

Global warming Vs Helium fusion in Sun

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Abstract

Global warming has been considered due to carbon dioxide emission and efforts are diverted to reduce the carbon dioxide emission. In this paper some different approach has been highlighted. In the Sun hydrogen fusion reaction has been going on for last 5 billion years. This fusion reaction has been yielding helium gas and it is believed that hydrogen gas is almost consumed and helium fusion has started. This fusion produces almost 100 times more heat causing the surface of the Sun getting more temperature. Due this increase in the Sun's temperature, temperature on the earth is also increased which we experience as global warming. This paper discusses this view in depth.

1.0 Introduction

1.1 Why global warming?

Global warming is a term used to refer increase in the average temperature of the air at the surface of the earth. It has been observed that since 1980 the temperature on the earth has been continuously increasing. Scientists believe that this increase in global warming is due to increase in the global industrialisation which has increased the concentration of global CO₂ gas, fossil fuel combustion by automobiles, aeroplanes, deforestation etc. It is also believed that these factors reduce the ozone layer in the stratosphere thus facilitate more UV radiation to reach the earth's surface. Though this hypothesis is correct, still it is difficult to digest that CO₂ emission alone can cause such exorbitant impact over the entire world because this gas being heavier, would prefer to remain at the surface of the earth rather than finds its place in the stratosphere. Since 1978, solar irradiance has been measured by satellites [1] at an altitude of 645 km. It has been postulated on the basis of these measurements that the Sun's output has not increased since 1978, so scientist believe that warming during the last 30 years cannot be attributed to an increase in solar energy reaching the Earth!

NASA [1] reports that energy released by sun is not constant; instead it is spread over some range. The average values of overall change in solar radiation arriving on the surface of the sun suggests that the maximum energy released by the sun's surface is 1367.25W/m² and the minimum energy released is 1365.01 W/m², difference being 2.24W/m². This difference is observed within the same year [1]. Since this measurement is mentioned in W/m², it is difficult to deduce the variation in the temperature of the sun. Nevertheless, it is necessary to study the reasons for observing the variation in the sun's surface radiation energy of 2.24W/m². It is also pertinent to ask that, why this increase in the radiation energy is noticed only lately, why not this was experienced since the inception of the Solar system? We might get the answer to this question by examining the nature of nuclear reactions taking place in the Sun and has there been any variation in this reaction lately?

Sun produces energy due to hydrogen fusion and it is produced at the core (Figure 1) of the sun [2]. How such nuclear fusion does occurs in the Sun and does it produce some specific heat or radiation?

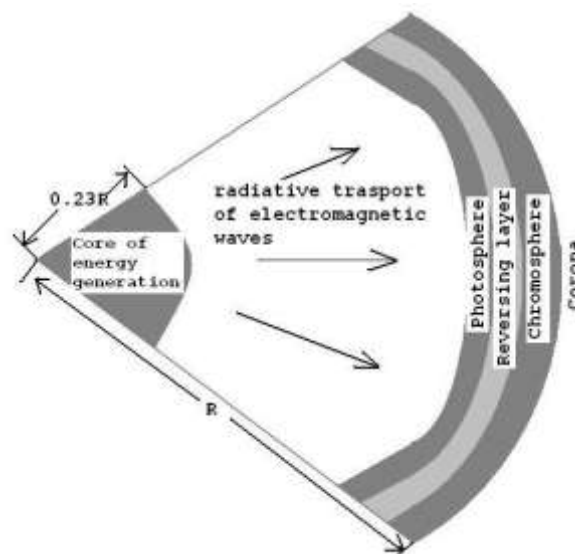
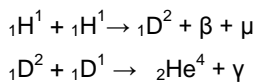


Figure - 1: A schematic diagram of the various regions of the sun[2]



It is well understood that hydrogen atoms at some specific temperature and pressure undergoes fusion process producing helium gas and several types of cosmic gamma radiations and visible radiations [3]. The hydrogen fusion is the predominant reaction taking place in the Sun. This can take place by one of the following processes producing helium gas (${}^2\text{He}^4$)[4-5]:



Where ${}^2_1\text{D}^2$ is deuterium (an isotope of hydrogen containing a neutron). The net result of such reactions is that four protons (${}^1_1\text{H}^1$) fuses to produce one ${}^2_2\text{He}^4$ and the excess energy. This energy is released in the form of electromagnetic radiation, such as γ -rays due to conversion of the mass differences between four protons and one helium atom, which amounts to 25.7 MeV. This difference is calculated as follows:

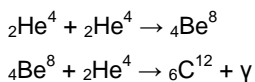
$$\text{Mass of } 4 \times {}^1_1\text{H}^1 = 4 \times 1.00728 \text{ amu} = 4.02912 \text{ amu}$$

$$\text{Mass of } {}^2_2\text{He}^4 = 4.00150 \text{ amu}$$

$$\text{Mass difference} = 0.02762 \times 931 = 25.7 \text{ MeV}$$

931 is the conversion factor of amu to MeV.

Thus the byproduct of the hydrogen fusion is formation of helium atoms. Once all hydrogen atoms are consumed the sun will contain only helium atom. Helium atom will undergo nuclear fusion if the sun's temperature rises to 10^8K . At this temperature ${}^2_2\text{He}^4$ atom will be converted into heavier atoms, predominantly ${}^6_6\text{C}^{12}$ and ${}^8_8\text{O}^{16}$. Conversion of ${}^2_2\text{He}^4$ into ${}^6_6\text{C}^{12}$ is accomplished by the following nuclear reactions:



This nuclear reaction suggests that three helium atoms ($3 \times 4.00150 \text{ amu}$) produces one carbon atom [which has six protons ($6 \times 1.00728 \text{ amu}$) and six neutron ($6 \times 1.00867 \text{ amu}$)] making mass of carbon 12.0957 amu . Thus the mass difference between three Helium and one carbon atom is $0.0912 \text{ amu} \times 931 = 84.998 \text{ MeV}$. Release of energy in helium fusion is greater than that obtained with hydrogen fusion (25.7 MeV). Hence net increase in energy release by helium fusion is 59.298 MeV, which is a huge amount of energy difference between the two types of fusion. Because of this release of energy, the surface temperature of chromosphere (Figure 1, i.e. surface of the Sun) increases. This increase in temperature of the Sun causes increase in surface temperature of the earth. Therefore, it may not be wrong to speculate that the global warming on the surface of the earth is a direct consequence of the increase in the surface temperature of sun's surface which in turn is due to the helium fusion reaction occurring in the core of the sun.

It is interesting to note that in order to increase the temperature of the core of the sun to 10^8K , the sun will contract. But as soon as the helium fusion starts core temperature of the sun will increase. To prevent the sun from disintegrating, the size of the sun will increase, which in turns will lower the core temperature of the sun. This decrease in the temperature will decrease the rate of helium fusion. Thus the fusion of helium atom will stop which will force the core of the sun to decrease its size till the correct temperature of the sun has attained to start helium fusion. This process of decrease and increase of core of the sun will also affect the surface temperature of the sun (i.e. Chromosphere, figure 1). It is not yet fully established as to what is the frequency of the process of increase and decrease of the size of the sun. Nevertheless, its impact is being observed on the surface of the earth.

Perhaps because of this fluctuation, we now experience so called Global warming on the surface of the earth and we are wrongly relating this effect to the CO_2 emission effect. It is believed that about 600 million tons of hydrogen undergoes fusion reaction yielding 596 million tons of Helium-4, as a by-product. The remaining 4 million tons is released as energy [2].

1.2 Depletion of Ozone layer

Release of nuclear radiation due to helium fusion would certainly be of higher energy which can be responsible to affect the equilibrium of $\text{O}_2\text{-O}_3$ and thus would affect the ozone layer. This process will also allow higher energy of UV radiation (i.e. shorter wave length of UV radiation) to fall on the surface of the earth which can also be responsible to increase the surface temperature of the earth. It may not be wrong in speculating that depletion of ozone layer is not the consequence of so called CO_2 emission but due to shorter wavelength of UV radiation being emitted by the surface of the sun due to Helium nuclear fusion reaction taking place in the sun's core.

In order to prove these hypotheses there is a need to record the entire solar spectrum of sun as well as its surface temperature by a satellite stationed at its geo stationary orbit. Such data will then be able to give factual reasons for global



change in the temperature. A regular recording of these data will help us to come to some useful conclusion to establish the real cause for the rise in global temperature.

2.0 Conclusion

It is believed that helium fusion occurring in core of the sun is responsible to change the surface temperature of the sun and hence the atmospheric temperatures on the earth. It is suggested that before criticising the views expressed in this paper it is advisable to measure the surface temperature as well as the solar spectrum of the sun over a period of few years on monthly basis by the geostationary satellites to establish the real cause of the global warming.

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