From the Guest Editor

THERMAL SCIENCE FOR THE REAL WORLD
Reality and Challenge

by

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Thermal science becomes a main tool to the search for hidden pearls in various phenomena from geoscience to nuclear energy. This article elucidates the absolute temperature in view of the geometric potential theory, which sheds a new light on many mysteries in our world, including unification of Newton's gravity and Coulomb's electronic force, quantized trajectories of planets, the Earth's inner core, prediction of the speed of light and two-scale thermodynamics. Some conjectures are suggested to elucidate relativity in view of thermodynamics.

Keywords: *inner core of the Earth, modified Newton's gravity, plasma-like state, magnetic force, dark energy, relativity, two-scale thermodynamics, two-scale economics, planet's quantized trajectory*

Introduction

Before writing this editorial article, I should begin with the absolute temperature, anyone know its value, it is –273.16 $^{\mathrm{o}}$C, but why is it not other values?

It was El Naschie who first gave a theoretical derivation by the E-infinity theory [1]:

$$T_0 = 1 - 2\alpha = 1 - 40\varphi^4 = -273.16\ ^\circ\mathrm{C} \tag{1}$$

where α is the fine structure electromagnetic coupling constant, α = 137.082039325 MeV, φ is the golden mean, $\varphi = (1+\sqrt{5})/2$.

The out space has a temperature of –273.16 $^{\mathrm{o}}$C , this is a threshold, no man can obtain a matter with a temperature below –273.16 $^{\mathrm{o}}$C. So we can guess that the temperature might be relative to electromagnetism.

Now the next question is what the temperature is. As everyone knows that the temperature is relative to the kinetic energy. We consider a molecule in an out-space, where the Earth's gravity vanishes completely, the temperature of the molecule becomes –273.16 $^{\mathrm{o}}$C. So

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the Earth system should reach a space where the temperature is –273.16 °C. According to the previuos analysis, the radius of the Earth system should be much larger than 6371 km of the Earth's radius or the distance between the Moon and the Earth.

The geometric potential vs gravity

Now we turn back to consider the temperature inside of the Earth. What is the temperature in the centre of the Earth? To answer this question, I should give a brief introduction to the geometric potential theory [2]. The theory claims that any a boundary can produce a force, it can be a gravity or capillary force, and it has been widely used to explain various phenomena, which are beyond the ability of Newton's laws [3-7].

The geometric potential can be expressed:

$$E(r) = -\frac{k}{r} \tag{2}$$

where k is a constant and r – the radius of the studied matter.

The force produced by the boundary can be calculated:

$$F(r) = \frac{\mathrm{d}E}{\mathrm{d}r} = \frac{k}{r^2} \tag{3}$$

Equation (3) implies both Newton's law of gravity and Coulomb's law:

$$F = G\frac{M_1 M_2}{r^2} \tag{4}$$

$$F = K\frac{q_1 q_2}{r^2} \tag{5}$$

where M_1 and M_2 are masses of two attracted subjects, q_1 and q_2 are two attracted charges, and G and K are constants.

We assume that when $r = R_\infty$, the Earth's gravity vanishes, so eq. (3) has to be modified:

$$F = \frac{k}{r^2}\left[1 - \left(\frac{r}{R_\infty}\right)^p\right]^q \tag{6}$$

where p and q are constants, $q > 0$. Additionally we can assume that potential has the form:

$$E = -\frac{k}{r}\left[1 - \left(\frac{r}{R_\infty}\right)^P\right]^Q \tag{7}$$

where P and Q are constants, $Q > 1$.

We suggest a modification of Newton's law for gravity:

$$F = \frac{GM_1 M_2}{r^2}\left[1 - \left(\frac{r}{R_\infty}\right)^p\right]^q \tag{8}$$

or

$$F = \mathrm{G}M_1 M_2 \frac{\mathrm{d}E}{\mathrm{d}r} \tag{9}$$

where E is defined as eq. (7).

The modified Coulomb's law is:

$$F = K\frac{q_1 q_2}{r^2}\left[1 - \left(\frac{r}{R_\infty}\right)^p\right]^q \tag{10}$$

or

$$F = Kq_1q_2\frac{\mathrm{d}E}{\mathrm{d}r} \tag{11}$$

where E is defined as eq. (7).

Earth's structure

When r tends to zero, the force produced by the geometric potential is infinite large:

$$F = \lim_{r\to 0}\frac{k}{r^2}\left[1-\left(\frac{r}{R_\infty}\right)^p\right]^q \to \infty \tag{12}$$

To explain eq. (12), we consider the well-known atom energy (nuclear energy). When an atom is broken into two parts, huge energy can be produced. If an electron would be broken, energy would also be produced.

The inner core has an extremely high potential, and it is an extremely abundant supply of energy in future.

According the energy conservation, we have:

$$K(r) + E(r) = C \tag{13}$$

where K is the kinetic energy, E – the potential energy, and C – the total energy, which is a constant. We assume that the temperature scales with the kinetic potential in the form:

$$K(r) \propto T \tag{14}$$

According to eq. (13), we have:

$$T(r) \propto -E(r) \tag{15}$$

So the temperature can be expressed:

$$T = T_\infty + \frac{k}{r}\left[1-\left(\frac{r}{R_\infty}\right)^P\right]^Q \tag{16}$$

where T_∞ is the absolute temperature. Equation (16) implies that the temperature of the inner core of the Earth tends to be infinite large.

Every matter in the inner core is subject to an extremely high pressure and an extremely high temperature, under such an extreme condition, every matter should not be in a state as that for solid or gas or liquid or plasma, it should be an unknown state, which is similar to the plasma state, and I want to call it as a magnet-like state, where elements, which are listed in the periodic table, might not exist independently, even the electrons and nuclei might not be distinguished from each other. The matter in the inner core might move regularly, and the regular motion produces a magnetic force, which can be measured on the Earth's surface.

Temperature near the Earth surface

When climbing a high mountain, we can feel cool on the top; and when in a deep mine, we can predict a high temperature. In a deep space, or in a microgravity condition, an air vehicle has much less air drag and less gravitational acceleration, these factors are helpful to design optimally a new generation of an aircraft to fly extremely fast with remarkably less energy and oxygen consumption in a microgravity condition.

The temperature near the Earth surface can be expressed:

$$T(r) = a + \frac{b}{r} \tag{17}$$

where a and b are constants. We assume the Earth's radius is R_0 and its temperature is T_{surface}, that implies:

$$a + \frac{b}{R_0} = T_{\text{surface}} \tag{18}$$

By the Taylor series method [8-11], we:

$$T(R_0 + h) = T_{\text{surface}} - \frac{b}{R_0^2} h \tag{19}$$

When $h > 0$, we can predict the temperature on a mountain is lower than that on the surface. On a deep mine, we have $h < 0$, eq. (19) implies a higher temperature. Any organic matters, like a tree, can be easily carbonized in a deep underground due to the high temperature.

Quantized trajectory

Why does our solar system have 8 (or 9?) planets, moving in their own trajectories while not other places? Why do electrons have quantized trajectories? Both phenomena can be explained by the potential theory.

Each subject, a planet or an electron, moves around a trajectory where the potential produces maximal attraction force, that is:

$$F = \frac{\mathrm{d}E}{\mathrm{d}r} = \frac{k}{r^2}\left[1 - \left(\frac{r}{R_\infty}\right)^P\right]^Q + \frac{kQP}{R_\infty^P} r^{P-2}\left[1 - \left(\frac{r}{R_\infty}\right)^P\right]^{Q-1} \to \max \tag{20}$$

or

$$\frac{\mathrm{d}F}{\mathrm{d}r} = 0 \tag{21}$$

from eq. (21) we can obtain quantized trajectories from $r = 0$ to $r = R_\infty$.

Light and dark night

Now the last question is why the night is so dark? Everyone knows the night is dark, but why? Someone might say that the opposite side of the Earth block the light. Yes, it is the fact, but it cannot block the light in the whole universe. The Earth is too small to block all of the Sun's light, and the night should be as bright as or even more bright than the daytime if the Sun should be a light source. But the night does be dark. The dark must be relative to the Sun's light, which moves fastest, about 300000 km/s.

A photon must be travelled from a high potential to a lower one. The Sun has the highest potential in our solar system, the Earth has a lower potential, so a photon can travel from the Sun to the Earth; The Mars has also a lower potential, so the light can also reach it. However, if it is a dark matter with a higher potential than that of the Sun, the light cannot shin on it.

According to eq. (13), when $E = 0$, we have maximal kinetics:

$$K_{\max} = C \tag{22}$$

or

$$\frac{1}{2}mu_{\max}^2=C \tag{23}$$

where m is the weight of the mass, which can be expressed:

$$m=m_0a=m_0\frac{k}{R_\infty^2}(1-\beta^p)^q \tag{24}$$

When a photon travels through a no-gravity space, we have:

$$m=m_0g=m_0\frac{k}{R_\infty^2}(1-\beta^p)^q \tag{25}$$

or

$$m=m_0g=m_0\left\{\frac{k}{r^2}\left[1-\left(\frac{r}{R_\infty}\right)^P\right]^Q+\frac{kQP}{R_\infty^P}r^{P-2}\left[1-\left(\frac{r}{R_\infty}\right)^P\right]^{Q-1}\right\} \tag{26}$$

where g is the gravitational acceleration, m – the weight, m_0 – the rest mass, and $\beta = r/R_\infty$. When g tends to zero, the mass tends to infinity. We assume $q = 1/2$, then we have:

$$m=\frac{m_0}{\sqrt{1-\beta^p}} \tag{27}$$

This equation is similar to that in relativity. Now eq. (23) leads to the following result:

$$u_{\max}^2=\frac{2CR_\infty^2}{m_0k(1-\beta^p)^q} \tag{28}$$

or

$$u_{\max}=\frac{u}{(1-\beta^p)^q} \tag{29}$$

where

$$u=\sqrt{\frac{2CR_\infty^2}{m_0k}} \tag{30}$$

Equation (28) can predict the velocity of light.

Two-scale mathematics

Every physical law is scale dependent. Newton's laws work on a macro-scale, when the scale tends to an extremely smaller one, saying a molecular size, water becomes discontinuous, and the all theories, which are built on the assumption of the continuum assumption, become invalid.

Turbulence can be explained by the two-scale thermodynamics [10, 12-14], the large scale follows the continuum assumption, while the smaller one is the molecule scale. The turbulence must begin with a molecular motion, the average velocity across a distance Δx or a across a period Δt can be expressed:

$$\bar{u}\propto(\Delta x)^\beta \tag{31}$$

$$\bar{u}\propto(\Delta t)^\gamma \tag{32}$$

where Δx can be considered average distance among molecules, Δt – the minimal measure time, $\Delta t \approx \Delta x / \bar{u}$, β and γ can be explained as the two-scale fractal dimensions in space and time, respectively. Equations (31) and (32) are the basic assumptions for the fractal calculus. The two scale thermodynamics views each object using two different scales. It can be also used for explanation of economic phenomenon. For example, individual pig-raising should be eliminated completely according to the macro-economics, because it might pollute the environment. However according to the micro-economics, the micro-economics should be encouraged because it is a good micro-economic model. To be good or not to be good, it depends upon the scale, so an economist should develop a two-scale economic theory.

Conclusion

This article gives some conjectures which might be all wrong, but the aim is to focus the challenge of thermal science in future for the real world. The thermal science will play an increasing role in every field. We might obtain infinite energy from deep earth in future.

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