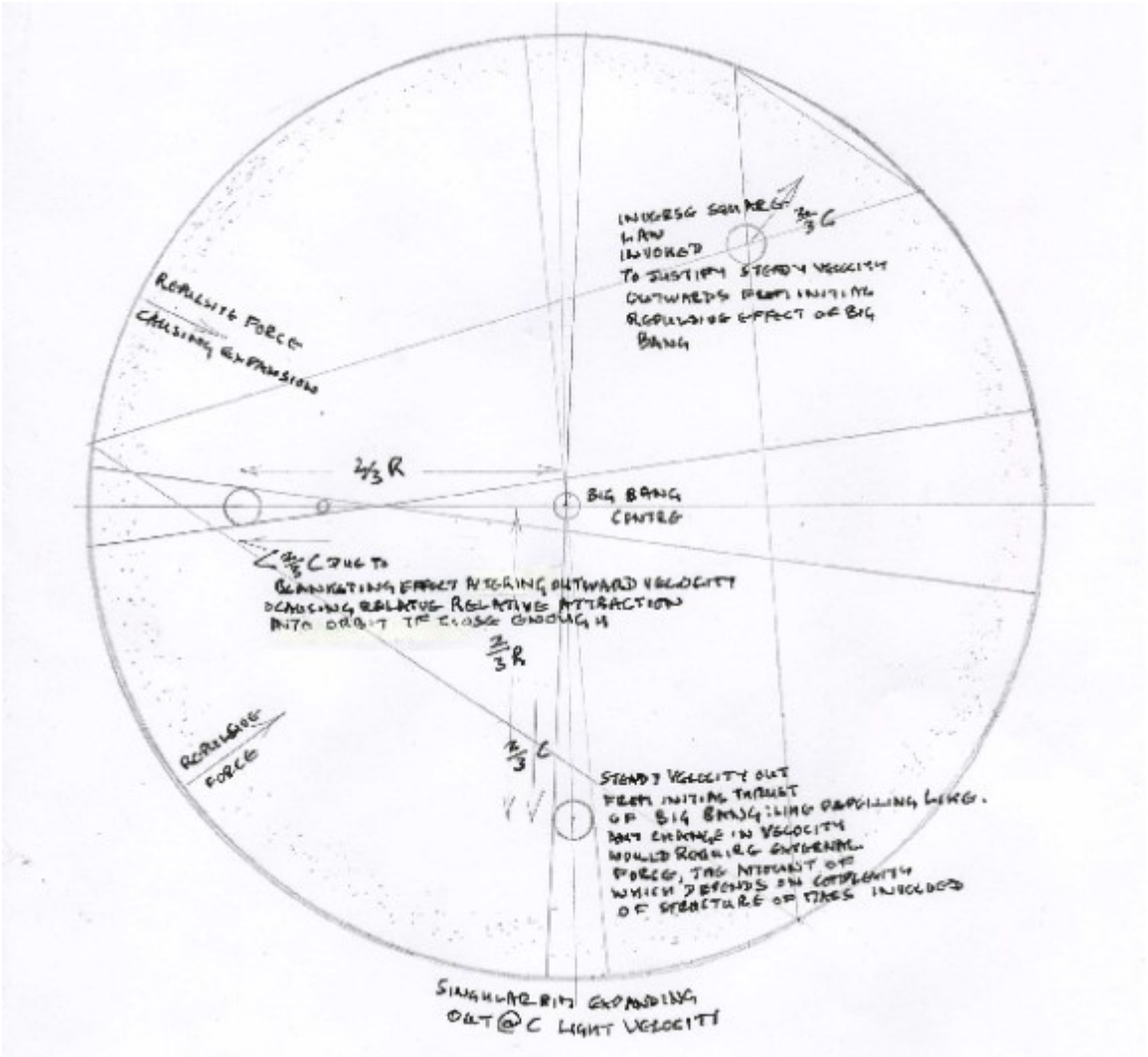

Diagram 2b

However if two stellar bodies or planets were to approach each other (Diagram 3B), the proposed blanketing effect would start to push them together so that they would start to curve towards each other and when they reached distances close enough that they could not escape, they would fall into an elliptical orbit. It appears that here is some sort of alternative scenario for the explanation of gravitation as a repulsive force.

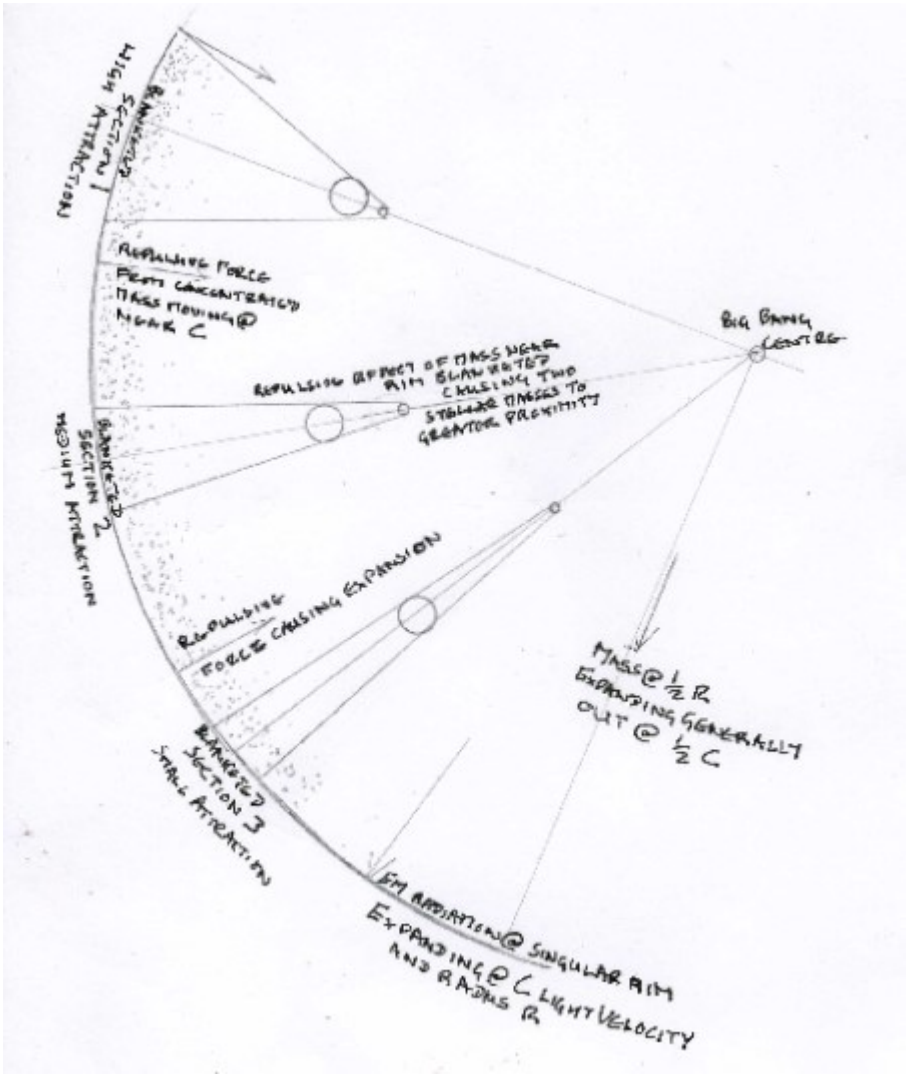

Diagram 3b

In order to rationalise the extreme case of the attractive gravitational forces of neutron stars, it has to be assumed that the repulsive force created by the prolixity of stars and galaxies at the outer edges is vast and all pervasive which it will be if every object with rest mass is subject to inertia. It also has to be assumed that the blanketing effect is incremental, rather than just on or off. For the conjecture to hold water it has

to be assumed that the repulsive force of the universe's outside edge is far greater than the repellant force that will also be exerted on a planet by for instance, a neutron star.

Such a scenario would be the basis for a revised definition for Mach's Principle. In summary it would do away with the notion of gravitation as a separate effect but instead allow the repulsive force driving the expansion of the universe to also define inertia. This force, being equal in all directions (inverse square law), would act on all matter within the universe so that their initial motion expanding outwards would be unaffected whilst at constant velocity, but which would resist any acceleration. This is all as before in paper 1.

If gravitation were a repulsive force which could be blanketed by intervening mass then a basic rationale for dark energy and indeed the big bang at once suggests itself. A section on the problem of dark energy in Paul Davies book 'The Goldilocks Enigma' seems relevant.

"*In the mid 1990s two groups of astronomers stunned the scientific community by announcing that the expansion rate of the universe is actually speeding up, as indicated by observations of supernovas in distant galaxies. That is, the universe is now expanding faster than before, and looks to run away with itself if the trend continues. The discovery rocked the foundations of cosmological theory, built as it was on the firm conviction that gravitation acts as a brake on the expansion, serving to slow it down from its explosive start at the big bang to the relatively modest rate observed today. Now the name of the game had changed. A mysterious antigravity force is opposing gravity and has succeeded in transforming deceleration into acceleration… It is too soon to predict that the force causing the universe to accelerate is one and the same as Einstein's original antigravity, although that is certainly the simplest explanation. As I have explained, antigravity can be considered as a consequence of the energy- and the concomitant negative pressure- of empty space itself. Alternatively we can attribute the energy and negative pressure to an invisible field that permeates space. Either way, we don't see anything of it, so the generic term dark energy is used to denote all these possibilities. Astronomers are planning better measurements to find out more. Whatever it is, if you add up the dark energy responsible for making the universe accelerate, you find that it actually represents a total mass that is more than all matter-visible and dark- put together. It*

seems that dark energy constitutes most of the mass of the universe yet nobody knows what it is …"

In further support although the connection is not immediately obvious due to the technical nature of the paper, in December 2009 year a Dutch physicist, Erik Verlinde (see http://staff.science.uva.nl/~erikv/page20/page18/page18.html) came up with a theory which has caused some interest and comment from the physics fraternity. It is a theory that derives Newton's classical mechanics. This was followed by the publication of 'On the Origin of Gravity and the Laws of Newton' on 6 January 2010. The abstract reads as follows: "*Starting from first principles and general assumptions Newton's law of gravitation is shown to arise naturally and unavoidably in a theory in which space is emergent through a holographic scenario. Gravity is explained as an entropic force caused by changes in the information associated with the positions of material bodies. A relativistic generalization of the presented arguments directly leads to the Einstein equations. When space is emergent even Newton's law of inertia needs to be explained. The equivalence principle leads us to conclude that it is actually this law of inertia whose origin is entropic*."

My proposal of repulsive gravitation agrees with Verlinde's statement that Gravity is not a fundamental force but an emergent phenomenon. There is also a correspondence in his involvement of the holographic principle with my other work which is not covered at all in these three papers having little apparent relevance to cosmology but the implications of which led me to the conclusions above.

When recently considering the search for dark matter and the nature of WIMPS or MACHOs, I came to a solution of sorts in line with the above proposals as follows. I was aware that one of the reasons for the estimate of dark matter and energy taking up 95% of the universe's mass was also based on the original observations of Astronomer Vera Ruben from 1980 when she published a paper indicating that the stars on the outer reaches of the galaxy were observed to be travelling at much the same velocities as those further in which conflicted with the inverse square law. It was reasoned that the reason for this must that there was a large halo of dark matter stretching out to these outer reaches. No other evidence of this has yet been found, although there have been many experiments searching for rare massive particles and also theories that the laws of Newton do not prevail at such distances.

It occurred to me recently that in a spiral galaxy, such as our own, a star in the midst thereof would be blanketed from the repulsive (or attractive) effect of the outer rim of the universe by all the surrounding stars in that one plane of the spiral on the assumptions made in this paper. When such galaxies are viewed from a distance it is quite possible to see how relatively crowded the stars are placed around the centre of the galaxy. In that plane the usual accepted rules of gravitation and motion might not apply in the midst of that mass of stars due to the repulsive effect of the singular rim of the universe being blanketed off or at least diluted, by the concentration of stars in the flat spiral, and they would then each exhibit much the same velocities. I cannot be sure that this would be the result but it seems to me that there would be much less inverse square law involved, and if so then there would be no need for a halo of dark matter to encircle the galaxy in a sphere. Having said that, the stars on the outer edges of the galaxy would presumably tend to rotate at lesser velocities according to Newton-Kepler predictions their being seriously blanketed only to one side by the central bulk of the galaxy.

This was speculative enough for me to be interested but not too excited by such a possibility, until I read further from a Wikipedia summary on dark matter that globular clusters of stars within galaxies show little evidence that they contain dark matter. From which I conclude that the inverse square law of gravitation as we understand it acts as we might ordinarily anticipate with the outer stars circulating at appropriately lower velocities. Since globular clusters are spherical rather than spiral and less densely distributed in one plane, then by the same reasoning as above, this is what might be expected and would not be inconsistent with my explanation of the nature of gravitation.

If so then here was a simple conclusion to explain why the halo of dark matter around the galaxies was probably a nonstarter, and reinforce the possibility that gravitation might be regarded as an emergent force. I understand that dark matter has to be cold, which would also fit very well with my proposals. Such an explanation for dark matter would hold good for both attractive and repulsive gravitation.

References

- Davies, P. The Goldilocks Enigma, Allen Lane 2006
- Verlinde, E. On the Origin of Gravity and the Laws of Newton, Institute for Theoretical Physics, University Amsterdam, Jan 2010