

Photons In The Universe Tour:International Year 2015

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Abstract—The popularization of science, is a very important in the formation of future scientists in science and technology activity. That is why in this work are promoting the International Year of the light, considering its huge impact on the work of current research worldwide.

Keywords—popularization of science; International Year of the light; Photons in the universe.

The first shadows at the end of the day fell; the lighting was decreasing gradually giving way to the arrival of darkness and the beginning of a cold February night. It was left to feel a light breeze carrying all a mixture of smells coming from the gardens to our around. Slowly my eyes were accustomed to the darkness and for a moment I lifted up my eyes to heaven and as much as I looked for the Moon, I did not find it. However, the night was clear, it was adorned by a fascinating blanket of stars, which seemed to be woven so artfully that they appeared to form the dome of my own garden, producing a beautiful feeling inside of me that ended in a polite invitation to lie on the lawn to enjoy calmly that beautiful sky populated with majestic stars. The silence reigning, typical of winter nights, became my accomplice and ally since there was a special moment in which I felt to hear my own thoughts imaginarily recreating the possibility to be able to take them with my hands.

My task of observation of thousands of tiny stars that certainly seemed to form the milky way was

interrupted suddenly by the voice of my companion, my little daughter, who very intrigued asks me a question which got me thinking: where does the light come from?, pointing with her finger to two very large constellations which were in the sky. Starting from there, my imagination began to travel, coming to think that the small and tiny brightness observed in the sky, along with many more, had traveled billions of kilometers, by somewhat as years and had as final that precise time, only to be seen by eyes that on many occasions did not give any importance.

As always happens for sure, the most extraordinary things go unnoticed form before our eyes and we see them as something normal in our daily living. However, I expected that this was not one of those moments; the magnitude of the spectacle I was watching made me feel how slightly small we are as human beings, compared with the vast universe and at the same time the great importance to witness the truly indescribable event of the moment.

Slowly, I went deeper into that feeling and I cannot understand if what happened next really happened or I became a victim of my own imagination a product of the moment that was going to try to explain this very basic question; then I asked myself what could a ray of light from a star answer if you asked it about its source? Or what would it tell me if I asked it to tell me its story?

Within my imagination at that time I could see a small light beam from one of the stars I was watching and suddenly, in my mind were the following questions: How is that possible? Will I have witnessed some important fact? Would perhaps the explosion of a star? Where did that tiny fragment of beautiful light

come from? At the moment I felt lucky, since my eyes detected it was coming direct to me, characterized by a warm feeling, a jingling yellowish color and a soft movement that harmonized with the star space.

Suddenly and surprisingly, the frequencies of the pinging of the star seemed to match to form a soft voice that began to narrate how this small amount of energy travelling had been created and come off from one of the biggest power of the universe which was situated several hundred million kilometers from the Earth and it is called the center of a red giant star.

It told that within a large red giant star and as a result of natural forces of gravitational type and the accumulation of gases, a large enough pressure that allows you to confine their atoms is created, giving rise to more complex new structures of atoms, process by which large amounts of power are generated, releasing small amounts in the form of beams of light or photons that have been defined as the more elementary particles of matter which possess the ability to be able to transport all forms of radiation that exists in nature; a so large variety that humans only can observe with the naked eye (visible light) a small fraction of what they really are.

It continued saying that within the source that gave us birth, a lot of us were able to leave; others were inside, since they collided with each other, perhaps forming new elements and other trapped or directed by gravity and the star forces that did not allow them to go out and release. I, however, not possessing sufficient mass and a larger speed, could set free and go out to make the most fantastic trip imaginable.

After the release of my creator, we started a tour that would maybe last for millions of years. Where I was going? I did not know. None of those that left had returned to tell us the story of the road. However, many as I started this trip; many before and many later, with a common origin and convinced that we would always be part of the universe.

When leaving, I witnessed the existence of many travelers like me, but with different composition: ones as particles, others such as dust and others as a simple power travelling. Some, by their nature, remained behind, while others moved away faster, perhaps going to more quickly reach their destination, whichever this was. I simply decided to continue my journey and enjoy it fully.

On the way I observed planets of different sizes and composition, some were solid, other gaseous, some are only masses of dust and others so large that they collapsed on themselves forming rings of asteroids. Others were the perfect balance between size and speed being trapped in orbits of other larger planets, becoming their moons. Not all are completely round, they were of different shapes and sizes, other more elegant planets have rings of fine dust and ice that when passing among them we created a bright rainbow with unimaginable colors across the spectrum of radiation that we could spend entire lives without stopping watching them. And all this was reflected in the vastness of space. The observed spectacle is one

of the most wonderful and impressive things we can observe, especially for a particle as small as I am.

It had been just a few hours since my birth, when I was already coming out of the solar system, starting a journey through the darkness of the universe. And despite what we are, we cannot illuminate everything that surrounds us, being so small as to succeed. Also there is not enough matter to be able to reflect ourselves on them.

A long and dark road waited for us. However, being a particle of light it did not annoy me enlighten my way around. Meanwhile, behind me, I could observe how my creator became smaller as it traveled. Some of my classmates are located in front of me, others back and sides; and despite the darkness I see how the latter are spreading as we move.

After traveling for a while, I passed by a giant nebula which is one of those that give rise to the planets, solar systems and galaxies and that are formed by dust and gases. I could see several galaxies, some so distant that I could hardly recognize them, and finding myself near one of them I saw, amazed, the variety of particles like me with different characteristic customs and origins. I realize that those characteristics are what we do to be unique, however small that we are.

As time went, my colleagues and I were separating more and more from each other; everyone taking their course. Some were incorporated to composites of gas or dust they found on their way, especially in nebulae which caught our attention and many of us were invited to be part of them. Some accepted the invitation and agreed to become part of something much bigger as a response to the feeling that you feel when you realize how small you are and with the conviction that through the accumulation of many of us you can create great things and that we are simply part of the whole, and this gives us a feeling of greatness.

I also stumbled across different comets, some traveling as fast as me but I did not see any that was in my direction. Some of us met and others only accompanied ourselves by a period of time, while we saw others traveling away from us. Almost all comets are made of solid matter, and when approaching to a sun, they sublime leaving a long tail or wake. It should be noted that the comets are very different to asteroids.

I went through different solar systems, with planets in many colors, bright, opaque, some with a temperamental character and others simply indifferent. It is difficult to decide on one of them. But nevertheless, each one has its unique character and a way of being that makes it special. No matter what their condition, each one is special for its singularity and unique composition.

In some parts of our journey we experience unique singularities, for example, we had the opportunity to pass near black holes and unfortunately some of us were attracted by them, but others were able to escape to his great strength and continue with our grand tour of the universe.

Billions of years and millions of light years passed, so is how we measure our speed which refers to travel at the speed of light for a year, that it is very fast, however others like me measured it in parsecs. A parsec is equal to 3.26 light years, what saves us time in representing large numbers; in this case it is the same to say 3.6 light-years to a parsec.

As time went, we approached a small very particular solar system, with a unique variety of planets. I passed next to a giant which was adorned with rings, then near a gas giant with a large moon. I also went through a ring of asteroids around this sun and finally I passed by a red planet before I got here. But before descending here I had to go through a few layers of atmosphere of your small planet. The first was called EXOSPHERE that is located more than 800 kilometers of the surface of your planet and is composed mostly by hydrogen and helium which decreases as you walk away from the surface and some manage to escape into space when the force of gravity is very small.

I then went through the THERMOSPHERE or IONOSPHERE, which is between 80 and 800 kilometers from the surface of the solid part of your planet, in which I could see traces of your civilization, as well as artifacts created by you. I also came across layers of electrically charged atoms which you called ions, for being of electricity conductive layers which allows the transmission of radio and television signals since they reflect electromagnetic waves. But its temperature is very extreme changing from - 73 up to 1500 degrees centigrade, and this layer is which protects you mostly from meteorites, since it is in this layer where the greater part of them are destroyed, and that represents a great spectacle like shooting stars. But there are some meteorites so big that they fall to the ground. The boundary between the exosphere and the thermosphere is called the mesosphere.

I Passed through the exosphere and the thermosphere and reached the STRATOSPHERE which is between 12 and 50 kilometers of height. Here, I came across different strata or layers of elements that due to their density or specific gravity, the lighter were in part higher and the heaviest at the bottom. One of these layers is ozone which serves as a sunscreen against UV rays coming from the sun and the stars. This layer is mostly made up of hydrogen and there is almost no oxygen here, so you could not breathe in this region. We know the border between this layer and the former as the STRATOPAUSE, and serves as a temperature regulator, varying its temperature from - 60 up to 17 degrees Celsius. Finally, I reached the TROPOSPHERE, which is where all the meteorological phenomena such as clouds, tornadoes and cyclones happen. This layer has a height of approximately 8 km at the poles and 15 km at the equator. Here, more than 70 percent of the gases on the planet as well as water vapors are concentrated. The boundary between these two layers is known as the TROPOPAUSE.

Proudly said: to be able to get here, I had to travel through all that. On cloudy days you could not see my visible appearance; however, you keep receiving part of me, as all living beings of this planet which receive photons of my star and form thousands more, which makes us be composed partly of the same matter of the stars and the universe.

After millions of years of travel I have come to you. How lucky I am at the end of my journey and adding myself to a living, thinking being; being part of it as long as I exist, as well as thousands of photons and particles arriving daily at each of the inhabitants of this planet with a unique, and ancient profound history, and at the same time of a size so insignificant that we pass unnoticed most of the time. However, there are some dreamers that we wake up to the imagination and remind them of the greatness of the small that the entire universe is composed.

Stunned by this story, I thought how amazing is that a thing so small may have a so distant origin, and that just joins us, one way or another without being noticed, making us part of the universe and that it is hard to understand how something so tiny and insignificant makes us part of something so great. The stars are always in the sky, some so large which simply make us feel as if we were that particle; traveling through the universe in a larger particle called Earth.

Each being is unique and many go unnoticed, but the effort and the outcome of the evidence makes a difference and it is what makes possible that when looking up at the sky and see only a point of light in the vastness of space, it helps us to understand that this small point of light has traveled and lived more than we can imagine and that surprisingly this small particle that is illuminating the darkness of the immense space joins us, recognizing that in one way or another, we are part of all. In other words we can say that we are all part of the stars; no matter how small they are.

Bibliography

- [1]. light pollution: the propagation of light in the atmosphere and its implications for astronomy, David Galadí Enríquez, COFIS, 2011
- [2]. the dark side of the light. Francisco Colomer, NAO, 2010
- [3]. the light pollution in Spain. Carlos Herranz, Fernando Jáuregui and David Galadí-Enríquez, web of the SEA, 2007