

# HEAT

(According to 'MATTER (Re-examined)')

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*Abstract:* Presently, 'heat' is understood as a type of energy and 'heating' as a process of transfer of energy. Energy, being the ability to do work, is a quality and hence a functional entity. Functional entities have neither objective reality nor positive existence in space. Therefore, energy has neither form nor structure, nor real existence. However, in contemporary physics, energy (an imaginary entity) is treated almost like a real entity with form, structure, and objective reality, with the ability to transfer and change forms. It is currently used as the cause of actions, where no other cause is obvious.

According to an alternative concept, presented in the book, 'MATTER (Re-examined)', energy is a functional entity that develops wherever and whenever work is done in association with a three-dimensional material body. Heating is a process of reducing the three-dimensional matter-content level of a macrobody. In any body, its 3D matter-content and work associated with its integrity and state (of motion) are complementary and support each other. 3D matter-content of a body is the quantity of 3D matter it contains in the form of basic 3D matter-particles. Energy-content about a body is the stress developed, due to structural distortions (work done), in the universal medium in and about the body.

*Keywords:* Heat, 3D matter-content level, temperature, matter, energy, work done.

## Introduction:

An alternative concept is proposed in the book 'MATTER (Re-examined)'. In it: The entire space, outside the most basic 3D matter-particles, is filled with an all-encompassing universal medium, structured by quanta of matter in two-dimensional latticework formations in all possible planes. Due to its structure, the universal medium is inherently under compression. The compression experienced by any 3D matter-particle in the universal medium is gravitation. The magnitude of gravitation corresponds to the extent of the universal medium that exerts the pressure. The extent of universal medium between two 3D matter-particles is always less than the extent of universal medium on their outer sides. Hence, higher gravitational actions on the outer sides, opposing the lesser gravitational actions from between the 3D matter-particles tend to move them towards each other. This tendency is understood as gravitational attraction or gravity. Gravitational attraction (gravity) is the resultant (relatively minor by-product) of separate gravitational actions on two 3D matter-particles by the universal medium.

Free quanta of matter, within a gap in its latticework structures, are compressed, shaped and moved by the universal medium to form a disc-shaped (segmented spherical) 3D matter-core that spins about one of its diameters at a spin speed proportional to its 3D matter-content and moves at the highest possible (hence constant) linear speed relative to the universal medium. Movements of the 3D matter-core are caused by the transfer of structural distortions in the universal medium. These most basic 3D matter-particles, after their developmental stages, form the corpuscles of radiation (the photons).

Gravitation can act only on (convex) curved surfaces of the most basic 3D matter-particles. Therefore, to invoke gravitational attraction between two photons, their 3D matter-cores need to be coplanar. Under suitable conditions, two complementary photons form a union of primary 3D matter-particle (biton) by grouping in binary fashion to revolve about each other in a common circular path, while spinning about a common axis passing through their 3D matter-cores and the centre of their circular path. Bitons, in turn, form all other superior 3D matter-particles and macrobodies.

The magnitude of structural distortions in the universal medium, in and about a material body, is the work done about the body. Intrinsic work about a body was done during the creation of its constituents and the formation of the body. This part of the work maintains the integrity of the body. Additional work invested in the universal medium in and about the body determines its state of motion.

All conclusions expressed in this article are taken from the book 'MATTER (Re-examined)' [1]. For details, kindly refer to the same.

### **Photon:**

Photons are the most basic 3D matter-particles. Critical constant linear and spin speeds of their 3D matter-cores are imperative for their stability and existence. Spin speed of a photon's 3D matter-core is proportional to its 3D matter-content. 3D matter-core of a photon is moved at the highest possible linear speed by the universal medium. The linear speed of a photon is with respect to the structural formations in the universal medium. The structural formation of the universal medium, in any region, depends on the magnitude and direction of distortions in it. Therefore, if structural formations in the universal medium are shrunk (compressed), a photon will appear to move more slowly to an observer outside the region of the structural distortions. Similarly, if structural formations in the universal medium are stretched (dilated), a photon will appear to move faster for an observer outside the region of structural distortions. Anyway, the linear speed of a photon remains constant with respect to the universal medium.

Should the 3D matter-core of a photon move faster than its critical linear speed, parts of the 3D matter-core tend to rub stronger into the structure of the universal medium and thereby assimilate quanta of matter from the universal medium into itself. Increasing the 3D matter-content of its 3D matter-core compels it to spin faster. Therefore, attempting to increase the linear speed of a photon (by external actions) increases its frequency rather than its linear speed. Similarly, should the 3D matter-core of a photon move slower than its critical linear speed, parts of the 3D matter-core tend to move away from the rubbing surface of the structure of universal medium and thereby reduce its internal pressure. This encourages some of the quanta of matter from the 3D matter-core of the photon to escape freely into the universal medium. The 3D matter-content of its 3D matter-core reduces and makes it necessary for the 3D matter-core to spin more slowly. Therefore, attempting to reduce the linear speed of a photon (by external actions) reduces its frequency rather than its linear speed. In either case, the linear speed of the photon remains critically constant with respect to the universal medium.

### **Biton:**

A biton is a binary unit made up of two complementary photons, moving in a common curved path at their critical linear speeds (speed of light). High centrifugal action on the photons is neutralized by equally high gravitational attraction between them. A biton reaches a stable state when constituent photons are also spinning about a common axis, passing through the centre of their circular path. Spin speed (frequency) of a photon is proportional to its 3D matter-content. Each photon completes one spin during the time it takes to complete one revolution in its curved path. Hence, the radial size of a biton depends on the 3D matter-contents of its constituent photons. Photons of a biton continuously strive to maintain their 3D matter-contents equal at all times.

Stable (radial) size of the biton is determined by the balance between centrifugal actions on the constituent photons and gravitational attraction between them. Due to this mechanism, every biton has an inherent tendency to stabilise itself. In its stable state, 3D matter-contents of constituent photons of a biton are equal, both photons are spinning in synchronism, photons are moving in the common circular path, at any instant they are diametrically opposite in their common circular path, the median perimeter of the biton is equal to one wavelength of the photons, and 3D matter-cores of both photons are coplanar. Lower 3D matter-contents of the photons make them spin slower and make the radial size of the biton larger. Higher 3D matter-contents of photons make them spin faster and make the radial size of the biton smaller. Variation in any of these requirements activates the biton's self-stabilizing mechanism into action. All superior 3D matter-particles and macrobodies are formed by bitons, in various combinations. Changes in the 3D matter-contents of constituent photons in bitons of a macrobody give rise to the phenomena of its heating/cooling.

### **External pressure on a biton:**

Instability of a biton may be caused by changes in any one of its balancing actions. External pressure on a biton and changes in the 3D matter-contents of its constituent photons affect biton's stability. External pressure

on a biton is added to the gravitational attraction between the photons. Increased external pressure on a biton tends to provide additional push on the constituent photons towards each other and reduce the biton's radial size. Reduction in external pressure on a biton tends to let the centrifugal action move constituent photons away from each other and increase the biton's radial size. Changes in 3D matter-contents of constituent photons vary the magnitudes of gravitational attraction between them and affect centrifugal actions on them. An increase in gravitational attraction or a reduction in centrifugal actions on photons tends to reduce biton's radial size. Similarly, a reduction in gravitational attraction or an increase in centrifugal actions on photons tend to enlarge biton's radial size.

We shall examine actions on a single biton during variations in external pressure on it. In a macrobody, each of its affected constituent bitons behaves identically, and together they cause changes in the macrobody as a whole.

Constituent photons of bitons tend to move towards each other under increased external pressure and thereby reduce the radial size of their mean circular path. This is not a stable state for the biton, because both photons require more than one complete revolution in the circular path to complete one spin about their common axis. This requires a change in the transfer of structural distortions in the universal medium (which are instrumental to movements of photons' 3D matter-cores) about the circular path of photons in the biton. Structural changes are always resisted by the self-stabilizing property of the universal medium. Resistance by the universal medium tends to reduce the linear speeds of photons in their common circular path.

A tendency to reduce the size of the circular path by increased external pressure is opposed by increased resistance to the linear motion of constituent photons. An attempt to reduce the linear speed of a photon results in the loss of 3D matter-content from its 3D matter-core. As a result, the frequencies of photons (being proportional to their 3D matter-contents), reduce. Due to the reduced frequency of constituent photons, the biton requires a much larger circular path for its photons to retain its stability. This will encourage loss of 3D matter-content from 3D matter-cores of photons at higher rates. These seemingly contradictory actions will continue until the biton reaches a stable state, with lower 3D matter-content, but with a larger radial size than before it experienced the external compression. Under increased external compression, a biton strives to reduce its 3D matter-content level and increase in radial size.

Photons of bitons tend to move away from each other under centrifugal actions against dilated external pressure and thereby increase the radial size of their mean circular path. This is not a stable state for the biton, because both photons require less than one complete revolution in a circular path to complete one spin about their common axis. Change in the pattern of their motions requires changes in the transfer of structural distortions in the universal medium about the circular path of photons in the biton. Structural changes are always resisted by the self-stabilizing property of the universal medium.

The tendency to enlarge the circular path by dilation of external pressure is assisted by a reduction in resistance to linear motion of constituent photons. An attempt to increase the linear speed of a photon results in assimilation of 3D matter-content into its 3D matter-core. As a result, the frequencies of photons increase. Due to the increased frequency of constituent photons, the biton requires much smaller circular path for its photons to retain its stability. This will encourage assimilation of 3D matter-content into 3D matter-cores of photons at higher rates. These seemingly contradictory actions will continue until the biton reaches a stable state, with higher 3D matter-contents, but with a smaller radial size than before dilation of external compression. Under dilated external compression, a biton strives to increase its 3D matter-content level and reduce its radial size.

### **Heat:**

The process of reduction in the 3D matter-content level of a macrobody is the 'heat' or heating. The process of increasing the 3D matter-content level of a macrobody is cooling. Usually, all materials expand and weigh less when hot. However, certain compounds/mixers may be anomalous due to many different reasons. Heating of a macrobody may start (or spread from) any locality in the body.

The entire space (the whole of the universe) is filled with matter (of uniform matter-density). However, we (the rational beings), being three-dimensional entities, live and operate in a 3D spatial system. We can sense only the part of matter that exists in the 3D spatial system. The rest of matter that exists in other spatial dimensions is insensible to us. Although the matter-densities of 3D matter-cores of photons and the universal

medium (currently considered as empty space) are identical, we can sense/observe only the photons and superior 3D material bodies formed by them.

The 3D matter-content level of a macrobody is different from its 3D matter-density. The total 3D matter in a material body, related to its total volume, gives us the body's 3D matter-density. In this case, inter-particle distances between the constituent 3D matter-particles of the body at various levels (which are filled with matter in lower spatial dimensions) are not taken into consideration. In the case of the 3D matter-content level, radial sizes of bitons in the material body are specifically considered to determine the 3D matter-density of the body. E.g., For a photon, its 3D matter-content level and 3D matter-density are identical. If a biton is considered individually (neglecting the space within circular paths of constituent photons), its 3D matter-density and 3D matter-content level are not identical. A hot body, under external pressure, should have a low 3D matter-content level. However, if the structure of a material is such that inter-atomic and other inter-particle spaces can vary to compensate for the changes in the radial sizes of its bitons, its 3D matter-density will not relate to 3D matter-content levels of its bitons.

Changes in external pressure on constituent bitons of a body are the only action required to heat or to cool a material body. External pressure about a biton may be varied by two methods: direct heating and indirect heating.

#### **Direct heating:**

Bitons are very minute 3D matter-particles, when compared to the macrobodies constituted by them. Hence, external pressure on a macrobody affects each of its bitons in the affected region as a uniform external pressure. During heating, both constituent photons of a biton undergo a similar process to reduce their 3D matter-contents, as explained above. Biton reaches a stable state with a lower 3D matter-content level and larger radial size than it had before the application of compression on the macrobody (direct heating) began. Effects on the biton are directly induced by the external pressure on the macrobody. Hence, this method of heat/heating may be called direct heating. Depending on the location of external pressure, heating may begin at any part of the body or on the whole body.

#### **Indirect heating:**

Heating may also be induced by increasing the 3D matter-contents of constituent-photons of the bitons in a macrobody, separately or together. Photons of low-frequency radiation, incident on a macrobody, are slowed down during their entry into the body's matter-field (matter-field of a macrobody is the structurally distorted region of the universal medium, in and about the body). These photons come to a halt before they can be reflected away from the body's matter-field. There are also numerous photons in the bitons of the body, near its surface, moving in their own circular paths. As and when the 3D matter-core of one of the photons in a biton happens to be co-planar with the 3D matter-core of a halted photon, they combine under the action of gravitational attraction to increase the 3D matter-content of the photon in the biton. An increase in 3D matter-content of one or both of its photons destabilizes the biton. Photons of the biton start to trace separate circular paths about the common centre of the biton. Increased resistance to their linear and spin motions tends to effectively reduce their speeds. Tendency to reduce the speed of a photon reduces its 3D matter-content rather than its speed. Therefore, both photons reduce their 3D matter-contents (at rates proportional to their frequencies).

Free quanta of matter, discarded from the 3D matter-cores of photons, may form new photons and radiate away from the region. Many of the low-frequency photons from this radiation may heat up neighboring bitons in the same way as the external radiation incident on the macrobody.

This process will continue until the biton achieves stability and settles at a lower 3D matter-content level and enlarged radial size than when it started to receive the low-frequency radiation (indirect heating). All bitons in the neighborhood also synchronize with the biton that received 3D matter-content from the photons in the incident ray. An increment in the radial size of the biton reduces inter-particle spaces in the neighboring region, which raises pressure in the universal medium in the region. Increased pressure in the universal medium acts as external pressure on all bitons in the region. All these bitons reduce their 3D matter-contents as in the case of direct heating. This method of reducing the 3D matter-content level of a macrobody by spreading external pressure (created during absorption of low-frequency photons) in a macrobody may be called the indirect method of heating. This method is called indirect because it is the absorption of low-frequency radiation that

initiates the development of external pressure on the bitons in the macrobody, which in turn reduces their 3D matter-contents.

### **Cooling:**

Cooling is a process in the reverse direction to heating. Unlike heating, cooling commences only at the surface of a macrobody, which is in direct contact with a lower pressure (low distortion-density) region in the universal medium. As a constituent photon of a biton with low 3D matter-content level enters a low-pressure (low distortion-density) region in the universal medium, it experiences lower resistance to its forward motion on its forward surface. Lowered resistance let forward push on the photon's 3D matter-core to accelerate it. The forward surface of the 3D matter-core of the photon presses strongly onto the structurally distorted region in the universal medium and assimilates a few quanta of matter from the universal medium into its own 3D matter-core. Assimilation of quanta of matter increases the 3D matter-content of the photon and increases the photon's frequency. Every half-spin, constituent photons of biton reverse roles. After half a spin of photons, the photon that was moving through a lower distortion-density region (facing outwards from the macrobody) of the universal medium will now move through a higher distortion-density region (facing inwards to the macrobody), while the other photon will now move through the lower distortion-density region (facing outwards from the macrobody) in the universal medium and assimilate quanta of matter into its 3D matter-core. In this way, 3D matter-cores of both photons will acquire more and more 3D matter-content. This process will continue until the distortion-densities on both sides (region facing outwards from the macrobody and region facing inwards to the macrobody) of biton in the universal medium have similar distortion-densities. This condition can occur only when the whole of the macrobody has reached the room temperature. This is the cooling process of a hot body.

If two parts of a body are at different 3D matter-content levels (one hotter than the other), the hotter part of the body may continue to radiate low-frequency photons, while the other cooler part of the body may continue to receive 3D matter-content from the low-frequency photons radiated from the hotter part. As a result, the cooler part tends to heat up, and the hotter part tends to cool down simultaneously.

### **Mechanism of heating:**

Heating of a gaseous body may be considered for illustration. When a gaseous body is compressed, compressive pressure reduces its volume. Smaller constituents of the body are brought nearer and held in that relative position against natural efforts trying to keep them at a regular distance in their natural formations. External pressure invested some work in and about the body to reduce its volume. Work done is held within the body's matter-field till the compression of the body is removed, and the work is dissipated by investing equal work in the opposite direction by inter-molecular efforts, when the body attains its original volume.

During the reduction of its volume, primary 3D matter-particles (bitons) in the body under compression discard 3D matter-contents in the form of free quanta of matter into the surrounding universal medium. If available in sufficient quantity, free quanta of matter are gathered and compressed by the universal medium to create new photons and radiate them from the region, initially in the form of low-frequency heat radiation. This may be indicated by an increase in the body's temperature. The body radiates 3D matter in the form of low-frequency photons (heat rays) away from the body, and the 3D matter-contents of the same are lost to the body. Gradually, as the 3D matter-content level of the body reaches a steady state. Work done in and about the body to compress it (either by external mechanism or sealed container) has not changed, and constituent photons of bitons of the body are held nearer and at a lowered 3D matter-content level. In this state, work done in and about the body is continuously opposed and neutralized by the work done by inter-particle field-efforts. Low-frequency radiation of photons from the body ceases gradually. Due to the container, the gaseous body is unable to release the compression pressure outside the body. That is, the body cannot influence the 3D matter-content level of an outside body (a thermometer). When the 3D matter-content level of the body stabilizes, the thermometer will indicate the temperature of the body as room-temperature (which is equivalent to a much higher 3D matter-content level).

When external pressure on a body is reduced, work done by inter-particle field-efforts and centrifugal actions surpass the gravitational attraction and moves the photons in the bitons away from each other. As external pressure is lowered, 3D matter-cores of photons in the bitons assimilate matter from the surrounding universal medium to increase their 3D matter-content levels (the body cools down). After some time, gradually, the body regains enough matter from the surroundings so that the constituent photons in the bitons return to

their stable distances from each other. At any stage, when the body reaches a steady state, at which work done by external pressure is balanced by work done by inter-particle field-efforts, it is at room temperature.

As there is no other body nearby, external pressure on a body in free space is minimal. In free space, a body will be coolest and at its highest 3D matter-content level. Heating a body is to reduce its 3D matter-content level and the total 3D matter-content of the body. Cooling a body is to increase its 3D matter-content level and total 3D matter-content in the body. It is found that a hot body weighs less than the same body in cooler conditions. It shows that 3D matter lost or gained by a body during heating or cooling changes the gravitational attraction between the body and other macrobodies. Since gravitational attraction depends on the 3D matter-content of a body, we can infer that heating or cooling can change the 3D matter-content (represented by its mass) of a body. During heating, a body loses 3D matter-content and thus reduces its weight. During cooling, the body absorbs 3D matter-content and gains weight.

### **Heat and temperature:**

Heat and temperature are different phenomena. However, currently, they are often considered the same or equivalent. This belief is based on human experience that by heating a body, its temperature can be increased. Heat (or heating) is a process by which the 3D matter-content level of a body reduces. Conversely, cooling is a process by which the 3D matter-content of a body increases. Temperature is a number, denoting the average 3D matter-content level of a body with respect to the 3D matter-content level of a reference body, calibrated with respect to the 3D matter-content levels at different reference states.

Changes in the temperature of a body do not always mean corresponding changes in the 3D matter-content level of the body, which depends solely on external pressures on its constituent bitons. To indicate the 3D matter-content level of a body, the reference material in the thermometer has to be in direct contact with the body. The 3D matter-content level of a body, cooling below room temperature, cannot be measured by remote sensing thermometers.

### **Heat and energy:**

Currently, heat is regarded as a form of energy that can be transferred and transformed. Only an entity that has objective existence and some form of structure can be transferred or transformed. But energy is understood as the ability to do work. As an ability is a quality, ability (itself) cannot be transferred or transformed. A real entity that has the ability may be transferred or transformed to improve or deteriorate its ability. Hence, energy cannot be regarded as a real entity. Energy, being a functional entity, can perform all functions assigned to it by rational beings, however illogical they may be.

Heat is related to the transfer and transformation of 3D matter. Due to changes in the 3D matter-content of a body, energy associated with the body also changes. Here, energy is considered to be a shadow of work done in association with a 3D material body.

### **Conclusion:**

Heat (heating/cooling) is a process that changes the 3D matter-content level of a 3D material body. Direct (and indirect) method of heating/cooling is caused solely by variations in external pressures on constituent bitons (primary 3D matter-particles) of the body. Simple mechanical actions by the universal medium accomplish heating/cooling of a body. During heating, the 3D matter-content level of a body reduces, and (usually) the body expands. During cooling, the 3D matter-content level of a body increases, and (usually) the body contracts. A 3D matter-body is at its highest 3D matter-content level when it is coolest and in free space.

### **References:**

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

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