HEAT AND WEIGHT

According to 'MATTER (Re-examined)'

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Abstract: The weight of a macrobody is its acceleration due to gravity, in gravitational units, towards another larger macrobody. During variations in its temperature, a macrobody changes the quantity of its 3D matter (mass). Since mass is a factor in the equations that determine gravitational attraction and acceleration, a macrobody's acceleration due to gravity does not change with variation in its mass. An alternative concept, presented in the book 'Matter (Re-examined)', considers the mass as a mathematical relation representing the equivalent of the 3D matter it contains and the 3D matter content of the body as the quantity of 3D matter it contains. It advocates a mechanism that induces additional changes in the magnitude of gravitational attraction beyond those caused by variations in the macrobody's mass. Thus, it is logical to find that a macrobody weighs less when hot than in a cooler state.

Keywords: Heating, cooling, attraction due to gravity, weight.

Introduction:

An alternative concept, presented in the book 'MATTER (Re-examined)', envisages only one type of unstructured matter particle (the quantum of matter) in the universe. It is derived from a single assumption ('Substance is fundamental, and matter alone provides substance to all real entities'). The entire space, outside the most basic 3D matter particles, is filled with quanta of matter in the form of latticework structures of 2D energy-fields. 2D energy-fields, in all possible planes in space, together form an all-encompassing universal medium. Each 2D energy-field extends infinitely in all directions in its plane. The universal medium is inherently under compression, and this compressive pressure is gravitation. All actions are by and through the universal medium, and hence, there are no actions at a distance through empty space.

Universal medium gathers and compresses quanta of matter, freed from itself, during local breakdowns in any part of space. A collection of free quanta of matter, compressed by gravitational actions from the surrounding universal medium, is converted into 3D status to form 3D matter-cores of photons. The disc-shaped 3D matter-core and associated structural distortions in the surrounding universal medium, together, constitute a photon. Photons are corpuscles of light or similar radiation. They are the basic 3D matter particles in nature. Unions of photons in various combinations form different superior 3D matter particles, atoms, etc. The 3D matter-core of a photon is a spherical-segmented spinning disc. By the actions of the universal medium, a photon moves at constant linear speed (of light) and spins about one diameter of its 3D matter-core. Spin speed (frequency) and angular thickness of the spinning 3D matter-core are proportional to its 3D matter-content.

The presence of the 3D matter-core of a photon breaks the continuity of 2D energy-fields in all planes passing through it. Discontinuity of the universal medium causes gravitational actions from the 2D energy-fields on the 3D matter-core of a photon. Gravitation acts only on the curved periphery of a photon's 3D matter-core. The magnitude of gravitational effort is proportional to the extent of the 2D energy-field acting on the 3D matter-core. The extent of the 2D energy-field in any direction from the 3D matter-core of a photon in free space is infinity. If there are two photons with the disc-planes of their 3D matter-cores in the same plane, gravitational efforts are greater on their outer sides than on their inner sides. As a result, these photons tend to move towards each other. The resultant gravitational effort, trying to move the photons towards each other, is the gravitational (apparent) attraction between them. Similar actions between constituent photons (in the same plane at any given instant) in two macro bodies result in gravitational attraction between them. At any instant, only those photons in both macro bodies, whose disc-planes coincide, contribute towards gravitational attraction between them.

Heating is a process by which the macrobody loses its 3D matter-content and associated energy. Reduction of 3D matter-content of a photon reduces the thickness of its 3D matter-core and spin speed. Conversely, cooling is a process by which the macrobody gains 3D matter-content and associated energy. Enhancement of the 3D matter-content of a photon increases the thickness of its 3D matter-core and spin speed. The temperature of a macrobody gives an indication of its 3D matter-content level and energy-content level with respect to its 3D matter-content and energy-content levels at room temperature.

A free body is a hypothetical object situated in vast space that is not under the influence of any external sources other than the surrounding (stable) universal medium. A macrobody is a union of more than a few primary/fundamental 3D matter particles. The term 'force' is used in its general meaning to indicate the cause of an action. All conclusions expressed in this article are from the book '*MATTER (Re-examined)*' [1]. For details, kindly refer to the same.

Heat:

In physics, heat is the energy transferred from a high-temperature system to a lower-temperature system. The present concept envisages heat as the process of losing 3D matter-content of a macrobody with reduction in its associated energy-content [1]. Every constituent 3D matter particle in a macrobody has a fixed position relative to its neighbours. As the inter-particle bond is fairly weak, certain relative movements (under external efforts) of constituent 3D matter particles in loose groups are permitted in fluid macro bodies.

We shall consider a gaseous macrobody for illustration. Under compression, its volume reduces. Constituent 3D matter particles are pushed nearer and held in that relative position against the natural tendency to move them back to regular mutual distances in natural formation. Pressure energy, invested in a macrobody to reduce its volume, is held in association with it until compression is removed and the macrobody attains its original volume. During the reduction of macrobody's volume, it is heated without any other external influences, as can be noted by the increase in its temperature. Macrobody radiates 3D matter (and associated work) in the form of heat [1]. (In current theoretical terms, certain energy is radiated away from the macrobody in the form of heat and lost.).

Gradually, the macrobody loses enough 3D matter-content, so that its temperature returns to room temperature. Energy input, or work done, in association with the compression of the macrobody has not changed, but the macrobody has lost some 3D matter-content (heat). 3D matter-content (heat), lost from the macrobody, is not originated or converted from pressure energy. Therefore, the 3D matter-content lost from the macrobody is not related to the pressure energy invested in association with the macrobody. During heating, the macrobody loses part of its energy-content, corresponding to the lost 3D matter-content. Thus, heating a macrobody reduces its 3D matter and energy levels, and thereby reduces its total 3D matter-content and energy-content. This is contrary to the prevailing common belief that during heating, the energy level of a macrobody increases. Conversely, when external pressure on a macrobody is reduced, it cools down. That is, the macrobody takes in 3D matter-content from the surrounding universal medium, and work is done by the universal medium to increase its energy-content.

External pressure on a macrobody is lowest when it is in free space. Because there is no other object to influence the part of the universal medium associated with the macrobody. In free space, a macrobody is coolest and at its highest 3D matter-level and energy-content level. Cooling a macrobody increases its 3D matter-level and energy-content level, and thereby increases its total 3D matter-content and energy-content. The temperature of a macrobody is generally taken as an indication of its (3D matter-content level and) energy-content level. Contrary to popular belief, higher temperature indicates a lower energy-content level, and lower temperature indicates a higher energy-content level of a macrobody [1].

Weight:

In order to determine the 3D matter-content of a small macrobody near the Earth's surface, a functional entity called 'weight' is used. Weight is the magnitude of (apparent) attraction due to gravity between a small macrobody and the Earth. Normally, the factors affecting the weight of a small macrobody, like the Earth's total 3D matter-content (assumed to be concentrated at a point below the small macrobody) and the distance between the centres of the small macrobody and the Earth, are considered constant. Knowing the acceleration of a small macrobody under free fall, we are able to determine the magnitude of attraction due to gravity (weight) between the small macrobody and the earth by using the equation F = ma. ['F' is the force, 'm' is the mass representing the 3D matter-content, and 'a' is the acceleration]. This value is further converted to gravitational units by dividing factors on the right-hand side of the equation by a predetermined value of acceleration due to gravity near Earth's surface, ‘g’ in units of force. In this case, g = a. Thus, the weight is able to give us the numerical equivalent of the ‘mass’, and that is generally taken as equivalent to the 3D matter-content of the small macrobody.

The weight of a small macrobody may also be understood (in operational definition) as the effort required to support it in a relatively static condition with respect to the surface of the Earth from moving towards the Earth's centre. The full weight of a small macrobody can be obtained only when its acceleration by attraction due to gravity is fully neutralised by the acceleration provided by the reaction from a support or restricting effort against its fall towards the centre of the Earth.

Consider a small macrobody accelerating towards the Earth under the mutual attraction due to gravity. (For the sake of this discussion, we shall ignore the acceleration of the Earth towards the macrobody and consider that the acceleration of the small macrobody is the combined action of accelerations of both the small macrobody and the Earth.) The small macrobody continues to be under acceleration due to gravity until it merges with the Earth. When the small macrobody is free to accelerate towards Earth, it is in free fall. Since the small macrobody is not restricted (supported), it appears to be ‘weightless’. If a supporting effort applied against attraction due to gravity is more than that required to prevent the small macrobody’s acceleration towards the Earth, the weight of the small macrobody is proportionately higher. This is how a person in an accelerating rocket feels higher gravitational effort (weight).

The action of external effort on a macrobody in the direction of its linear motion and the magnitude of its acceleration also depend on its present linear speed. Therefore, as the velocity of the small macrobody towards the earth increases, the effect of attraction due to gravity on it decreases [1]. The magnitude of its acceleration declines. However, the small macrobody continues to increase its velocity at a slower rate. This process will continue until the velocity of the small macrobody reaches a stage when its constituent 3D matter-particles break down to primary 3D matter-particles. Thus, many of the smaller macrobodies in space, accelerating towards Earth, normally revert to their constituent primary 3D matter-particles long before they attain the velocity of light. Liberated primary 3D matter particles of a disintegrated small macrobody move away in various directions, depending on the direction of their motion at the instant of liberation. This phenomenon reduces the probability of too many small macrobodies from outer space bombarding Earth or any other larger macrobodies in space. Many of the smaller macrobodies, which are able to attain linear speeds nearer to the speed of light, disintegrate before they can approach Earth.

Temperature & acceleration due to external effort:

Changes in the 3D matter-contents of the primary 3D matter particles in a macrobody, due to a difference in its temperature, affect its inertial actions under external efforts. The relationship between the magnitude of the external effort and the macrobody’s acceleration is its ‘mass’. The magnitude of external effort, divided by the magnitude of acceleration of the (static) macrobody, is its rest mass. The rest mass of a macrobody is assumed to represent its 3D matter-content. In these calculations, variations in the 3D matter-content of the macrobody under the changes of its temperature are not taken into consideration. Since a change in temperature of a macrobody changes its 3D matter-content level, its rest mass also changes.

Let the action of an external effort of constant magnitude accelerate a macrobody, whose temperature varies. At higher temperatures, the macrobody has less 3D matter-content, and hence its acceleration is higher in magnitude. This indicates a reduction in its rest mass. Similarly, at lower temperatures, the macrobody has a higher 3D matter-content level, and its acceleration is of lesser magnitude. This indicates an increase in its rest mass. Thus, a macrobody at a higher temperature has higher acceleration compared to the acceleration of the same macrobody at a lower temperature, under the action of identical external effort.

Temperature & acceleration due to gravity:

Consider a small macrobody in the vicinity of Earth. Attraction due to gravity between the Earth and a small macrobody takes place whenever the disc-planes of (constituent) photons of both coincide [1]. Changes in the 3D matter-content of a photon change the angular thickness of disc segments of its 3D matter-core. Higher 3D matter-content increases and lower 3D matter-content reduce the angular thickness of a photon's 3D matter-core. As the smaller macrobody is cooled, its 3D matter-content level increases. Corresponding to an increase in the 3D matter-content level, the angular thickness of the 3D matter-cores and spin frequencies of constituent photons increase. These changes increase the angular sweep area of photons’ 3D matter-cores and increase the number of instants of attraction due to gravitation between the small macrobody and the Earth. As the smaller macrobody is cooled, its attraction due to gravity towards the Earth increases. Opposite conditions occur when the smaller macrobody is heated.

Let the rest mass of the small macrobody be 'm' and the rest mass of the Earth be 'M'. 'G' is the gravitational constant in the 3D spatial system, and 'd' is the distance between the centres of the small macrobody and Earth.

Gravitational attraction between earth and macrobody at reference temperature,

$$GF = Mm\,G \div d^2 \qquad \textbf{(1)}$$

GF is the accelerating effort on small macrobody.

Accelerating effort = mass × acceleration $\quad GF = ma$

Substituting attraction due to gravity in this equation; $\quad Mm\,G \div d^2 = ma \qquad$ **(2)**

(where 'a' is the acceleration of small macrobody due to gravity towards earth).

$$a = M\,G \div d^2 \qquad \textbf{(3)}$$

Let the increase in mass due to the enhancement of the sweep area of segments of matter-cores of the photons during a reduction in temperature is proportional to (K_1t). Mass of the small macrobody increases to m (K_1t), where 'K_1' is constant of proportion and 't' is change in temperature.

This increment affects both sides of the above equation (2) equally. Let the distance between their centres remain constant.

Attraction due to gravity, $GF = Mm\left(K_1 t\right)G \div d^2$

Putting these values in equation (2); $Mm\left(K_1 t\right)G \div d^2 = m\left(K_1 t\right) \times a$

$$a = M\,G \div d^2 \qquad \textbf{(4)}$$

Equation (4) is the same as equation (3). Hence, an increment in mass of the small macrobody due to a reduction in temperature (or due to any other phenomenon, except the addition of 3D matter) does not affect its acceleration due to gravity towards Earth. However, due to their increased 3D matter-content during cooling, photons in the smaller macrobody spin faster. Due to the increase in spin speed, the disc-planes of 3D matter-core of each photon in the smaller macrobody coincide more frequently (in unit time) with the disc-planes of 3D matter-cores of photons in the Earth. This increases the average magnitude of attraction due to gravity between them.

Let the increase in attraction due to gravity, by enhancement of frequency, be proportional to K_2t, where 'K_2' is the constant of proportion and 't' is the change in temperature.

Attraction due to gravity, $\quad GF = Mm\left(K_1 t\right)\left(K_2 t\right)G \div d^2 \qquad$ **(5)**

Putting mass of the smaller macrobody as m (K_1t) and the value of external effort from equation (5) in equation (2);

$$Mm\left(K_1 t\right)\left(K_2 t\right)G \div d^2 = m\left(K_1 t\right) \times a$$

$$a = M\,G\left(K_2 t\right) \div d^2 \qquad \textbf{(6)}$$

In this case, the magnitude of acceleration due to gravity is higher by a factor (K_2t) compared to the equation (4). The acceleration due to gravity of the smaller macrobody towards Earth increases as it is cooled. Reverse action takes place when the temperature of the smaller macrobody is raised. A (small) hot macrobody has a lesser acceleration due to gravity towards Earth compared to the same macrobody in a cooler state.

Conclusion:

Acceleration due to gravity, in gravitational units, is the weight of a macrobody. The gravitational unit determined for Earth (a large macrobody) is assumed constant. Hence, an increase in gravitational acceleration of a small macrobody towards it effectively increases the small macrobody's weight. Thus, the weight of a small macrobody near Earth increases as its temperature is lowered (cooled). Conversely, a reduction in gravitational acceleration of the smaller macrobody towards Earth effectively reduces the small macrobody's weight. Thus, the weight of a small macrobody, near Earth, decreases as its temperature is raised (heated).

References:

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

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