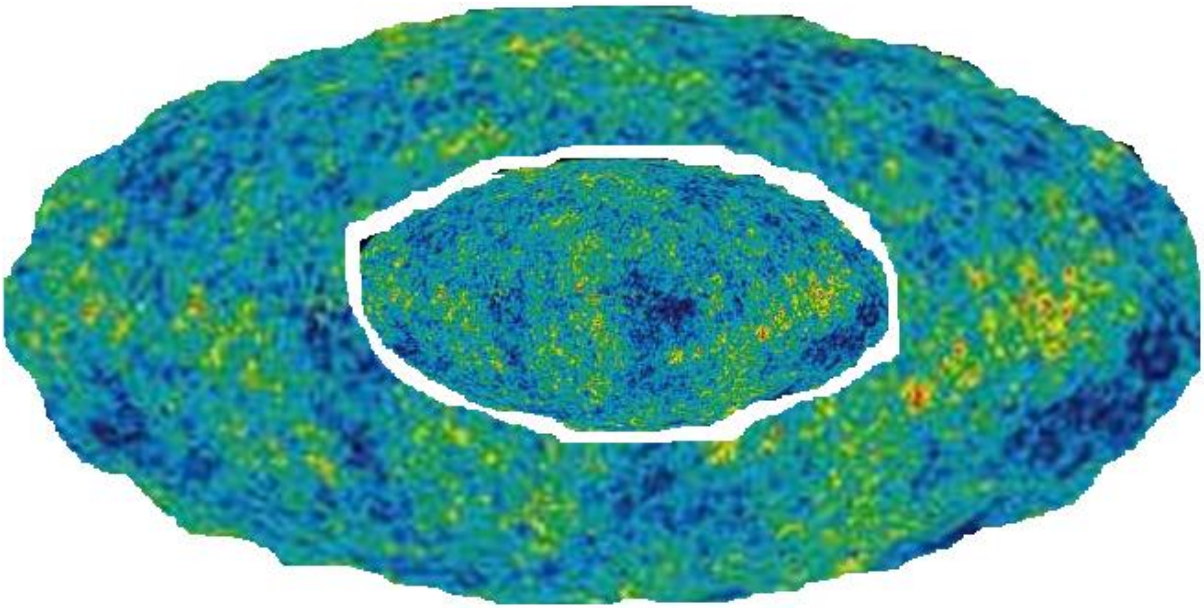
PUTTING OUR OBSERVABLE UNIVERSE INTO PERSPECTIVE

So how large is God's creation?

I am not going into a loooong roundabout way to answer this one, because the short answer is: **We do not know**! So why then this short article? The reasons are provided in the Objective section below:



OBJECTIVE:

1. Although we cannot say/see how large God's full creation is, this article at least attempts to show how **massively large** it is at a minimum!
2. For fun, to show how far our nearest star is away from us, if travelled by car
3. For fun, to show how far our Observable universe is when travelling by car

Version 1.1, Dec 2019

STORY:

Johnny looked up at the night sky wondering how far away the stars he can see, are. He decided to go and ask his father who had limited astronomical knowledge. His dad looked up, looked down at his son, looked up again and said, "*they look close, but are quite far away*".

INTRODUCTION:

This article is for children to explain our universe in an easier way.

Explaining the size of our local galaxy and even our observable universe in words or with examples, is almost impossible, especially the observable universe! The only way I can try and explain this is via the use of sand grains. Sand grains are small enough to try and put things into perspective.

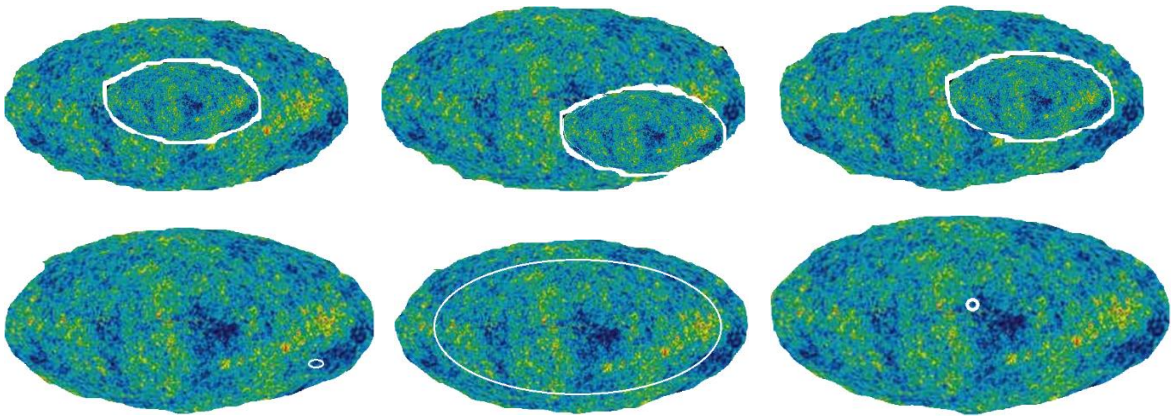
By the way, for those not very familiar with what is out there, a "star" does not look like this ✡ and is actually a burning ball of gas, just like our own sun. Their light emitted is what we see at night and the further away, the further back in the past we are looking at them. So if we look at a star a million light years away (will explain a light year soon), we seeing it as it looked a million years ago and it might have "brunt out" by now… (it might be gone today, but we still seeing it as it looked like a Million years ago). Similarly, since we have been able to broadcast television and other electromagnetic signals for only a few years now (say 70 years ago), we have only recently been able to "broadcast" our life on earth towards other stars. So if GOD decided to create other life elsewhere and they also only recently developed intelligence, their "life signals" would only have travelled towards us for the past few years.

What does this mean for our search of other intelligent life without success yet? It does not mean there is nothing/nobody out there, it may just mean that they are perhaps further away than their progress has been transmitted to us! E.g. if they developed intelligence 100 years ago, but they 120 light years away from us, their "intelligence signals" have not yet reached us…. However, this article is not aimed at addressing our search for intelligence.

WHAT IS MEANT BY "OBSERVABLE":

Let us get back to that word "observable", but the purpose of this article is not to get into detail about this, it is just to state that we can only "see" galaxies so far due to their light able to reach us. Since the universe is expanding at a tremendous rate (Man is still trying to establish the exact expansion rate with different opinions on the speed) and faster as we move out towards the utmost edges, the expansion is actually faster than what light out there moves towards earth (1 step forward, two steps back). Every second you are thus reading this article, there might be a sun slowly

disappearing out of our telescope views forever… So how many stars and galaxies have been disappearing out of view or have been out of view for millions of years already? What does the real universe looks like? Below are some illustrations of what it could be:



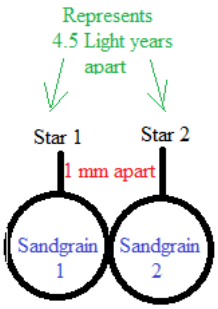
Source: https://www.newscientist.com/article/dn14098-hints-of-structure-beyond-the-visible-universe

Our observable universe can be inside any of the white circles above (or many other options) with earth being in the middle of that white circle based on our observations, but we do not know what our observable universe really looks like in comparison with the entire universe. All I want to share here is that we cannot determine the entire universe yet and we will just discuss the stuff inside the white circle which we refer as the "Observable" Universe. This means that we are discussing only a small part of the possible real universe! The calculated figures/distances below will blow your mind, but it only refers to the white circle above! (what we can "see" and that circle can be off any size like any of the ones above) .

OUR ASSUMPTION WE WILL USE:

For the calculations, we need to define what each Sand Grain will represents to use in our examples, so here goes:

- Let us assume that the average distance between stars is about the same as the distance between our sun and the nearest other sun (Proxima Centauri), which is about 4.24 light years away, but let use an easier number, namely 4.5 Light years away (note that stars are closer at the centre bulge, but further away near the edges of a galaxy, but we will use the 4.5 light years average below)
- To represent that 4.5 light years apart we can use two sand grains represented as follows:



The above states that two sand grains of average 1 mm in size and seated against each other represents 4.5 light years apart. Say star 1 is in the middle of sand grain 1 and star 2 in the middle of sand grain 2 and they are 1 mm apart. Due to the enormous sizes involved, this is the only way I can try and illustrate the size of our galaxy and universe! In the example below I have numbered 40 sand grains next to each other, say 1mm apart, representing 4cm in total (but expanded in the picture below). What this thus shows us is that the 40 grains below represents 180 light years in distance (40 grains x 4.5 light years each).

BUT WHAT IS A LIGHT YEAR?

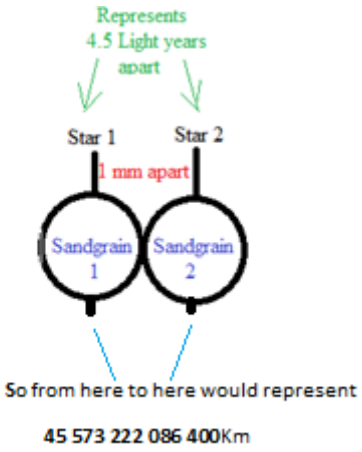
Light speed has been defined as 299 792 458 meters/second or 299 792 Km/second. So a light year is calculated as:

- 299 792 458 meters times 60 seconds for the meter distance in a minute, or
- 299 792 Km times 60 seconds for the Km distance in a minute which is thus
- 17 987 520 Km (for a **minute**) times 60 minutes for the distance in an hour, thus
- 1 079 251 200 Km **per hour** (yes, over 1 Billion Kilometres per hour fast) and

- 1 079 251 200 Km per hour x 24 hours for the distance in a full day, thus
- 25 902 028 800 Km **per day**
- 25 902 028 800 Km per day times 365.25 days to represent a normal year, which is
- **9 460 716 019 200 Km for a year**

Now for 4.5 Light years, you would just multiply the above by 4.5 and get **45 573 222 086 400**Km

Now when representing 4.5 light years (this massive distance above) as being the distance between two sand grains of 1mm each lying against each other, it is depicted in the diagram below:



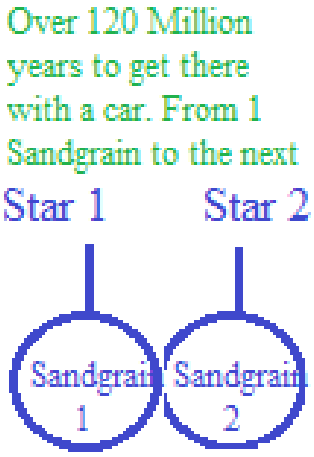
In short, the 1mm distance above thus represents a massive **45 573 222 086 400**Km for our example.

TRYING TO UNDERSTAND 4.5 LIGHT YEARS:

I need to explain what **45 573 222 086 400**Km represents, because this figure is just too much to comprehend without some example. So we will represent the above distance as 1mm between two sand grains. If light travelling at just over a Billion Km per hour and takes 4.5 years to reach our nearest star (which is more or less 4.5 light years away), you can imagine how far away that nearest star really is, but let us put that in better context:

If we had to get into a car and travel at 120Km per hour for say 8 hours a day and then rest for the rest of the day before continuing on our journey for another 8 hours per day and so on to move from the 1 sand grain to the next (as represented by 4.5 light years apart), how long would we take to move from the one sand grain to the next, being 1mm apart?

This will shock you, but it would take over 120 Million Years to get there! Yes Millions of years just to travel 4.5 light years by car. So in the sand grain example, it would take a car over 120 Million years to travel from one grain of sand to the next:




Two sand grains next to each other on a beach.

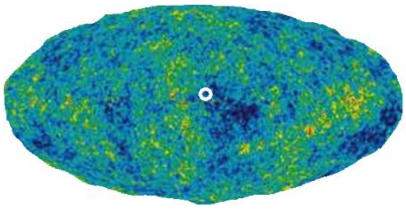
(**Annexure A** will show how long it would take to travel 4.5 light years with different methods like via a jet, or riding on a speeding bullet, etc…)

NOW THE OBSERVABLE UNIVERSE IN SAND GRAINS

So if 2 sand grains 1mm apart represents 4.5 light years and it would take a car over 120 Million years to travel from that one sand grain to the next, what would the length of the observable universe in sand grains be?

Well, it would represent over 20 000 Km of sand grains? Yes, 20 Thousand Kilometres of sand grains lying next to each other and to travel 1mm (from one to the next) would take us over 120 Million years by car! If you would thus stand on a beach looking down on the sand grains and consider that it would take you over 120 million years to travel from one little grain to the next, then to travel across the Observable universe would mean that you would need to travel from one grain to the next and so on for over 20 Thousand Km!

The only way to try and comprehend this is to lie on your stomach on the beach, look closely at two grains of sand next to each other and then grasp the fact that it would take a car 120 Million years to travel from the one little sand grain to the next. Then slowly look up and imagine how many grains in a straight line is on that beach and imagine moving from the one to the next would take 120 Million years each! A normal beach is probably only visible for about 5 Km in length, thus imagine over 20 000 Kms for the Observable universe and what if the Observable Universe is only the small white dot compared to what else is out there…!

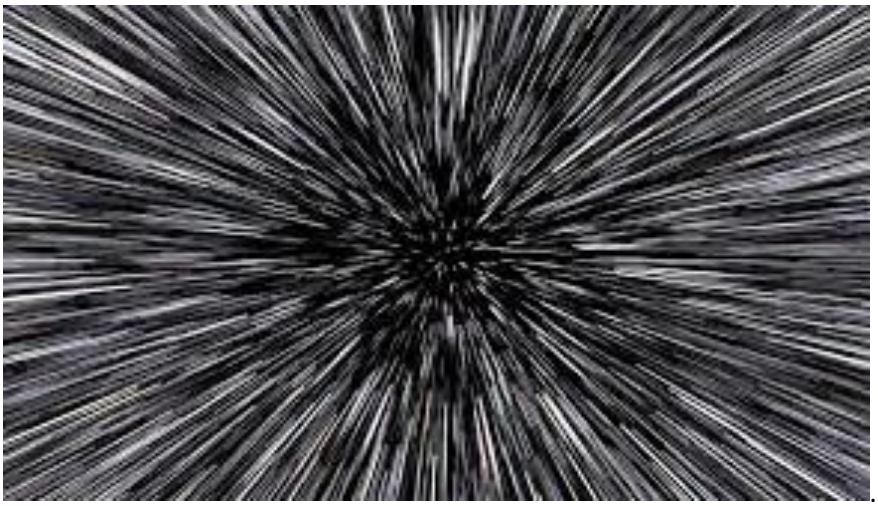


Hope the above helps you grasp how incredibly large our observable universe is…?

ANNEXURE A: Other methods to get to our nearest star

- For our nearest star which is less than 4.5 light years away (around 4.24 light years), a car would take around 114 Million years to travel that distance, if travelling for 8 hours a day or
- A car would take around 38 Million years to travel 4.24 light years, if travelling non-stop for 24 hours a day (so never resting and refuelling)
- A jumbo jet travelling at 900 Km/h non-stop to the nearest star would take over 5 Million years to get there
- A fast spacecraft travelling at 245 526.4 Km/h non-stop would take over 18 Thousand years to get there!
- You think the speed of sound is fast, no, it will take 3.7 Million years to travel to the nearest star and
- An average speeding bullet would take 1.6 Million years non-stop to reach our NEAREST star!

By the way, the faster you go, the less your chances are to evade an object in your way and this picture of flying through the stars as in the movies, is inaccurate, as stars are mostly very very far away from each other:



As for our Sun and our nearest other sun, we will probably not see anything else for 4.24 years while travelling at the Speed of light (let us call it “Warp Speed”), so quite boring.

O, and the faster we can travel, the slower time “flies”, which is a headache for another day!