CORONAL HEATING PROBLEM

According to 'MATTER (Re-examined)'

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Abstract: Sun's corona appears much hotter than its surface. Temperature of coronal region, which is farther from the surface by more than eight times the radius of sun, is estimated to be over 1 million degrees Kelvin while temperature of sun's surface is only about 6000 degrees Kelvin. (Temperature at the centre of sun is estimated at about 15 million degrees Kelvin). Earth, with average matter-density of 5515 Kg/m^3 and mean radius of 6360 km, has an atmosphere that extends to about 700 km (about 11% of radius). Beyond this distance there is no perceptible concentration of 3D matter-particles. On the other hand, sun with average matter-density of 1408 kg/m^3 and mean radius of 696000 km is determined to have an atmosphere that extends to its coronal region at a distance of about eight times its mean radius (about 800% of radius). It is absurd to think that sun can sustain concentration of matter-particles at this distance, with sufficient matter-density that can heat up to the estimated temperature of coronal region. As contemporary physical theories are unable to explain any logical mechanism that can produce this difference, it is considered as 'coronal heating problem' in physics. Alternative concept, presented in book 'MATTER (Re-examined)' has a logical mechanism that can produce observed radiation from coronal region (which is far beyond the limit of its atmosphere).

Keywords: Coronal heating problem, sun's corona.

Introduction:

Reader, who is acquainted with alternative concept, presented the book 'MATTER (Re-examined)' [1], will be in a better position to appreciate contents of this article. For others, in order to understand this brief explanation on mechanism of coronal heating, it is necessary to take few conclusions (mentioned herein) for granted. All conclusions, presented in this essay are from the above-mentioned book. For details, kindly refer to the same.

Alternative concept, mentioned above, envisages that unstructured matter exists in the form of small bits – quanta of matter. Quanta of matter form latticework-structures of 2D energy-fields, separately in each plane, which extent to infinity and are under compression. Actions by and in a 2D energy-field is limited to its own plane. 2D energy-fields in all possible planes in space, together, constitute universal medium. Universal medium fills entire space, outside basic 3D matter-particles, without voids. It accomplishes all actions, including creation of 3D matter.

Discontinuity in a 2D energy-field compels it to close-in on the gap, even if it contains 3D matter. This action is gravitation. Magnitude of pressure, applied by universal medium is proportional to its extent, acting on basic 3D matter-particle in the gap. Extent of universal medium between two basic 3D matter-particles is always less than extents of universal medium on their outer sides. Excess pressures on outer

sides and lesser pressure from inner side compels them to move towards each other, which appears as gravitational attraction. Due to latticework-structures in universal medium, gravitation acts only on curved surfaces of basic 3D matter-particles.

Presence of too many free quanta of matter in a region breaks down latticework-structures in universal medium to form disturbances. Latticework-structures, closing-in on the gap gather and compress free quanta of matter to create 3D matter. Work, done about 3D matter, appears as distortions (inertial-pocket) in surrounding universal medium. Inertial-pocket moulds the newly created 3D matter into disc-shaped matter-cores. In order to achieve stability, it is essential for universal medium to move disc-shaped matter-core at the highest possible (constant) linear speed and spin it about one of its diameters at a speed proportional to its matter-content. Inertial-pocket moves in universal medium by transfer of distortions, while carrying included 3D matter-core along with it. Disc-shaped 3D matter-core and associated inertial-pocket, together, form a photon – corpuscle of light or other radiations.

Photon is the most basic 3D matter-particle and all other 3D matter-bodies are made by their unions. 3D matter-core provides photon's matter-part and surrounding inertial-pocket appears (in each plane) as electromagnetic wave. In order to sustain stability, it is essential for photons to move at highest (constant) linear speed and spin at speed proportional to their matter-contents, with respect to universal medium. Attempt to increase linear speed of a photon results in its matter-core gaining additional matter-content from universal medium and thereby increasing its frequency, rather than increasing its linear speed. Attempt to reduce linear speed of a photon results in its matter-core losing part of matter-content into universal medium and thereby reducing its frequency, rather than reducing its linear speed. Radiation (of matter) is continuous flow of photons. It is classified according to frequency of constituent photons, heat rays being the lowest and cosmic rays being the highest.

Gravitational attraction between macro bodies is between matter-cores of their constituent photons. Matter-core of each photon in a macro body experiences gravitational attraction towards matter-cores of photons in other macro body, when median disc planes of their matter-cores coincide. At any instant, there are extremely few photons in each macro body under gravitational attraction. This is the reason for gravitational effort to appear very weak compared other manifestations of 'natural forces'. In reality, gravitational effort is enormously stronger compared to any of them. A photon experiences gravitational attraction towards another photon, disc-plane of whose matter-core is situated in disc-plane of its own matter-core, twice every spin.

All very large macro bodies are under continuous gravitational collapse. Gradually, increasing pressure (compression) heats them and produces appropriate radiations from their region. Atomic (nuclear) actions are not required to produce radiations from a large macro body. During compression, primary 3D matter-particles lose matter-contents (in the form of free quanta of matter) from their constituent photons and expand to further increase internal pressure of macro body. Thus, heating is a process of losing matter-content (reducing matter-content level) of a macro body. Hotter a macro body is, lesser is its matter-content level. With minimum (or no) external pressure (as in free space), a macro body is at its highest matter-content level (coolest state).

If free quanta of matter, released from primary 3D matter-particles during heating, are in sufficient quantity (more than that could be assimilated into latticework-structures of 3D energy-fields), they form disturbances that leads universal medium to create new photons from them. Frequency of photons, created by universal medium depends on rate of availability of free quanta of matter in the region. Greater availability of free quanta of matter causes production of higher-frequency photons. This, in turn, is interpreted as radiated from hotter region. However, it should be noted that availability of higher-frequency radiations from any region does not indicate direct relation to temperature (matter-content level) of that region of macro body. Radiation of higher-frequency radiation merely indicates availability of free quanta of matter at higher rate in the region. This could be due to various other reasons also.

Coronal temperature:

A macro body under compression loses matter-content from its primary 3D matter-particles. Rate and

quantity of quanta of matter, released free, from matter-cores of constituent photons, depend on the magnitude of compression. Universal medium gathers these free quanta of matter into disturbances, which in turn are converted into photons and radiated from the region. Matter-contents (frequency) of majority of newly created photons (as dictated by rate and quantity of free quanta of matter available in a region) tend to form a close band in spectrum. As compression on macro body increases frequency of major part of radiated photons increase.

Let us consider photons radiated in radial directions from sun's interior region. As these photons move outwards, gravitational attraction between them and constituent photons of sun tend to retard them. Attempt to retard a photon tends to reduce its matter-content by discarding quanta of matter from its matter-core, into space. Free quanta of matter form new photons, which radiate in all directions from the region. Region from where major part of these radiations appears to originate is coronal region of sun. Photon (radiation) received by observer from coronal region has no direct relation to temperature or any other state of sun. Magnitude and frequency of coronal radiation depend only on rate and quantity of free quanta of matter available in that region.

Temperature of a region on or about a very large macro body (like stars) is assed by determining frequency of radiation that reaches an observer from the region. Corona is far away from outer region of sun's atmosphere. Coronal region can be viewed separately only from sides. Figure 1 represents a plane passing through centre of sun and observer. Sun is represented by semi-circle on the left. A screen (or an eclipsing macro body) is shown in the figure that blocks direct radiation from sun's body towards the observer. This prevents all radiations emanating from the region of sun's body reaching the observer. Shaded region in figure represents part of spherical shell-like region, formed by corona, around sun. Region in darker shade shows coronal shell in the plane and region in lighter shade shows inner part of corona from where radiations of relatively lower frequency are received. Although regions are shown with definite borders, it may be noted that they represent vague separations between regions.

Region, from where highest-frequency radiations are available, is considered as sun's corona. Highest concentration of radiation corresponding to corona is available to observer within angular sector between lines OD and OC. Hence, temperature of corona is determined by measuring frequency of radiations received from this sector. In other sectors, radiations corresponding to coronal temperature have lower concentrations. Coronal region is very far from atmosphere of sun.

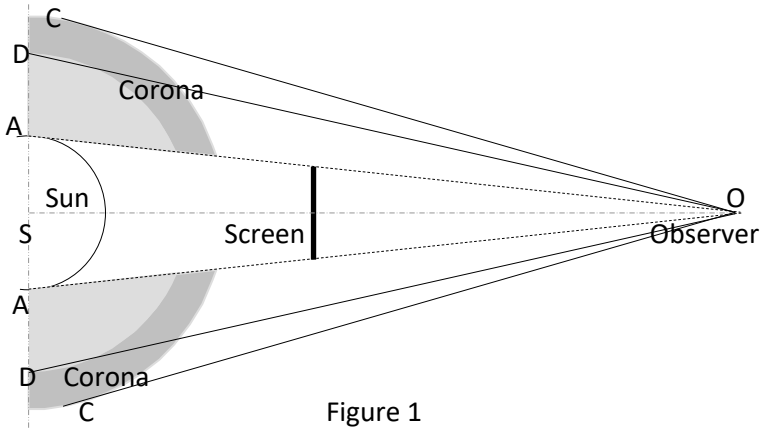

Figure 1

Magnitudes of all efforts/actions in 3D spatial system (that radiates spherically) diminish in inverse proportion to square of distance from origin. Considering actions in 3D spatial system, as a photon moves away from sun, magnitude of gravitational attraction, F, between them reduces in inverse proportion to square of distance between their centers.

$$F = \frac{k_1}{D^2} \qquad \textbf{(1)}$$

Where F is magnitude of gravitational attraction, k_1 is constant of proportion that includes their matter-contents and gravitational constant and D is the distance between their centres.

Magnitude of gravitational attraction between two matter-bodies is proportional to their matter-contents (not necessarily masses). Matter-content is mathematically represented by mass. Due to highest possible linear speed of photon, no external effort in the direction of its linear motion can act on it. Although photon has 3D matter-content, its mass in the direction of its linear motion is infinity and photon

is generally considered as a mass-less entity. However, external efforts, acting on photon in directions other than direction of its linear motion have appropriate effects on it. When direction of external effort is in the direction opposite to direction of its linear motion, external effort is fully effective on photon and this effect is exhibited in the form of its mass. G is gravitational constant.

Hence, magnitude of gravitational attraction between photon and sun, $F = \frac{k_1 GMm}{D^2}$ **(2)**

Where M is mass (matter-content) of sun and m is mass (matter-content) of matter-core of photon.

As photon moves away from sun, it loses part of its matter-content and reduces its frequency. Reduction in frequency reduces number of times disc-plane of photon's matter-core coincides in any one plane. Hence, reduction in frequency reduces average gravitational attraction on photon in inverse proportion to distance from sun. Hence, another factor governing gravitational attraction between moving photon and the sun is loss of its matter-content (frequency). However, effects of this change, being comparatively very small, are neglected in this illustration, as explained below.

Gravitational actions are originated by universal medium, separately in each 2D energy-field (plane). Hence gravitational actions and gravitational attractions have 2D nature in space. For approximate calculation (only for illustrative purpose) we may use gravitational constant, G, determined for macro bodies in 3D spatial system, with certain modifications. Gravitational attraction is between moving photon and each of constituent photons in sun, disc-planes of whose matter-cores coincide with that of moving photon's matter-core. Gravitational attraction between each pair lasts only when disc-planes of their matter-cores coincide. Therefore, although gravitational attraction from sun has 3D nature, gravitational attraction on moving photon has 2D nature. Inverse-square law in 3D spatial system uses spherical space with inverse proportion of D^2. While considering action in 2D spatial system for moving photon, circular space with inverse proportion of D is more appropriate.

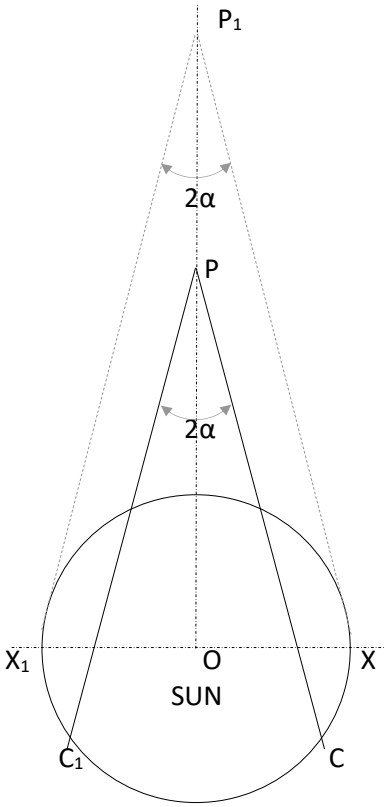

Figure 2

Hence; Magnitude of gravitational attraction between photon and sun, $F = \frac{k_1 GMm}{D}$ **(3)**

There is enormous difference between sizes of sun and a photon. Matter-cores of photons experience gravitational attraction only on curved periphery in their disc-planes. Matter-core of a photon is of segmented-spherical shape. Moving photon experiences gravitational attraction towards sun only from photons of sun within angular sector encompassed by segments of its matter-core. Width of angular segment of matter-core depends on total matter-content of photon. Let angle subtended by segments of photon's matter-core at its spin axis is equal to 2α degrees. As the photon moves outward, reduction in matter-content reduces angle subtended by segments of its matter-core, in space.

Large circle in figure 2 represents sun, whose radius is R and P represents a photon, moving away from sun. P_1 shows future position of photon, when whole of sun is encompassed within angular sector occupied by segment of its matter-core. OP = D is the distance between photon and sun. Until the moving photon reaches position P_1, only photons in a part of sun's body (apparently) interacts with it to produce gravitational attraction between them. At P_1, angular sector of segment of photon's matter-core encompasses whole of sun's body. From P_1 onwards, magnitude of gravitational attraction between moving photon and sun is according to equation (2). But until the moving photon reaches position P_1, magnitude of gravitational attraction is corresponding to part of sun covered by segment of its matter-core. Let us assume the part of sun, subscribing to gravitational attraction is proportional to distance D.

$$\angle OP_1X = \alpha\,, \qquad \text{Tan}\,\alpha = \frac{OX}{OP_1}\,, \qquad OP_1 = \frac{OX}{\text{Tan}\,\alpha} = \frac{R}{\text{Tan}\,\alpha}$$

Let F is the magnitude of gravitational attraction, when photon is at P_1.

Relation between magnitudes of gravitational attraction at P_1 and at any other distance D from sun;

$$= \frac{F}{OP_1} \times OP = \frac{F}{\frac{R}{\text{Tan}\,\alpha}} \times D = \frac{F \times \text{Tan}\,\alpha \times D}{R}$$

Hence, equation (3) should be modified as;

$$F = \frac{k_1 GMm}{D} \times \frac{\text{Tan}\,\alpha \times D}{R} = \frac{k_1\, GMm\, \text{Tan}\,\alpha}{R} \qquad \textbf{(4)}$$

In equation (4), factor M gradually increases as the photon moves outward.

Gravitational attraction on moving photon, opposing its forward motion tends to retard it. Attempt to retard a photon, compels matter-core of photon to discard quanta of matter into surrounding universal medium. Availability of free quantum of matter in the region produces disturbances, which are converted to photons by universal medium and radiated. Frequency of photons, formed in the region, depends on quantity and rate of availability of free quanta of matter. Magnitudes of gravitational attraction being highest near the point P1, large quantity of quanta of matter are released free into universal medium in this region. Therefore, photons formed in region near P_1 (coronal region of sun) are of much higher frequency.

All large macro bodies are under gravitational collapse. Compression due to gravitational collapse heats them and cause radiation from the region occupied by them. Radiation is continuous flow of photons from the region of a macro body. Majority of photons radiated from the region of a hot macro body have definite relation to its temperature. Hence, frequency of radiation from the region of a macro body is usually considered as an indication of its temperature. As there are also other methods for formation of photons, radiation of photons of certain frequency from a region should not be attributed solely to heating. In the case of sun's coronal region, observed radiation is formed in that region of universal medium from available free quanta of matter. It has no direct relation to temperature of sun's macro body, except that photons that caused availability of free quanta of matter were originally radiated from the region of its macro body.

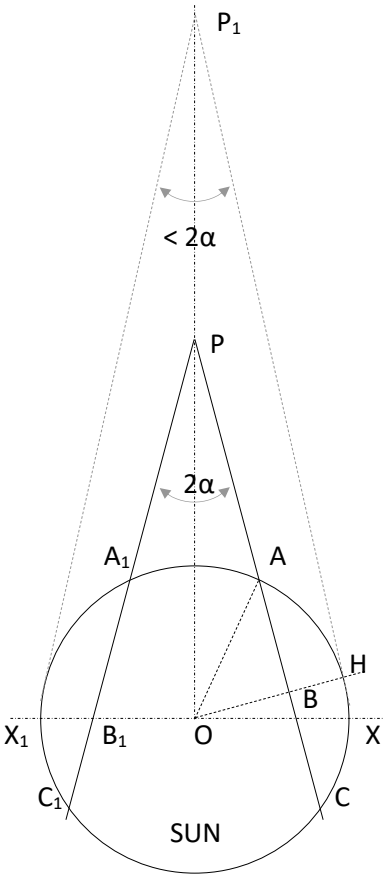

Figure 3

Distance of point P_1 from sun is determined by angular sizes of photons' matter-cores. These depend on their matter-content (frequency). Photons with higher frequency create coronal region nearer to the macro body. Usually, larger macro bodies have greater gravitational collapse, which cause radiation of higher-frequency photons along with lower-frequency photons from their region. Most of lower-frequency photons, up to gamma rays have too narrow segments of matter-cores. Gravitational attraction on them is very small and continues to increase until they are far out in space. Lose of quanta of matter from their matter-core are too little and spread in wider region to create new photons. Most of the photons in lower region of gamma rays tend to form superior 3D matter-particles. As photons in higher-frequency range of gamma rays are unsuitable to form superior 3D matter-particles, they are radiated away from the macro body. Matter-core segments of photons of higher-frequency in the range of gamma rays are wider. They create radiation from coronal region of sun.

As gravitational collapses of larger macro bodies are associated with formation of higher-frequency photons, they have coronal region nearer to their surfaces. Extremely large macro bodies like 'black holes' also have coronal regions. They are very near to macro bodies' surfaces. Radiation from this region is further controlled/nullified by gravitational attraction from the macro bodies (so that they cannot be observed from outside).

For illustrative purpose (with respect to figure 3), we may take that sun's macro body is homogeneous throughout and its constituent photons are evenly distributed. Number of photons in any part of sun's macro body is proportional to its volume. We shall analyze magnitude of gravitational attraction, when segment of photon's matter-core is evenly positioned about direction of photon's motion and moving outward along line OP_1. When photon is in position P, photons of part of sun AA_1C_1C provides gravitational attraction.

$$\text{Volume of sun} = \frac{4\pi R^3}{3},\ \angle OPB = \alpha,\ \text{Sin}\alpha = \frac{OB}{OP} = \frac{OB}{D},\ OB = D\,\text{Sin}\alpha,$$

$$\text{Height of spherical segment } ABCH = BH = OH - OB = R - D\,\text{Sin}\alpha$$

$$OA = R,\ AB = \text{Radius of spherical segment} = \sqrt{OA^2 - OB^2} = \sqrt{R^2 - D^2\,\text{Sin}^2\alpha}$$

Volume of one spherical segment of sun's macro body, ABCH

$$= \frac{\pi\ AB^2\ BH}{3} = \frac{\pi\left(\sqrt{R^2 - D^2\,\text{Sin}^2\alpha}\right)^2(R - D\ \text{Sin}\alpha)}{3} = \frac{\pi\left(R^2 - D^2\,\text{Sin}^2\alpha\right)(R - D\ \text{Sin}\alpha)}{3}$$

Volume of sun excluded from sweep area of evenly paced segment of photon's matter-core

$$= \frac{2\pi\left(R^2 - D^2\,\text{Sin}^2\alpha\right)(R - D\ \text{Sin}\alpha)}{3}$$

Volume of sun, whose photons are (apparently) interacting with moving photon to produce

$$\text{gravitational attraction} = \frac{4\pi R^3}{3} - \frac{2\pi\left(R^2 - D^2\,\text{Sin}^2\alpha\right)(R - D\ \text{Sin}\alpha)}{3}$$

$$\text{Mass of sun, producing gravitational attraction} = K\left\{\frac{4\pi R^3}{3} - \frac{2\pi\left(R^2 - D^2\,\text{Sin}^2\alpha\right)(R - D\ \text{Sin}\alpha)}{3}\right\},$$

where K is constant of proportion (matter-density) between volume and mass.

Magnitude of gravitational attraction according to equation (4);

$$F = \frac{k_1\,G\,m\,\text{Tan}\,\alpha}{R} \times K\left\{\frac{4\pi R^3}{3} - \frac{2\pi\left(R^2 - D^2\,\text{Sin}^2\alpha\right)(R - D\ \text{Sin}\alpha)}{3}\right\}$$

$$F = \frac{k_1\,G\,m\,\text{Tan}\,\alpha}{R} \times K\left\{\frac{4\pi R^3}{3} - \frac{2\pi\left(R^3 - R^2\,D\,\text{Sin}\alpha - R\,D^2\,\text{Sin}^2\alpha + D^3\,\text{Sin}^3\alpha\right)}{3}\right\}$$

$$F = \frac{K k_1\,2\pi\,G\,m\,\text{Tan}\,\alpha}{3R} \times \left\{2R^3 - \left(R^3 - R^2\,D\,\text{Sin}\alpha - R\,D^2\,\text{Sin}^2\alpha + D^3\,\text{Sin}^3\alpha\right)\right\}$$

$$F = \frac{K k_1\,2\pi\,G\,m\,\text{Tan}\,\alpha}{3R} \times \left(R^3 + R^2\,D\,\text{Sin}\alpha + R\,D^2\,\text{Sin}^2\alpha - D^3\,\text{Sin}^3\alpha\right)$$

As magnitudes of m and α are too small compared to M, we may for the time being ignore changes in them. As changes in M is at higher rate than changes in m and α, gravitational attraction between the photon and sun gradually increases until photon reaches in the vicinity of position P_1. After crossing the point P_1, gravitational attraction between them gradually reduce as per equation (3).

Due to very large size difference between sun and matter-core of photon, it is not correct to consider direction of gravitational attraction between moving photon and each of photons in sun's macro body as acting in direction opposite to moving photon's motion. Parts of gravitational attraction on photon's

matter-core are available in various directions spanned across macro body of sun. Direction of (whole of) gravitational attraction becomes directed towards centre of sun only when distance between them is such that whole of sun's macro body is included within angular sector covered by segments of photon's matter-core. Angular sectors of high-frequency photons, below the range of gamma rays, are less than one degree of arc in width. Hence, results may be further refined by modifying equation (4) for component of gravitational attraction in direct opposition to direction of photon's linear motion.

As sun is a gaseous macro body, it has no definite border to mark or measure distances from its surface. Distance to sun's coronal region from its surface is currently estimated as about eight times sun's radius. In order to create coronal region at this distance, majority of photons radiated from the region of sun should have near or about 14° width for segments of their matter-cores This corresponds to frequency of about 2×10^{20} Hz . Photons, above this range of frequency, are fewer and they would have crossed threshold of highest gravitational attraction before reaching coronal region. Quanta of matter released from them, being fewer in quantity, would form photons of lower frequency range. Residual parts of photons would pass coronal region as radiation in the range of gamma/cosmic rays.

Conclusion:

Sun's coronal heating problem is the result of misunderstandings of certain fundamental physical phenomena. Although frequency of radiation from a hot body may be related to its temperature, radiation of any frequency from a region in space may be produced by other means also. Hence, it is not correct to assume direct relation between frequency of radiation and temperature of (radiating) macro body in all cases. Temperature of sun's macro body has no direct relation to radiation from its coronal region. These radiations are originated in coronal region, where 3D matter-particles are not present in any appreciable concentration.

Radiation is continuous flow of photons (corpuscles). Due to particular shape of photons' matter-cores, very large difference in sizes of photon and sun and peculiarity of gravitational actions, gravitational attraction between radiated photons and sun's macro body gradually increases until photons reach coronal region and reduce after they cross coronal region. Gravitational attraction, being in opposite direction to their linear motion, tends to retard photons in radiation. Attempt to retard a photon compels its matter-core to discard quanta of matter and reduce its matter-content. Free quanta of matter in space form photons. Highest rate of availability of free quanta of matter occur in coronal region and hence photons, formed in that region are of very high frequency. Radiation of high-frequency photons from coronal region, which is very far from sun's surface, is misunderstood as radiation produced by heating from sun.

Reference:

[1] Nainan K. Varghese: *MATTER (Re-examined)*, https://www.matterdoc.info/

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