Armchair Astronomy No.4 - The Size of Space

Heavens Above! Astronomy from your Armchair. (© R Bee 2007)

The Size of Space

The Universe is a very big place. Bigger than you could possibly imagine. But let's try. Let's look at our own Solar System first.

If you imagined that our 1.4 million km diameter Sun was actually a 1.4 cm diameter grape (that's a scale of one in 100 billion), our Earth would be a 1/8th mm diameter grain of salt and 1.5 metres from the Sun. Pluto, at the edge of our Solar System would be 57 metres away. The next nearest star, Alpha Centauri (actually a binary star with two grapes 14 metres apart), would be 400 km away. You can probably just grasp that in your mind. But the diameter of our Milky Way galaxy, a fried egg shaped collection of 400 billion stars, would be 10 million km. Hmm!

It starts getting BIG at this stage. Hold on to your heads. Remember, one light year is really 9.46 trillion km but only 94.6 km in our scale model. The distance to the nearest major galaxy like our own (Andromeda Galaxy, actually 2.5 million light years away) would be 240 million km. And the distance all the way to the edge of our observable universe in our model? 3.5 trillion km. That's 15,000 times further than the Andromeda Galaxy. You would not be alone if you admitted that those numbers cannot be imagined and hurt your head when you try. And remember, that's on a 1 in 100 billion scale model. It is because of such vast distances between the stars and galaxies that most scientists believe that, while there may be and probably is life on planets around other stars, they certainly haven't travelled all that way to Earth to play silly games with crop circles.

It's when you contemplate those vast distances while you gaze at the stars overhead at night that you feel a marvelous sense of awe and could be forgiven for waxing poetic, as I did below:

Beyond our Solar System's sway
Beyond the sparkling clusters
Beyond the diffuse nebulae
With blazing stars to light 'em,
Beyond our local Milky Way
Where matter darkly musters,
Past galaxy on galaxy,
And on, ad infinitum. (R Bee 2007)

Of course, there is another marvelous side to these vast distances in space (and even the not so vast). Did you know that the very act of looking into space, with either the naked eye, binoculars or a telescope, is a trip in a Time Machine? I kid you not!

Light travels at a finite speed – 300,000 km per second. When you look at an object, you are seeing the light emitted by or reflected off that object. On Earth, the delay times are trifling and can be ignored. But from space, the time for the light to travel to your eye is significant. So when you see a planet, star, nebula or galaxy, you are seeing it not as it is NOW but as it WAS when the light left it on its way to your eye.

So you see the Moon as it was 1.25 seconds ago, the Sun 8.3 minutes ago and the nearest star, Alpha Centauri, 4.25 years ago. You are, in every real sense of the word, looking back in time. So, when you see that beautiful red star Betelgeuse in Orion, you see it as it was 430 ago in the year 1578. What is exciting is that Betelgeuse is a red hot candidate to go supernova at any time and it could in fact already have done so since 1578. That means the light from its cataclysmic explosion is already on its way to us, but we won't know till it arrives.

It always gives me a thrill when I look through my telescope at a galaxy 15 million light years away, that I am seeing the universe at it was circa 15 million B.C. Now, that's time travel. H.G. Wells, eat your heart out.