**Unveiling the Secrets of the Sun**

The solar system’s only glowing giant, the Sun, is a case of deception in beauty. Behind those layers of powerful and bright yellow are some phenomena we are not quite prepared for.

The Sun has been with us since ancient times, but we know very little about it. Actually this whole article is attempt to prove that we know so little about the Sun, the star that’s bang next to us! Of course, now as our understanding of stars in general is increasing with modern science and technology we are slowly beginning to unveil the Sun’s secrets.

The Sun can be introduced as a massive star which is classified as a yellow giant – ‘yellow’ because of its yellow appearance.

 Now, here comes the interesting part: the first most basic misconception is that we often say that the Sun is a glowing ball of gas. It is actually a glowing ball of plasma, the fourth state of matter. When atoms lose their electrons at high temperatures to form ions, then these ions surrounded by a sea of electrons forms a soup, called plasma. This plasma behaves very differently from a gas.

All of us have been troubled by the glare and heat of the Sun on a hot summer day. Stop! Where does the glow come from?

Until the nineteenth century it was generally accepted that the process by which the Sun gave heat and light was very similar to the burning of logs to create a fire. But there was a slight problem with this theory: assuming you had enough logs to completely fill the Sun and enough oxygen to burn these logs, unless you would keep adding logs to the fire, the logs would eventually run out, and the fire would be no more. At the same time, carbon dating had emerged so that when scientists dated rocks they proved that the Sun had been around for an unimaginably long time. This was confusing… No matter how many logs one placed initially, they just wouldn’t burn for a billion years!

To solve this problem of the very big, scientists looked to the very small, the atoms.

In the right conditions, that is, under great pressure if you were to take two atoms and get them to collide with each other, a very interesting thing happens. Instead of the two repelling each other, they merge into one mega atom. This process, called fusion, takes place in the interior of stars like our Sun. During this process the mass of the resultant atom is always slightly less than the mass of the two original atoms put together. The ‘missing mass’ is given out in the form of energy, as photons or light particles.

And so the Sun is able to produce this huge amount of heat and light because there are virtually millions of hydrogen atoms in the core of the Sun which are fusing with one another to form helium.

Another fascinating aspect of the Sun is its magnetic field. The Earth is a solid and has two magnetic poles. With the Sun matters get a bit tricky: the plasma which makes up the surface of the Sun does not rotate uniformly on the axis of the Sun. Termed as differential rotation, this along with other factors, contributes to the Sun having a number of magnetic poles. Scientists aren’t sure of this number, but it is almost certainly in the range of 10 million! That is a huge number as you can see, and the lines of force (magnetic energy) which emanate from these poles intersect and loop each other continuously. These conflicting lines of force can cause some very interesting phenomena. For example, this may lead to a change in the shape of the plasma in certain regions giving it a ‘U’ or looped shape. Many times due to these intense magnetic fields, solar flares are caused. These solar flares release high energy particles which enter neighboring regions of the Sun and bombard other particles. This process happens over and over again until enough force is created to start a **solar quake**. This is not the only thing that is very similar to what happens on the Earth. It is has also been recorded that a **solar tsunami** has taken place in recent years.

Along with this there are coronal mass ejections which pose a severe threat to us. Coronal mass ejections are this huge haze of high energy particles that rises from the surface of the Sun and is ejected into space.

Now the catch is that, the Sun is rotating on its axis and so there comes a point when this haze which is rising, is right in line with the Earth. When a coronal mass ejection happens in such a situation, this haze heads straight towards us. Since this is highly magnetic in nature it first gets deflected by the Earth’s magnetic field, but it eventually enters the Earth from the weaker side of the magnetic field. Once these high energy particles have entered the Earth’s atmosphere, they overload transformers leading to short circuits and blackouts in entire electricity grids. Our satellites which are orbiting the earth can also be knocked out.

One of the worst episodes of coronal mass ejections affecting life on Earth took place on 1 September 1859. Within hours, telegraph wires throughout the world spontaneously shorted and many fires were reported. At the same time, the Northern Lights associated with the sun and that usually occur at the North Pole, were seen in unlikely places like Rome, Hawaii and Havana. Scientists understand this today, and call it a **Solar Superstorm**. They say that during this superstorm, for almost an entire minute, the amount of sunlight the Sun produced at the region of the flare actually doubled. In March 1989, a solar storm much less intense than the perfect space storm of 1859, caused the Hydro-Quebec (Canada) power grid to go down for over nine hours, and the resulting damages and losses were estimated to be in hundreds of millions of dollars. Scientists believe a Solar storm could very much happen again, perhaps even more intense than the one in 1859.

To prevent us being caught at the wrong foot many agencies keep elaborate records of solar activities, and help us to prepare for such catastrophes. While reducing the electricity supply in electric wires reduces chances of overload, we could program satellites to turn off at a command to prevent them from being damaged during these ejections.

But these ejections have a prettier side to them also. As the high energy particles interact with the atmosphere, stunning auroras are formed. It is similar to the process of passing electric currents through a tube of gas that makes the gas particles glow. In these auroras that are formed by the high energy particles interacting with the Earth’s atmosphere, the oxygen produces a green color while the nitrogen produces a pink-purple color.

I would like to end this article with a fact which will certainly inspire the fans of the legendary rock group, The Beatles.

As technology has advanced we have been able to map the temperature of the Sun’s outermost layer, the corona, with more and more proficiency. These tools have suggested that the corona is extremely hot. But there was a problem with this assumption. The corona is very far from the core of the star where the fusion of the hydrogen molecules actually takes place. It is equivalent to placing a thermometer 2 or 3 metres away from a fire place, so that the thermometer will not show a temperature reading equal or even as bit lower than the fire burning in the fireplace. But then scientists took a second look at the events that took place in the star and stumbled upon a very rocking explanation! This (rocking) explanation is that the energized particles and the photons reach the surface of the Sun after originating from the core. Later as they cool, they fall back. Back in the core they are reheated repeating the above process. This entire process takes place several times with millions and millions of particles, creating a lot of sound. This sound energy is the main reason for the corona becoming so hot, even though it is the farthest away from the core. As a matter of fact, the Sun is a very noisy place; we just aren’t able to hear all the booms as there is a void or space between the Earth and the Sun and sound waves need a medium to travel.

Is that where the Beatles got their inspiration from?

*The End*