Temperature of the Sun and Neutron's life time anomaly

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Abstract:
In the sun's core, electron-positron pair production is indicated by the relativistic method of temperature calculation. The two greatest mysteries, "the Sun's coronal temperature" and "the lifetime anomaly of neutrons," can both be explained by the same.

Keywords: Temperature of the Sun; neutron's life time anomaly; electron positron pair production; Gravitational redshift.

1.INTRODUCTION

Nobody truly understands what goes on at the sun's core [1, 2]. However, experimental physicists have been trying to establish what are the particles that the Sun contains, one of such methods is to study of solar wind. The composition of the solar wind is a mixture of materials found in the solar plasma. Presence of Fe nucleuses along with protons, alpha particles and other few elements in the coronal ejection of the Sun established by the researchers [3]. Evidence of iron like solar core have been discussed by many authors time to time [1, 4]. Along with Hoyle and others Eddington who did first propose the idea that the chief source of a star's energy was sub-atomic and that hydrogen played a dominant role in supplying this energy did believe that sun is mostly made of hydrogen and iron until WW-II [5,6]. Samples collected by the Apollo missions to the moon in the late 1960s and early 1970s shows Evidence for an Iron-Rich Sun [7].

Presently accepted value of the temperature of the core the Sun is 15 Million ^{o}C, but in an experiment [8], it is claimed that the fusion researchers reach 150 Million ^{o}C, yet they are not able to achieve the goal of sustainable fusion energy. Reaching 10 times hotter than the estimated temperature is definitely an appreciable technical achievement, but it also indicates a major theoretical drawback. We cannot deny the truth that the sun is shining, so it must be admitted that the error in the theory is greater than 1000%. Therefore, there's cause for concern that something more noteworthy might happen close to the sun's core. The Lorentz gamma factor $\gamma = \frac{1}{1+\frac{\phi}{c^2}}$ [9] indicates a different inner core temperature and also indicates something different is happening at the core of the sun. One of the Sun's biggest mysteries [10] "Why is the temperature of the Sun's corona greater than Million °C ?" can also be understood with the same.
One another mystery of the nuclear physics neutron's life time anomaly. The lifetime of the neutrons stored in a bottle seems to be different by almost 9 seconds than the lifetime of the neutrons in a beam which is known as 'The Mystery of the Neutron Lifetime' one of the most remarkable open questions in fundamental physics [11].

2. CALCULATIONS AND DISCUSSIONS

2.1. Temperature of the Sun

If 138,000 kilometres thick inner sphere of the sun is about 150 g/cm³ danse [10], then from the Lorentz gamma factor $\gamma = \frac{1}{1+\frac{\phi}{c^2}}$ [9], one can estimate that at the inner core of the sun

$$(\gamma - 1)m_p c^2 \approx 0.013 \times 10^6 \text{eV} \qquad (\, m_p \text{ is mass of a proton})$$
$$(\gamma - 1)m_{Fe} c^2 \approx 0.7 \times 10^6 \text{eV} \qquad (\, m_{Fe} \text{ is mass of an iron Nucleus})$$

The typical pair production temperature is 0.511 MeV so, electron positron pair production of iron at the core is indicated by the theory.

The nuclear fusion that occurs in the core of the sun turns hydrogen nuclei into helium nuclei. In fact, *that is how the elements heavier than hydrogen are made*. The thermonuclear fusion at the core of stars can produce the first 26 elements, up to iron. It is estimated that the Sun will go through only two stages of fusion: the hydrogen-helium stage and the helium-carbon stage [12]. These solar models found in standard textbooks strongly disagree with observations [6]. Measurements on rays from a solar flare in Active Region 10039 on 23 July 2002 with the RHESSI spacecraft spectrometer revealed puzzling hints that a solar CNO cycle operates near the solar surface, where H, He, C and N are abundant [13,14]. It also indicates that in this region temperature of the sun should be greater than 16 Million ^{o}C (the required temperature for the CNO cycle is at least 16 million ^{o}C [15]). From the afore mentioned Lorentz gamma factor one may estimate that on the surface of the sun $\gamma_s = \frac{1}{1+\frac{\phi}{c^2}}$ =1.0000021 (it is important to take into account how gravity affects a projectile's horizontal and vertical velocity components; the maximum value is indicated) so that $(\gamma_s - 1)m_p c^2 \approx 1.9\times 10^3$eV($\approx$ 22Million °C). Due to low density very small fraction of the particles take part in the nuclear reaction on the surface.

According to NASA [24] coronal temperature is typically reaches 10 or 20 Million degrees Kelvin, and can be as high as 100 Million degrees Kelvin. Hydrogen nucleus is mostly ejected from the surface of the sun for which temperature may reach $(\gamma_s - 1)m_p c^2 \approx 1.9\times 10^3$eV($\approx$ 22Million °C) and for helium it may reach $(\gamma_s - 1)m_{He} c^2 \approx$ 88 Million °C.

Recent fusion experiments show that though fusion occurs, interaction cross-section is not high enough to give positive energy gain even at 150 million ^{o}C. Thus, a question may arise: "Is fusion the primary source of energy of the sun?"

O. Manuel, former NASA Principal Investigator for the Apollo Mission to the Moon was correct to some extent that fusion is not the primary source of energy production in the Sun. According to him Sun's radiant energy ". . . generated, not by fusion, but by radiation from a hot supernova (SN) core in the Sun's interior [2]. However, in spite of the many evidences of the presence of iron at the core shown by Manuel, researchers thought that the SN concept is too extreme, but what if Fe formed through fusion at the core of the sun? From the Lorentz gamma factor mentioned above at the core temperature corresponding to He nucleus $(\gamma - 1)m_{He} c^2 \approx 0.59\text{x}10^9$ °C, temperature corresponding to C nucleus $(\gamma - 1)m_C c^2 \approx 1.79\text{x}10^9$ °C, temperature corresponding to O nucleus $(\gamma - 1)m_O c^2 \approx 2.39\text{x}10^9$ °C, temperature corresponding to Ne nucleus $(\gamma - 1)m_{Ne} c^2 \approx 3\text{x}10^9$ °C and temperature corresponding to Si nucleus, $(\gamma - 1)m_{Si} c^2 \approx 4\text{x}10^9$ °C, that is the Si burning temperature, as Si appear at the core, it immediately fuses to iron (where m_{He}, m_C, m_O, m_{Ne} and m_{Si} are mass of a He, C, O, Ne and Si nucleus respectively) . More precisely, hydrogen fuses to Iron through its various intermediate states, and the Fe formed in the core will produce electron-positron pairs, resulting in gamma rays. However, there is a back reaction too when, $T \geq 3 \times 10^9$ K, individual photons have enough energy to return all the lost binding energy back into heavy nuclei, which will break Fe into He nucleuses, which is an energy-absorbing process. [see page 130 of ref. 16] though the He nucleuses so produce at the core re-fuse to Fe through intermediate stages (since, $(\gamma - 1)m_{He} c^2 \approx 0.052 \times 10^6$eV greater than He burning temperature), thus an equilibrium will be created that will control the energy of the system.

It is still unclear which processes explained the observed Solar opacity [see page 66 of ref. 16]. According to Basu that stellar opacity calculations are far from correct[17]. The gamma rays energy greater than 1 MeV dominantly lose energy through pair production; the gamma rays of energy 0.511 MeV to 1 MeV from the core of the sun move towards the surface. On the way to the surface, the energetic photons must pass through large amounts of ionized material—or plasma—to reach the star's surface, where they are radiated, thereby losing energy. In the high-temperature regime, when most of the gas is completely ionized, the opacity is dominated by Compton scattering[18] . Inside core of the sun electron and positron Compton scattering plays dominant role to the solar opacity. Yet some of the gamma rays may reach the photosphere, where they are attenuated mostly by the Compton back scattering of electrons. However, Compton back scattering by free electrons may also become a cause to reach some soft gamma rays to an observer on the Earth [19].

2.2. Neutron's life time anomaly

One another mystery of the nuclear physics neutron's life time anomaly may be addressed with the same gamma factor. In contrast, bottle experiments that trap ultra-cold neutrons in a container move much slower than regular ones—a few meters per second compared to the 10 million meters per second ($\sim 10^7$ m/s) from fission reactions [11].

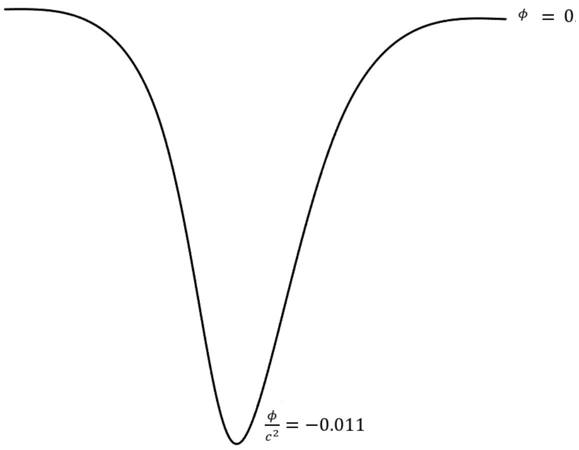

Figure I: Gravitational potential well

If we consider decay of neutrons at the $\frac{\phi}{c^2} = -0.011$ at rest the lifetime of neutron 779 seconds appears as 787.66 seconds w.r.t an observer at $\phi = 0$. If the neutron falls into the gravitational potential well (Figure I**)** from $\phi = 0$ the velocity of the neutron at that location $\approx 4.4 \times 10^7$ m/s. If in a beam experiment the source is neutron ejected from beryllium as mentioned in the reference [20] the maximum energy of the neutron ejected is about 9×10^6 eV that is neutron at velocity $v \approx 4.2 \times 10^7$ m/s, (since, $\left(\frac{1}{\sqrt{1-\left(\frac{4.2\times10^7}{3\times10^8}\right)^2}} - 1\right) m_n c^2 \approx 9\, MeV$ where $m_n$is mass of a neutron) agree with this calculation. Gravitational redshift equation T=t$\left(1 + \frac{\phi}{c^2}\right)$ has many experimental evidence including global positioning system [21]. The life time of the neutron follow the relation T=t$\left(1 + \frac{\phi}{c^2}\right) = \frac{t}{\gamma}$ so that 779≈ $\frac{787.66}{\gamma} = 787.66\sqrt{1 - \left(\frac{v}{c}\right)^2}$. The obviousness of this time variation for the life time of a particle was mentioned by Yukawa in his Nobel Prize lecture [22].

3. CONCLUSIONS:

Can the Lorentz gamma factor $\gamma = \frac{1}{1+\frac{\phi}{c^2}}$, which Einstein suggested in 1920, be disregarded? If the response is negative, it will assist us in solving two more enigmas related to the universe. Not only that, but it may also help to achieve unlimited clean energy. Why have the foundations of physics not been progressed for 40 years? Recently raised by Sabine Hossenfelder[23]. Is it the consequence of the World War II?

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