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Explanation behind the less hot Core of the sun than its Corona

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***Abstract*—** Core region of the sun is less hot due to absorption of thermonuclear fission (Demass) energy emitted from the Corona. Thermonuclear fusion (Enmass) process is going on the Core region continuously where Hydrogen is converted into Helium. Core region of the sun is gradually expanding. Due to the above cause the Corona region is hotter than Core.

Keywords— Enmass, Demass, Corona, Core

I. THEORY AND DISCUSSION

Einstein's equation involving mass and energy is given below:

$$E = \sqrt{((mc^2)^2 + p^2 * c^2))} \quad (1)$$

Supposing zero momentum when the mass is at rest,

$$\text{Equation (1)} \Rightarrow E = mc^2 \quad (2)$$

The mass of a neutron (n^0) at rest is $1.6750*10^{-27}$ Kilograms. Therefore, from equation (2), Energy required "E" for the formation of a single neutron captured from the photons, is given below:

$$E = (1.6750*10^{-27} * 299792458 * 299792458) \text{ Joules}$$
$$= 1.51* 10*10^{-10} \text{ J} = 939.57 \text{ MeV} \quad (3)$$

.

Mass and Energy relationships are given at Table 1 below.

Coming to the fusion process which is going inside the core of the Sun, the following reaction can be written;

$$_1^1H + {}_1^1H + (h\nu)_{photon}$$
$$+ \text{ excess in binding energy (EBE)}$$
$$\text{for creation of } {}_2^4He \text{ from } 2\,{}_1^1H$$
$$= {}_1^1H + {}_1^1H + 2n^0 + \text{EBE} = {}_2^4He \quad (4)$$
$$\text{where, } (h\nu)_{photon} = 2n^0 = 1879.2\text{MeV} \quad (5)$$

The binding energy is the energy which is needed to consign in to split the nucleus into individual protons and neutrons. In order to calculate the binding energy, adding the masses of the individual protons, neutrons, and electrons and subtracting the mass of the atom from the added mass (both expressed in Atomic Mass unit) and then converting that mass difference to energy. For Hydrogen-1 atom, gives:

$$\text{Mass defect for } {}_1^1H \text{ atom} = \Delta m_{{}_1^1H}$$
$$= (0*1.008664\ u + 1*1.007276\ u + 1*0.00054858\ u) - u$$
$$= 0.00782450u \quad (6)$$

where ,by definition one Atomic Mass Unit (u) is defined as 1/12th the mass of a Carbon-12 atom. Generally, the mass of an atom expressed in "AMU" or "u" is approximately equal to the sum of the number of protons and neutrons times "u" in the nucleus.

Real mass is for all time less than the sum of the individual masses of the constituent protons and neutrons since some of energy is used as the binding energy. This energy has mass, which is removed from the total mass of the original particles. This mass, identified as the mass defect, is gone vanished in the ensuing nucleus and keep up a correspondence to the energy freed when the nucleus is shaped.

For ready reference, Table 1 is given below:

The binding energy for one Hydrogen-1 atom calculated as:

$$0.00782450\ u * 931.5\ MeV/u = 7.2885\ MeV$$
$$\approx 7.29 MeV \quad (7)$$

.

For two "Hydrogen-1" atoms, total binding energy required is:

$$7.29MeV * 2 = 14.582MeV \quad (8)\ .$$

Similarly, we can calculate the binding energy for one Helium-2 atom.

$$Mass\ defect\ for\ {}_2^4He\ \text{atom} = \Delta m_{{}_2^4He}$$
$$= (2*1.008664\ u + 2*1.007276\ u$$
$$+2*0.00054858\ u) - 4u = 0.032977u \quad (9)$$

The binding energy for a single Helium-2 atom is:

$$0.032977u * 931.5\ MeV/u = 30.781MeV \quad (10)$$

$\therefore$ Excess in binding energy for creation of a ${}_2^4He$ from two ${}_1^1H$ atoms

$$= (30.781 - 14.582)MeV = 16.136\ MeV \quad (11)$$

Particles	***Mass contained***	***Mass (AMU)***	***Energy contained in the Particles***
1 AMU	1.660540 x 10^{-27} Kg	1.00 *u*	931.5 MeV
Neutron	1.674929 x 10^{-27} Kg	1.008664 *u*	939.57 MeV
Proton	1.672623 x 10^{-27} Kg	1.007276 *u*	938.28 MeV
electron	9.109390 x 10^{-31} Kg	0.00054858 *u*	0.511 MeV

Table 1. Mass and Energy relationship

Therefore, total energy one has to supply externally is $(1879.2 + 16.136)MeV = 1888.336MeV$ for the fusion process in making of an ${}_2^4He$ atom from two ${}_1^1H$ atoms in the core of the Sun.

Now, Equation (4) can be written in the modified form below;

$${}_1^1H + {}_1^1H + 1888.336MeV = {}_2^4He \quad (12)$$

II. CONCLUSION

So, an amount of $1888.336MeV$ is needed as calculated earlier for the fusion process to the Core of the Sun which is supplied from the Corona [1] where thermonuclear fission is going on. There is absorption of energy for the formation of single Helium atom and it is constantly going on with each Helium atom. Therefore, for the formations of trillions of ${}_2^4He$ atoms involve trillion times of energy absorption of this number $(1888.336MeV)$. So a constant flow of massive energy from Corona of the sun to the Core and simultaneously a constant absorption of energy at the Core are going on for the formation of trillions of ${}_2^4He$ atoms uninterruptedly, making the Core is cooler [2] than Sun's Corona. Corona is acting as a source of the entire mechanism.

REFERENCES

[1] https://en.wikipedia.org/wiki/Corona.

[2] https://www.nasa.gov/feature/goddard/sounding-rockets/strong-evidence-for-coronal-heating-theory-presented-at-2015-tess-meeting/

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