Where We Live

Dimension and Scales

Communication Skills

M.Sc. Computational Mechanics

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Mohammad Mohsen Zadehkamand

Arzu Ahmadova

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EXTENDED ABSTRACT

THERE ARE MORE STARS IN THE UNIVERSE THAN THERE ARE GRAINS OF SAND ON THE EARTH AND THERE ARE MORE ATOMS IN ONE GRAIN OF SAND THAN THERE ARE STARS IN THE UNIVERSE.

We are living on the Earth; A planet in the solar system with an approximate diameter of 12,756 kilometers, containing all mountains and oceans we know and also the only place which has life on, as far as we know. But it is not the whole story. In this lecture for the communication skills course, we are trying to show briefly in just 10 minutes how far we can go within the limitation of light to see how big the visible universe is!

First we put emphasis on the fact that calling something “big” or “small” is a relative concept and if one can make distances large (indeed, here we would need the definition of “large”!) then it may be seen that a big planet like earth is just an infinitesimal object flying in the universe.

There would be a comparison for the size of earth with other planets and the sun and adding to this we would have a sample model using Barcelona city map for demonstrating an approximated scaled distance between objects in the solar system and their dimensions.

Afterwards, it would be noticed that the whole solar system is a fraction of the Milky Way Galaxy and this galaxy is also one in thousands of billions of galaxies we know in the universe! The diameter of regular galaxies would be discussed and using the “Light year” dimension scale we would have some portray for the dimensions of galaxies and distances between them. For example we know that the dimension of our own galaxy, Milky Way galaxy, is around 100,000

light years, and one light year is defined as the amount of distance which light could travel with the speed of 300,000 m/s in one year. It is something around 950×10^{15} km, more than 10^{12} round trip from the earth to the moon, having in mind that the Apollo mission took 3 days to transfer first human from the earth to the moon. We also discuss a bit about the Andromeda galaxy, our nearest galaxy neighborhood which is 2.5 million light years away, a really small distance in astronomical scales.

Following, the “Hubble Deep Field Image” would be introduced and after showing the vast number of distant galaxies within this image, it would be mentioned that this image is just some fraction of the sky we see each night with our eyes.

Then the composition of the universe and its ingredients would be discussed. It turns out that roughly 74% of the Universe is dark energy. Dark matter makes up about 21%, and the rest (everything on Earth, everything ever observed with all of our instruments, all normal matter) adds up to less than 5% of the Universe.

The theory of “Dark Energy’ and “Dark Matter” would be introduced briefly, since they are so complicated concepts but it is very interesting to know that dark energy and dark matter describe proposed solutions to as yet unresolved gravitational phenomena. So far as we know, the two are distinct and we would explain a bit each of them.

Dark matter originates from our efforts to explain the observed mismatch between the gravitational mass and the luminous mass of galaxies and clusters of galaxies.

On the other hand, Astronomers know that the universe is expanding in a rate more than which they think it should. They theorize that the faster expansion rate is due to a mysterious, dark force that is pulling galaxies apart. They also know how much dark energy there is because it is known that how it affects the Universe's expansion. More is unknown than known in this regard. Eventually, dark energy is the biggest and complete mystery, but it is an important unknown in the universe.

Around 13.7 billion years ago, simply speaking, everything we know of in the cosmos was an infinitesimal singularity. Then, according to the Big Bang theory, some unknown trigger caused it to expand and inflate in three-dimensional space. As the immense energy of this initial expansion cooled, light began to shine through. Eventually, the small particles began to form into the larger pieces of matter we know today, such as galaxies, stars and planets. As calculations say, the very first atoms were formed 300,000 years after the Big Bang up to hundreds of millions of years that first stars and galaxies was born. The story goes up to now, for around 13.7×10^9 years and it would go further.

So this could be an initiation for going more deep inside the universe and ask from ourselves “WHY IS THIS BIG? AND HOW?”. We know that a long history is past and an elaborated design is done for us to be able to live for some reasons.