

# HEAT AND WEIGHT

According to 'MATTER (Re-examined)'

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*Abstract:* Weight of a macro body is its acceleration due to gravity, in gravitational units, towards another larger macro body. During variations in temperature, a macro body changes quantity of matter (mass), it contains. Since mass is a factor in equations, to determine gravitational attraction and acceleration, macro body's acceleration due to gravity does not change by variation in its mass. Concept, presented in 'Matter (Re-examined)', consider mass as mathematical relation and matter-content as quantity of matter, a macro body contains. It advocates a mechanism, which causes additional changes in magnitude of gravitational attraction over and above changes caused by variation in macro body's mass. Thus, it is logical to find that a macro body weighs less, when hot compared to its weight in cooler state.

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

## Introduction:

Alternative concept, presented in book 'MATTER (Re-examined)', envisages only one type of unstructured matter-particle (quantum of matter) in universe. It is derived from single assumption ('Substance is fundamental and matter alone provides substance to all real entities'). Entire space, outside 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 all-encompassing universal medium. Each 2D energy-field extends infinitely in all directions in its plane. All actions are by and through universal medium and hence, there are no actions at a distance.

Universal medium gathers and compresses quanta of matter, freed from itself, during local breakdowns in any part of space. Collection of free quanta of matter, compressed by gravitational actions from surrounding universal medium, is converted into 3D status to form matter-cores of photons. Matter-core and associated distortions in universal medium, together, constitute a photon. Photons are corpuscles of light or similar radiations. They are the basic 3D matter-particles. Unions of photons in

various combinations form different superior matter-particles, atoms, etc. Matter-core of a photon is spherical-segmented spinning disc. By actions of universal medium, photon moves at constant linear speed (of light) and spins about one diameter of its matter-core. Spin speed (frequency) and angular thickness of spinning matter-core are proportional to its matter-content.

Presence of matter-core of photon breaks continuity of 2D energy-fields in all planes, passing through it. Discontinuity of universal medium causes gravitational actions from 2D energy-fields on matter-core of photon. Gravitation acts only on curved periphery of photon's matter-core. Magnitude of gravitational effort is proportional to the extent of 2D energy-field, acting on matter-core. Extent of 2D energy-field in any direction from matter-core, in free space, is infinity. If there are two photons with disc-planes of their matter-cores in a plane, gravitational efforts are greater on their outer sides than on their inner sides. As a result, photons tend to move towards each other. Resultant gravitational effort, trying to move photons towards each other, is gravitational (apparent) attraction between them. Similar actions between constituent photons (in same planes 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 macro body loses its matter-content and associated energy. Reduction of matter-content of a photon reduces thickness of its matter-core and spin speed. Conversely, cooling is a process by which macro body gains matter-content and associated energy. Enhancement of matter-content of a photon increases thickness of its matter-core and spin speed. Temperature of a macro body gives indication of its matter and energy-content levels with respect to its matter and energy-content levels at room-temperature.

A free body is a hypothetical object situated in vast space and which is not under influence from any external sources, other than surrounding (stable) universal medium. Macro body is a union of more than few primary/fundamental matter-particles. Term 'force' is used in its general meaning to indicate 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. Present concept envisages heat as the process of losing matter-content of a macro body with reduction in its associated energy-content [1]. Every constituent matter-particle in a macro body has its fixed position relative to its neighbours. As inter-particle bond is fairly weak, certain relative movements (under external efforts) of constituent matter-particles, in loose groups, are permitted in fluid macro bodies.

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

Gradually macro body loses enough matter-content, so that its temperature returns to room temperature. Energy input or work-done, in association with compression of macro body, has not changed but the macro body has lost some matter-content (heat). Matter-content (heat), lost from macro body, is not originated or converted from pressure energy. Therefore, matter-content, lost from macro body is not related to pressure energy, invested in association with it. During heating, macro body loses part of its energy-content, corresponding to lost matter-content. Thus, heating a macro body reduces its matter and energy levels and thereby reduces its total matter and energy-contents. This is contrary to prevailing common belief that during heating, energy level of a macro body increases.

Conversely, when external pressure on a macro body is reduced, it cools down. That is, macro body takes-in matter-content from surrounding universal medium and work is done by universal medium to increase its energy-content.

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

## Weight:

In order to determine matter-content of a small macro body, near earth's surface, a functional entity 'weight' is used. Weight is the magnitude of attraction due to gravity between small macro body and earth. Normally, factors affecting weight of a small macro body, like; earth's total matter-content (assumed concentrated at a point below small macro body) and distance between centers of small macro body and earth, are considered constant. Knowing acceleration of small macro body under free fall, we are able to determine magnitude of attraction due to gravity – weight – between small macro body and earth, by using equation,  $F = ma$ . [ $F$  is force,  $m$  is mass representing matter-content and  $a$  is acceleration]. This value is further converted to gravitational units by dividing factors on 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, weight is able to give us numerical equivalent of 'mass' and that is generally taken as equivalent to matter-content of small macro body.

Weight of a small macro body may also be understood (in operational definition) as effort required to support it in a relatively static condition with respect to surface of earth, from moving towards earth's center. Full weight of a small macro body can be obtained only when its acceleration by attraction due to gravity is fully neutralized by acceleration provided by reaction from a support or restricting effort against its fall towards center of earth.

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

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

### Temperature & acceleration due to external effort:

Changes in matter-contents of primary matter-particles in a macro body, due to difference in its temperature, affect its inertial actions under external efforts. Relation between external effort and macro body's acceleration is its 'mass'. Magnitude of external effort, divided by magnitude of acceleration of (static) macro body is its rest mass. Rest mass of a macro body is assumed to represent its matter-content. In these calculations, variations in matter-content of macro body, under changes of its temperature are not taken into consideration. Since change in temperature of a macro body changes its matter-content level, its rest mass also changes.

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

### Temperature & acceleration due to gravity:

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

Let rest mass of small macro body is 'm' and rest mass of earth is 'M'. 'G' is gravitational constant in 3D spatial system and 'd' is distance between centers of small macro body and earth.

Gravitational attraction between earth and macro body at reference temperature,  $GF = MmG \div d^2$  (1)

GF is accelerating effort on small macro body. Accelerating effort = mass  $\times$  acceleration

$$GF = ma$$

Substituting attraction due to gravity in this equation;  $MmG \div d^2 = ma$  (2)

(where 'a' is acceleration of small macro body due to gravity towards earth).

$$a = MG \div d^2$$
 (3)

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

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

$$\text{Attraction due to gravity, } GF = Mm(K_1t)G \div d^2$$

Putting these values in equation (2);  $Mm(K_1t)G \div d^2 = m(K_1t) \times a$

$$a = MG \div d^2$$
 (4)

Equation (4) is same as equation (3). Hence, increment in mass of small macro body, due to reduction in temperature (or due to any other phenomenon, except addition of matter) does not affect its acceleration due to gravity towards earth. However, due to their increased matter-content during cooling, photons in smaller macro body spins faster. Due to increase in spin speed, disc-plane of matter-core of each photon in smaller macro body coincides more frequently (in unit time) with disc-planes of

matter-cores of photons in earth. This increases average magnitude of attraction due to gravity between them.

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

$$\text{Attraction due to gravity, } GF = Mm(K_1t)(K_2t)G \div d^2 \quad (5)$$

Putting mass of smaller macro body as  $m(K_1t)$  and value of external effort from equation (5) in equation (2);

$$Mm(K_1t)(K_2t)G \div d^2 = m(K_1t) \times a$$

$$a = MG(K_2t) \div d^2 \quad (6)$$

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

### Conclusion:

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

### References:

- [1] Nainan K. Varghese, *MATTER (Re-examined)*, <http://www.matterdoc.info>
- [2] Paolo Zuchi, Thermal free fall, <http://www.permotionenergy.com>

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