The Resolution of the Flatness Problem without Inflation

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Abstract

It is shown that , an easy answer to the flatness problem is given if we abandon an unjustified assumption used usually in application of Einstein's Field Equation in the large scale universe .

Introduction

Generally , the resolutions to the problems of physics which involve removing unjustified assumptions are considered better than those requiring addition of new assumption , especially when this new one is in such a degree of ugliness as that of the assumption that the early universe underwent a brief period of extremely rapid and enormous expansion referred to as *inflation* which is used to explain among other difficulties with the standard model of cosmology the unexplained extreme flatness of the early universe needed to account for the universe in which we find ourselves , which is known as the *flatness problem* .

Our aim here is to find a way out of the flatness problem by exploring the existing presumptions unconsciously used in application of Einstein's Field Equation .

The Resolution

We all know that Einstein's Field Equation can be applied successfully to all small and large cosmological values of mass , distance and velocity , inside matter or in vacuum , but in all these cases the region in which the equation is applied is somehow different from other parts of the universe either by different values of stress-energy tensor or the distance from heavy masses .

Now we will show by a simple thought experiment that the application of the field equation in a universe of total sameness can lead to different result from what is often assumed .

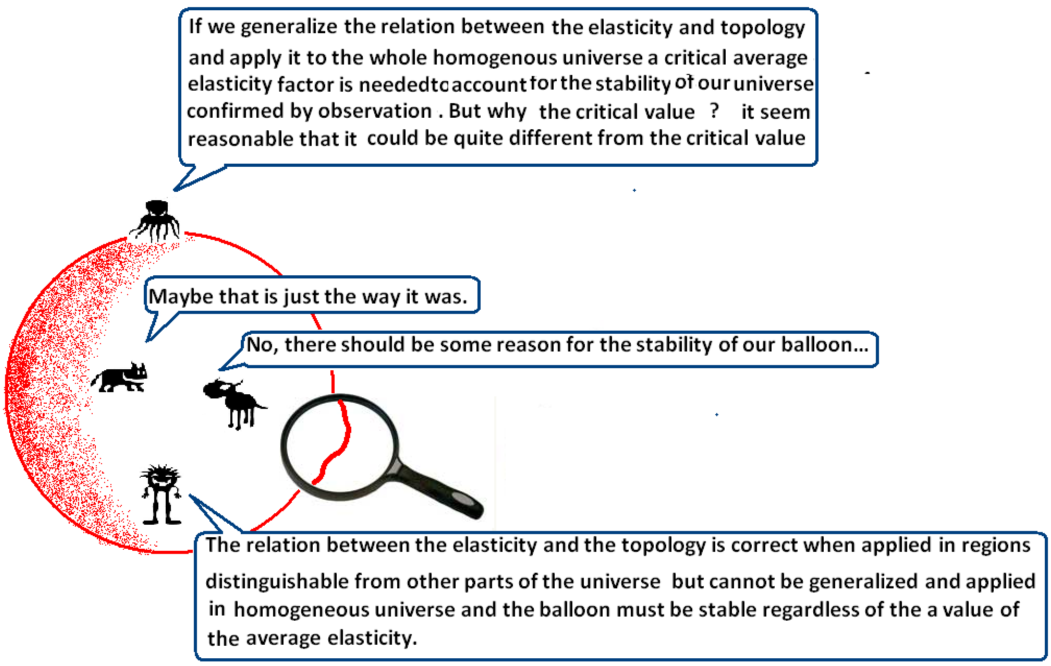
Before considering this thought experiment , it should be highly emphasized that it is intended only , by using the more familiar behavior of a creature exploring the surface of a balloon , to show that we are subjected to fall back on certain kind of unjustified presumption when we generalize any kind of field equations to a universe of total homogeneity , without any claims of similarities between the properties of space - time and the elastic balloon.

Suppose that a balloon inhabited by a creature (not necessary two-dimensional) who want to study the theories of elasticity on his universe in the large scale . It is not a very good balloon, in that it has different values of elasticity factor across the surface in a way analogous to the distribution of mass and energy in our universe . After covering enough area of his universe, the creature can find the relation between the elasticity factor and the curvature of the surface of the balloon to be in the following form: (curvature = E + A). Where (E) is a quantity that depends on the local elasticity factor , and (A) is another constant cosmological quantity not known to him however we know that it is a simple function of the radius of his spherical balloon .

Now when this creature want to apply his equation in his large-scale universe he may assume total homogeneity of elasticity across the surface of the balloon and by generalizing his relation between elasticity and the curvature of the balloon , his calculation will surely lead him to a global relation between the average elasticity and the global curvature of his universe (although we know that this is not correct , for the global curvature of the balloon depends only on the radius of the balloon and has nothing to do with the average value of elasticity factors).

Then he can also make additional calculations concerning the stability and he will surprisingly enough , taking into account the observations confirming the stability of his universe , find that the value of the average elasticity of his universe must be precisely equal to the critical value needed to this stability (which is also incorrect result because the balloon is stable regardless of the average elasticity).

Then some other inhabitants of the balloon will become a bit worried about explanation of this fact by saying '' that is just the way it was '' and to overcome this difficulty they may add other complications by making some speculation about the initial process of filling the balloon with the fluid , without turning their attention to the validity of their unjustified generalization of their equation which relate the elasticity factor and curvature .



Now , considering the application of Einstein's Field Equation in total homogenous universe , to avoid a similar mistake we must try the possibility that the relation between the curvature of space-time and the stress-energy tensor cannot be generalized to the universe of total sameness in all its parts , and that the global curvature depends only on the age of the universe and has nothing to do with the average density and thus the concept of critical density becomes meaningless and the large-scale shape of the universe is no longer dependent on its material content .We will lose nothing by adopting this possibility because the global curvature of the universe is obtained simply from the age of the universe and Einstein's Field Equation can be applied in any part of the universe while the current flatness of the universe is a natural consequence of its old age .

Conclusion

In addition to its agreement with other familiar types of field equation , the possibility that '' *the result of application of Einstein's Field Equation in a region that distinguishable from other parts of the universe cannot be generalized to a universe of total sameness in all its parts*'' free us from the flatness problem without any contradictions with the well-established facts .