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Thermal Wave Motion In Human Body: ODTs In Bio-Medical Sciences

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***Abstract*—Quantum vibration of Lifton (life particle) generates thermal wave in human body, which is associated to some realities, such as: (i) the conservation and transformation of matter and radiation (ii) the role of Einstein's energy- mass equivalence principle, $E = m c^2$ in human life-death systems (iii) the role of three basic energies ΔG, E_L (t, T) and ϵ_{PH} useful in the function of human body. It becomes important to reproduce the relationship $E = m c^2$ from Order – Disorder Transformations (ODTs) because of the involvement of order – disorder concepts of author (SKS) in every event of Universe.**

Actually, thermal wave motion controls heat-temperature maintenance inside human body. The temperature variation has been studied on the basis of ODTs. A differential equation of thermal wave motion has been developed, which under different conditions is useful for bio- medical sciences. Continuity of thermal wave motion remains when there is presence of life, while discontinuity develops when a person is dead. Interruption reflects towards severe disorder of human body system.

Keywords*—Wave motion in Human body system; Unified Scientific Theory; Order– Disorder Transformations: ODTs; Application of ODTs in Bio-Medical Sciences, Bio-Radiation; Lifton (Life Particle) ; Body Temperature and Blood Pressure, Damped harmonic vibration.

1. INTRODUCTION

Three basic energies (i) Gibbs free energy ΔG ($\Delta G = \Delta F - \Delta S$; *F :* Helmholtz energy and *S :* Entropy) , (ii) Internal resource energy – Life energy E_L *(t, T)* [Lifton energy : $E_L (t, T) = \epsilon_T / t = (\lambda / c t) k_B T$], (iii) External resource energy - Photon energy ϵ_{PH} ($\epsilon_{PH} = h/t$; *h* :Planck's constant)are essential for human life and death system [1] . Gibbs free energy is produced by supplying food, minerals and water to human beings. Life energy is the energy generated by bio- radiation energy particle- Lifton (quantized thermal radiation particle), while photon energy is the energy supplied by Sun radiation. It has been already observed that how these three basic energies play their role in running human life and how during death follow Einstein's mass energy equivalence principle $E = m c^2$ (*c:* velocity of light) under Order – Disorder Transformations (ODTs) . Looking to the importance of this principle in human life and death systems, it is also one of the objective of present study to reproduce the relation $E = m c^2$ from ODTs.

It is noticeable that how in earlier studies [2] the results of earlier renowned pioneers Planck, Einstein (photoelectric equation) , Niles Bohr, Heisenberg, De-Broglie etc. have been reproduced by Unified scientific theory of author [3] (SKS) based on order-disorder concepts. Order and disorder characteristic is the nature of all bodies and systems. Our whole universe is filled up with matter and radiation, which follow dual characteristics of particle and wave. That's why universe follows random behaviour (disorder behaviour), while nature follows symmetrical behaviour (order behaviour). Natural order may be described by invisible parameter, time – *' t '* . Every action *'A '* happens due to interplay between energy *' E '* and time *' t '* , which is equivalent in terms of disordered quantity *' D '* and ordered parameter *'O'* :

$$A = f(E) \cdot f(t) = f(D) \cdot f(O) \quad (1)$$

Nature and Universe affect to every action and event as universe part is played in quantity *f(E)* and nature part is played in quantity *f(t)* in above equation. ODTs are relevant to understand an action or event of atomic, molecular, bio-molecular, human life and death systems etc., which forms a Unified scientific theory as also advised by Lord Krishna in Bhagwadgita [4] – a Hindu religious philosophy. The success of an action or an event depends on the equilibrium established between universal and natural ingredient *'E'* and *'t'*, respectively during their happenings. Similarly a human may get success in performing an action only by stable mind and that state develops only by concentration- an equilibrium state, which is called spirituality.

Heisenberg [5] discussed about the measurement of the minimum values of '*E'* and *'t'* of above equation in differential space as follows:

$$\Delta E \cdot \Delta t \geq \hbar \ (\hbar = h/2\pi \ ; \ h: \text{Planck's constant}) \quad (2)$$

Above equation of Heisenberg Uncertainty principle has been found valid for atomic systems only. The generalized form of above equation in integral space forms ODTs- Unified scientific theory of author (SKS) as described by [2, 3]

$$\int\int f(T, t)\, \Delta T.\, \Delta t \approx \int\int f(E, t)\, \Delta E.\, \Delta t \approx (1/2\,\pi) \approx \int\int f(D,O)\, \Delta D.\, \Delta O\,, \quad (3)$$

where the symbols have their usual meanings. The statistical distribution function

$f(D , O)$ (say) is described by

$$f(D, O) = e^{E/\epsilon D} \cdot e^{-\epsilon O/\epsilon D} \quad (4)$$

The new concept of the author in the form of Unified scientific theory reflects the dual nature of determinism and indeterminancy in every physical phenomenon. Moreover, such a statistical discipline may be true for the movement of a single electron or photon and its associated wave or movement in a group form.

The objectives of this paper are to observe (i) the validity of author Unified Scientific Theory in reproducing Einstein mass –energy equivalence principle $E = m c^2$ (ii) the importance of statistical function $f(t, T)$ in describing the role of temperature variation in case of human body system under ODTs with respect to above described three basic energies , ΔG, $E_L(t, T)$ and ϵ_{PH} useful for bio-medical sciences (iii) to develop a differential equation of a harmonic wave useful for bio-medical sciences. Methodology used in this investigation has been given in Section-2, while the dynamics has been presented in Section-3. The obtained results and discussion have been given in Section-4, while conclusions are mentioned in Section-5 of this paper.

2 METHODOLOGY

Human life system depends on some physical principles of conservation and transformation of matter and radiation. Photon radiant particles of sun radiation, which works as external energy resource, play prominent role towards it. Similarly, bio-radiant particles work as internal energy resource inside human body. We have used the relativistic concept in present theoretical investigation of the thermal motion and its effects in human body. In the order- disorder concepts introduced here , we consider disorder as a conceptual form of photon energy, $\epsilon_{Ph} = h\upsilon = h/(Q_F t)$; while order as a conceptual form of energy for maximum quantization, Q_F , $(Q_F = \lambda / c\, t : Q_F \rightarrow 1)$, $\epsilon_{Ph} = h/t$. Q_F is a quantization factor, while the other symbols have their usual meanings. Time ' t ' is an invisible variable parameter, which describes natural order . Similarly, a Lifton energy, $E_L = \epsilon_T \upsilon = \epsilon_T /(Q_F t')$, which for maximum quantization Q_F , $(Q_F = \lambda / c\, t : Q_F \rightarrow 1)$ becomes $E_L = \epsilon_T / t'$. E_L is the energy of bio-radiant particle as considered earlier . We call ϵ_T as SYA constant . It becomes essential now us to reproduce Einstein mass-energy equivalence relation $E = mc^2$ by Order-Disorder Transformations (ODTs) in order to test its validity in relativistic motion consideration here.

Bio-radiant particle Lifton plays very important role with in human cell and in the development of biochemical activities. Similarly Gibbs energy ΔG contributed from food, minerals and water play prominent roles in the different activities of human body function. This energy along with other two resource energies generated by lifton and photon maintain equilibrium states helpful for different human body functional activities. Order Disorder Transformations (ODTs) methodology[3] of Unified Scientific Theory [2] has been employed here in order to see the role of three basic energies, photon energy, lifton energy, Gibbs energy in the maintenance of thermal equilibrium state in the human body system, as well as in the development of a differential equation useful for bio-medical sciences. The importance of obtained differential equation of thermal waves and its effects on human body have been discussed in detail in this paper.

3. DYNAMICS

(A) Reproducing Einstein's mass-energy relationship $E = m c^2$

The Einstein's mass – energy equivalence relationship is described by

$$E = m c^2 \quad (5)$$

This equation may be reproduced from Order-Disorder Transformations (ODTs)as given by eq. (3)::

$$\int\int f(E, t)\, \Delta E.\, \Delta t \approx (1/2\,\pi) \quad (6)$$

where $f(E, t) = e^{[E/(\epsilon re)\, ph]}\, e^{-[\epsilon ph/(\epsilon re)\, ph]}$ (7)

Here ϵ_{re} is the photon radiant energy as derived from the equivalence of quantized kinetic energy $(p / 2m ; p = h\upsilon / c)$ with the classical kinetic energy $(\frac{1}{2} mv^2)$ in quantized condition as given by

$$(\epsilon_{re})_{ph} = cp \quad (8)$$

By using the values of $(\epsilon_{re})_{ph}$ and ϵ_{ph} in eq. (7) and then the value of $f(E, t)$ in eq. (6), we finally obtain the Einstein's mass – energy relationship $E = m c^2$.

(B) ODTs of time ' t ' and temperature ' T '

Sun is the only source of supplying energy to all materials of this universe. There are a number of atomic nuclei of different elements inside sun by which multiple activities take place in the form of quantum energy particles with different wave length λ, which in turn are related to temperature T as

$$T \rightarrow f(E) \rightarrow f(1/\lambda) \quad (9)$$

Different atomic vibrations of elements inside sun due to dominance of temperature in the simplest form for ODTs may be described by [3]

$$\psi = \sin[2\,\pi\, f(T, t)]\,, \quad (10)$$

For which quantum parity condition $\int \psi \psi^* = 1$ leads to eq. (6) as represented also in combined form of eq (3). DNA function depends on time and energy / temperature variations, which is true for the life system.

Actually there is thermal wave motion inside human body system and Lifton energy $E_L(T, t)$ play an important role in running life system. There is a fixed body temperature for the normal function of the physical body. The increasing and decreasing situations of temperature from that optimum value affect body condition. Any interruption in the function of DNA arises from the degradation of temperature of a physical body system, which may be the cause of life collapse. Temperature varies inside human body depending on internal environment. Hot junction and cold junctions are developed inside human body, which affect thermal wave motion.

Hindu scripts like – Vedas and Ayurvedas - Charak Samhita have also discussed cold and hot fever as consequences of temperature fluctuations below and above normal temperature of the human body. The temperature and pressure of blood circulation varies at different places of the body. i.e., on a whole, it causes blood pressure. Thus, generated thermal wave motion is also affected by it. The above description has played prominent roles in the following dynamics.

(C) Body Temperature And Blood Pressure

Basic resource energy for the function of human physical body system is Gibbs energy $E = \Delta G$ as supplied to body by food, minerals and water. The potential energy generated by it returns to help the body to sweat through skin. Skin protects the body against harmful bacteria and other foreign particles. The human body has a remarkable capacity for regulating its core temperature somewhere between 98°F and 100°F when the ambient temperature is between 70°F and 130°F approximately. The temperature of the body is regulated by neural feedback mechanisms. Under controlled conditions these mechanisms cause sweating that begins almost precisely at a normal skin temperature of 98°F (37°C) and increases rapidly as the skin temperature rises above this value. The heat production of the body under these conditions remains almost constant as the skin temperature rises. If the skin temperature drops below 98°F (37°C) a variety of responses are initiated to conserve the heat in the body and to increase heat production.

The Importance of other two internal and external energy resources(Bio- radiation and Sun radiation) is well known. The distribution function $f(T, t)$ having all three basic energies ΔG , $E_L(t , T)$ and ϵ_{PH} as mentioned above may be described by

$$f(T, t) = e^{\Delta G / EL(t , T)} . e^{-\epsilon ph / EL(t , T)} \quad (11)$$

Life particles are in random motion inside body due to blood circulation. We consider a relativistic concept between photon and lifton particles motion. Such that $\epsilon_{PH} = h / t$ and $E_L(t , T) \rightarrow \epsilon_T / t'$ where ϵ_T ($\epsilon_T = \lambda k_B T / c$) is SYA constant of lifton energy E_L .

Thus distribution function takes the form

$$\rightarrow e^{\Delta G / (\epsilon T / t')} . e^{-(h/t)/(\epsilon T / t')} \quad (12)$$

where $t' = t / a$ and $a = (1- v^2 / c^2)^{-1/2}$. Here v is relative velocity, c is velocity of light. By employing above value of distribution function in the following ODTs equation of temperature 'T' and time 't' variables as obtained from eq. (3)

$$\int\int f(T, t)\, \Delta T . \Delta t \approx (1/2 \pi) \quad (13)$$

Finally, we obtain

$$[(\Delta G - \epsilon_{ph}) / E_L \quad L \quad PH / E_L] \quad (14)$$

Let $(\Delta G - \epsilon_{PH}) / E_L = \Lambda$ (15)

Thus, eq. (14) may be given by

$$E_L / (\Delta G . \Lambda) = (1/2 \pi t) e^{-\Lambda} , \quad (16)$$

Or $E_L = (1/2 \pi t) . \lambda ; \lambda = (\Delta G . \Lambda) e^{-\Lambda}$ (17)

Here, λ is the disorder factor, which is generated due to relative motion and it causes abnormalities and variations in the temperature. λ is responsible to describe all diseases , infections and disturbances in the human body system. From the above equation time ' t ' and temperature ' T 'variations may be described by

$$(2 \pi a^2 \lambda^2 k^2 T^2) / [c^2 \Delta G (\Delta G t - h)] = e^{-c (\Delta G t - h) / (a \lambda k B T)} \quad (18)$$

By finding the values of different constants of above equation, one may find out the temperature of human body at different timings. Hence blood pressure of the body may be determined at different time intervals.

(D) Differential Equation of Thermal Wave Motion

Different matters and bio-radiant energy exist inside human physical body. On the basis of their dual nature of particle and wave as true, it is considerable [Section 3(B)], $f(T, t) = E_L(T, t)$. Accordingly, following eq. for the wave function of the thermal wave motion in human body

may be described by

$$\Psi = Sin [2 \pi E_L(T, t)] \quad (19)$$

Such wave motion is useful in describing disorders generated inside the body system as they are responsible for creating infections. Deep studies of wave motion may be helpful in medical treatments.

The wave function Ψ represented by eq. (19) is also useful in finding the differential equation of thermal wave motion in human physical body system. We have evaluated the first differential $d\Psi / dt$ and second differential $d^2\Psi / dt^2$ and then finally following

second order linear differential homogeneous equation has been obtained.

$(d^2 \Psi / dt^2) - F_E (d \Psi / d t) + 2\pi F_E K e^{FE t} \Psi = 0$, (20)

where $F_E = (\Delta G / a \epsilon_T)$ (21)

and $K = e^{(-h/a \epsilon T)}$ (22)

Eq. (20) is an equation of free vibration with damping as followed here for Bio-radiation damping. In bio radiation damping, vibrating energy of moving charges, such as lifton, is converted to electromagnetic energy and is emitted in the form of radio waves or infrared or visible light. Resonant vibration in the Bio-radiation may be produced by resonance on quantum scale such as lifton in human body. If a human body has a strong resonant frequency then a bag of jelly would add a lot of damping to the system. Experiments have shown that only one resonance frequency or damped natural frequency of human structure systems are observed on structures, such as grand stands or floors with crowds [8].

A wave propagating into a system adds energy to a system, whereas damping removes it. Generally, the dissipated energy from the vibration is converted to heat, and if damping does not take enough energy out of a system, the system can self-destruct from energy overload. The amount of energy in a system at a given time is reflected in the system's stress/strain level. The more stresses/strains in the system, the higher the energy level. Once the stresses reach a value greater than the yield strength of the system, yield failure is imminent above eq. (20) may be generalized of the form:

$(d^2 \Psi / dt^2) - A (d \Psi / d t) + B . exp (x) \Psi = 0$ (23)

A and B are constants and x is variable. We obtain on comparing eqs.(20) and (23)

$A = F_E$, $B = 2\pi F_E K$ and $x = F_E t$. (24)

Damping coefficient $= F_E = (\Delta G / a \epsilon_T)$ (25)

Critical Damping coefficient $= 2n\omega = 8\pi (\Delta G/a\epsilon) e^{[(\Delta G t - h)/a \epsilon_T)]}$ (26)

Hence Critical Damping Ratio = Damping Coefficient / Critical Damping Coefficient

$= \xi$

$= (\Delta G/a\epsilon_T) / [8\pi (\Delta G/a\epsilon_T) e^{[(\Delta G t - h)/a \epsilon_T)]}]$ (27)

ω_n is the natural frequency at which human structure system tends to oscillate in the absence of any driving or damping force. The natural vibration or free vibration of human elastic structure system occurs at this natural frequency.

Case – 1 When $\xi > 1$; i.e., system is under damped (oscillating decay)

$(\Delta G/a\epsilon_T) > 8\pi e^{[(\Delta G t - h)/a \epsilon_T)]}$ (28)

Case – 2 When $\xi < 1$; i.e., system is over damped and will die out without damping.

$(\Delta G/a\epsilon_T) < 8\pi e^{[(\Delta G t - h)/a \epsilon_T)]}$ (29)

Case – 3 When $\xi = 1$; i.e., system is critically damped and system will not oscillate.

$(\Delta G/a\epsilon_T) = 8\pi e^{[(\Delta G t - h)/a \epsilon_T)]}$ (30)

Damped Natural frequency $= \omega_d = \omega_n (1 - \xi^2)^{1/2}$ (31)

$= (1 / 2n) [8\pi (\Delta G/a\epsilon_T) e^{[(\Delta G t - h)/a \epsilon_T)]}]$ (32)

The effects of vibration on the human body could be minimized by optimizing damping. In oscillatory wave motion many oscillations may occur and motion decays to 0 as time increases. The continuity of thermal wave motion remains when there is presence of life, while discontinuity develops when a person is dead. The existence of many ups and downs in wave motion reflects severe disorder of human body system.

Quantum vibration of lifton generates thermal waves [8]. The generated thermal waves will affect human body. Not only the tissues and organs will be affected but the functional systems of the body will also be affected. For example, in case of cataract the mechanism of injury leading to eye lens opacity is thermal. Thermal radiation emitted depends on body temperature, area and characteristics. Human electromagnetic emission is in the ELF band as known during considering the electrodynamics of nervous system. In case the nervous system become a region of high potential and maintain an induction of charge across the electrically active regions of the body it may fulfill the role of a dielectric and causing dipolar polarization with thermal effects. Thermal waves develop heat during interaction with exciting molecules of the substances. Every moment particles of human body move rapidly which constantly are disturbing the "Universal field" in the space. Few particles are vibrating fast and that's why we merely observe thermal radiation in infrared region.

4 RESULT AND DISCUSSION

The validity of Unified Scientific Theory in terms of ODTs has been observed in case of reproducing Einstein's mass- energy relationship $E = m c^2$ as we used relativistic concepts in present investigation. The obtained relationship for the first time between temperature and time of thermal wave motion in case of human body system will be useful in describing blood pressure at different timings. The present investigation will be useful in finding the continuity and discontinuity of thermal wave motion, which are the indications of presence of life and death in human body. The obtained results of a damped harmonic wave will be useful in further studies of Bio-medical sciences.

5 CONCLUSION

The study concludes the validity of Unified Scientific Theory of author (SKS) in case of reproducing the mass-energy relationship of Einstein. There is continuity of thermal wave motion when a

person is alive while discontinuity occurs due to disorder of body system, which indicates death. In case, there are many ups and downs in wave motion, it reflects severe disorders in human body system. The wave motion studies in case of human body as discussed in this paper are useful for further studies in bio-medical sciences.

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