The Baloon Universe

Key words: baloon model, universal expansion, hyper-ring, space dimensions, time.

Abstract

In order to explain the universal expansion, and the fact that all parts of the universe recede from each other at a rate determined only by their mutual distance, the analogy to the surface of an expanding balloon is often made. Here we try to take this analogy seriously and see where it leads. There are some interesting possibilities that emerge here, including a natural modeling of string theory, and some cosmological phenomena.

Introduction

If we take the balloon as a model rather than a metaphor, this balloon is a 3-dimensional hyper-sphere, which is embedded in a space that has at least 4 spatial dimensions. And this balloon may have a skin. If we take string theory seriously, or rather, M-theory, then this skin has 7 (contracted) dimensions, so we have a structure embedded in (at least) 10 dimensions, and thus the universe we see is actually a 3-dimensional hyper-ring with a thin Planck scale 7-dimensional skin.

The Center of The Universe

The round balloon model hinges on universal expansion being uniform (almost) everywhere, certainly in the era of hyperinflation. There is some evidence this might not be true; in which case the universal hyper-ring is lumpy rather than perfectly round. Nevertheless, if the embedding space is like the physical space we know, and if there is anything like time as we know it coupled with that space[1], then there is a center to the universe (outside it), and moreover, an observer stationed in this center has a special frame of reference. All things in the universe are at an equal distance from this frame of reference. And it can be regarded as the absolute frame of reference: The correct order of events in the universe (even for spacelike separated events), the correct distances and sizes of objects in the universe are those seen by the observer at the center of the universe. And time can be measured by the radius of the universe, making a clear distinction between past and future.

However, given the conservation of energy, nothing leaves the universe, and nothing enters from the outside. Or does it? If we continue to entertain the

balloon model, then we might consider that the 'energy'[2] that pushes the universe to expand, the 'energy' of hyperinflation, are things that come from the inside the hyper-ring. Thus, the so-called dark energy is not located inside the universe at all. And if there are particles pushing against the skin of the of the hyper-ring and returning to the center, then perhaps they might carry information about the hyper-ring, and thus the central frame of reference could hold some theoretical observer. Perhaps this constant onslaught of dark energy from outside the universe has implications for the physics inside the universe. One thing is clear: The physics inside the hyper-ring are not the same as the physics on the hyper-ring (i.e., in the universe). E.g., the speed of light is not an absolute boundary for it, as demonstrated by hyperinflation.

It has been suggested that non-local phenomena of quantum theory might be explained by communication thru another spatial dimension, outside the space we know. On this view, energy cannot leave or enter the universe, but information can.

Expansion

The expansion of the universe means that the radius of the hyper-ring is growing. Of course, if the expansion was at some stage not uniform, we are talking about the average radius expanding. One intriguing possibility is that like a balloon, the skin is stretched when expanding, and that the volume of the universe stays constant. If that is so, the Planck scale might be shrinking. But taking the balloon analogy even further, it might be that when over-inflated it would begin to be torn apart. In that case we would start to have discontinuities in space. Such discontinuities would not be visible, as light (and all forms of matter and energy we know) can only travel inside the space of the universe, and would simply go around these discontinuities. Moreover, I expect these rips to appear where there is less mass, i.e., in the intergalactic space.

Here however the balloon analogy breaks down, as balloons become deflated when they are ripped. But it seems that this is not the case here. Imagine a balloon that is electrically charged all over its skin, and in the center, you place an electrode with the same electric charge, and that charge continually increases. The balloon will inflate, of course, but even if it rips, the balloon would continue to expand, and in fact, due to the loss of the elastic bonds that resist inflation, this expansion would actually accelerate.

The acceleration of the cosmic expansion immediately comes to mind here, as well as its ultimate fate, the so called 'great rip'.

Notes

1. Such a temporal dimension would not be identical to the time of the universe, since time (as we know it) is inextricably tied with space, and indeed

advances in complete correspondence with the expansion of the universe. The center of the universe is where time begins, and where time is 0 forever.

2. I use parentheses, because as far as we can tell, the physics inside the hyper-ring are radically different from the physics of the universe we know. Space and time as we know them probably do not exist, and thus the notion of energy does not really apply there in the sense we know.