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Thermodynamics Effect of the Sun on the Earth

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Abstract
How the heat produced by the sun affects Earth. Mass, density and amount of heat which the Earth contains. Change of Earth's volume due to changes in its distance from the Sun. Why Earth's distance from the Sun cannot increase or decrease. Motion of Earth viewed from the Sun and from space. Velocity of the Sun in space and distance of the Sun from the centre of its circular motion.

Keywords: Earth, precession, Steiner's theorem, rotational axis, oscillation of Earth's orbit, the Sun

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I. INTRODUCTION

In astronomy, it is known that Earth and all the planets circularly move around the sun, but what is not known is which forces act Earth and its planets to cause the circular motion around the Sun. The only thing that is known is that the constant average distance of the planets from the Sun is maintained due to the action of the centrifugal force of the circular motion of the planets which is in balance with the gravitational pull between the Sun and the planets. The cause of rotation of the planets around their axis as well as the cause for shortening of the year (0.47") in present time is not known. All unknowns related to the kinematics and dynamics of celestial bodies can be resolved if thermodynamics is incorporated into astrophysics.

All current unknowns relating to the Earth and therefore to its planets will be resolved and explained in detail in this article, as well as the manner of determining the velocity of the Sun and its distance from the centre of circular motion, which shall give a significant contribution to the further development of astronomy.
In this article, we will use the quantities defined in the previous paragraph and which pertain to the Sun.

Earth

Earth is the third planet from the Sun, and all its orbital and physical characteristics are reliably known unlike other seven planets in this solar system of celestial bodies for which only distances from the Sun and their sizes are known.

Calculated mass of the Earth $(6\times 10^{24}\ kg)$ is possible and realistic, but the density is too large and unrealistic. It is thought that the density of the mass of the Earth is so large because it contains a large amount of iron concentrated in the interior of the Earth due to gravity. If the Earth's density at a surface at the depth of 20 *km* is not greater than 2,500 kg/m^3 as was measured, it is not possible for the rest of the Earth to be filled with iron which has a density of 7,800 kg/m^3. In this case, the same mistake was made as when determining the mass of the Sun, because what was determined was the attractive force of two masses in which the share of heat mass was ignored. Earth's mass additionally contains a large quantity of heat mass, so the calculated Earth's mass is the absolute mass consisting of solid matter mass and heat mass. Therefore, the Earth's density is not 5,500 kg/m^3 as was calculated from the quotient of the Earth's mass and volume, but it is not greater than 3.000 kg/m^2. Therefore the total mass of the Earth contains $3\times 10^{24}\ kg$ of solid matter and approximately $2{,}5\text{x}10^{24}$ heat mass. From this we can determine the amount of heat energy contained in the Earth's mass:

$$E_{TZ} = m_{TZ}\times c^2 = 2{,}5\times 10^{24}\times(3\times 10^8)^2 = 22{,}5\times 10^{40} \quad (kgm^2/s^2;\ Ws\ ;J;Nm)\ \text{or}$$

$$22{,}5\times 10^{40}\times 0{,}239\times 10^{-3} = 5{,}4\times 10^{37} \quad (kcal) \qquad 1)$$

$$1\ W_s\ ; J = 0{,}236\ kcal$$

Average temperature inside Earth is also not possible to determine with certainty from the same reason as was the case for the Sun, but it cannot be greater than the temperature within the Sun. Unlike the Sun, the Earth no longer loses its internal heat, but rather its heat loss is equal to that of the Sun i.e. $0{,}5\times 10^{-23}\%$. The amount of the heat the Earth receives from the Sun on the day side, is lost by radiation (by night) on the opposite side i.e. absorption coefficient is equal to the emission coefficient (radiation) according to the *Kirchhoff's law*. Otherwise, the Earth would heat up due to the energy received from the Sun.

If we view the motion of the Earth from space, directed towards the Earth's north pole, then the Earth's speed is equal to the speed of the Sun, and if we observe the motion of the Earth from the position of the Sun, than the Earth moves circularly around the Sun so the question then arises: which forces act upon the earth and other planets to cause them to circle the Sun.

Only answer is that it is a consequence of circular motion of the Sun around the centre to which the Sun belongs. If the Sun would be at rest in space, than the Earth would also be at rest or if the Sun would move rectilinearly, then the Sun would drag the Earth and all of the planets behind it, so in both cases there would be no circular motion of the Earth and the planets. The circular motion of the Sun is the necessary precondition for the Earth to move in a circle around the Sun but it is not sufficient for the Earth to permanently orbit the Sun and to maintain the constant radial speed and the same distance to the Sun. In order to meet all the requirements for permanent circular motion of the Earth around the Sun at a constant distance, where the Earth is not physically connected to the Sun, certain invisible forces must exist which need to be determined and quantified.

Thermodynamic effects of the Sun on the Earth:

From thermodynamics it is known that every matter changes it volume with a change of heat and temperature. The lower the temperature, the smaller the volume and vice versa. As a rule, this change is linear and is dependent on the type of matter i.e. on the cubic thermal expansion coefficient, which is known for a large number of substances. Therefore, all planets, Earth included, increase or decrease in volume when heat is brought or taken away, by getting closer or by moving away from the Sun. Permanent reduction in volume only occurs when the amount of heat brought to Earth and the planets decreases due to the Sun's loss of heat. This is where we should look for causes of earthquakes and volcanic eruptions.

By measurements it was established that the Earth, on its path around the Sun, comes closer and moves away from the Sun, when viewed from the position of the Sun. In January, Earth will be closer to the Sun by 2.5×10^6 km (perihelion) and in the month of June it will be farther from the Sun by 2.5×10^6 km (aphelion). This change in distance to the Sun has an effect on the influx of heat from the Sun to the Earth. When the Earth is farthest from the Sun it will receive less heat and when it is closer it will receive more heat. By coming closer to the Sun, the Earth gets warmer and increases in volume i.e. projection of the surface on which repulsive force of radiated heat acts upon, which we mentioned earlier in the above example (see The heat of the Sun). In this case, the repulsive force of radiated heat is greater than the gravitational force. By moving farther away from the Sun, the Earth receives less heat and loses previously received heat through radiation and reduces in volume i.e. projection of the surface on which repulsive force of the heat acts upon. In this case, the repulsive force of the heat is smaller than the gravitational force so the Sun will again attract the Earth. This process repeats continuously. The following proves that indeed this is the case:

If the Sun's heat power is brought to the Earth, with an average value of 1366 W/m^2, and repulsive force of the Sun is 4.8×10^{27} kgm/s^2 ; N, calculated in the previous chapter about the Sun, also an average value and with the average volume of Earth of 1.081×10^{21} m^3 and average diameter of 12.736×10^{6} m, then the projection of the Earth's surface is 127.396×10^{12} m^2 on which the average value of the repulsive force of the heat of the Sun acts upon.

When the Earth comes closer to the Sun in January, to a distance of 2.5×10^9 m, the distance between the Earth and the Sun decreases from 149.5×10^9 to 147×10^9 m, so the heat power per m^2 which acts upon the Earth's surface increases from 1366 W/m^2 to:

$$\frac{r_S^{\,2}\times \Phi_S}{L^2_{Z\ \min}} = \frac{\left(697{,}5\times 10^6\right)^2\times 62{,}75\times 10^6}{\left(147\times 10^9\right)^2} = 1.412 \quad (W/m^2) \qquad 2)$$

r_S - diameter of the Sun

Conversely, when in the month of July the Earth moves farther away from the Sun by 2.5×10^9 m, then the heat power per m^2 which acts upon the surface of the Earth is decreased from 1366 W/m^2 to

$$\frac{r_S^{\,2}\times \Phi_S}{L^2_{Z\ \max}} \frac{\left(697{,}5\times 10^6\right)^2\times 62{,}75\times 10^6}{\left(152\times 10^9\right)^2} = 1.321 \quad (W/m^2) \qquad 3)$$

The change in the distance from the Earth to the Sun not only changes the radiated heat transferred to Earth, but it also changes the Earth's average temperature and the volume. By coming closer to the Sun, the Earth's average temperature of 288°K (15°*C*) at an annual level increases with the same absorption coefficient α = 0.285.

$$\left(\frac{T_{\max sr.}}{100}\right)^4 = \frac{1.412\times 0{,}285}{5{,}67\times 1} = 71 \rightarrow T_{\max sr.} = 100\times\sqrt[4]{71} = 290{,}28^0 K \approx 17{,}28^0 C \qquad 4)$$

i.e. it decreases when the Earth moves away from the Sun to:

$$\left(\frac{T_{\min sr.}}{100}\right)^4 = \frac{1.321 \times 0,285}{5,67} = 66,4 \rightarrow T_{\min sr} = 100 \times \sqrt[4]{66.4} = 285,4^0 K = 12,4^0 C$$

In this case, by average temperatures, we mean the temperatures which appear along the entire length of the meridian turned towards the Sun from the North to the South pole, and in the time from “sunrise” to “sunset”.
By changing the transferred heat power and therefore also the temperature, the Earth’s volume will change and consequently the Earth’s diameter will also change i.e. projection of the surface on which heat repulsive forces act upon will change. Change in volume can be calculated by using the following equation:

$$V_1 = V_0 \times \left[1 + \beta \times (T_1 \text{-} T_2)\right] \quad (m^3) \tag{5)}$$

where V_1 is the new volume of Earth, V_0 – average volume at average diameter of the Earth and average temperature, cubic thermal expansion coefficient a (T_1-T_2) is the temperature difference compared to the average temperature cubic thermal expansion coefficient is β - 0.00038 and it applies for water at 20°*C* (293°*K*) and is an approximate value for rock and earth. When the Earth is closest to the Sun, then the Earth’s average volume increases to:

$$V_{\min} = d^3_{Zsr} \times 0,5236 \times \left[1 - \beta \times (T_{sr} - T_{\min})\right] = \quad \rightarrow$$

$$V_{\min} = (12,736 \times 10^6)^3 \times 0,5236 \times [1 - 0,00038 \times 2,6] = 1.080,6 \times 10^{18} \quad (m^3)$$

And the average diameter to:

$$d_{Z\max} = \sqrt[3]{\frac{V_{\max}}{0,5236}} = \sqrt[3]{\frac{1.082,62 \times 10^{18}}{0,5236}} = 12,7395 \times 10^6 \quad (m)$$

So the largest projection of the Earth's surface:

$$A_{\max} = d^2_{Z\max}\frac{\pi}{4} = (12,7395 \times 10^6)^2 \frac{\pi}{4} = 127,466 \times 10^{12} \quad (m^2)$$

which is acted upon by the radiated heat of the Sun, with the power of 1412 W/m^2:

$$\Phi_{\max} = 1.412 \times A_{\max} = 1412 \times 127,466 \times 10^6 = 179.982 \times 10^{15} \quad (W)$$

with a mass

$$m_{\max} = \frac{\Phi_{\max} \times t}{c^2} = \frac{179,982 \times 10^{15} \times 3.600}{(3 \times 10^8)^2} = 7.200 \quad (kg)$$

and generates repulsive force:

$$F_{\max} = m_{\max} \times c \times f_S = 7.200 \times 3 \times 10^8 \times 23 \times 10^{14} = 4,968 \times 10^{27} \quad (kgm/s^2; N) \tag{6)}$$

This force is opposed by the force of gravity of the Sun's mass:

$$F_{g\ \max} = \frac{G \times m_S \times m_Z}{L^2_{Z\ \min}} = \frac{66,74 \times 10^{-12} \times 26,77 \times 10^{34} \times 6 \times 10^{24}}{(147 \times 10^9)^2} = 4,960 \times 10^{27} \quad (kgm/s^2; N) \tag{7)}$$

which is smaller than the repulsive force of radiated heat. This is the reason why the Earth can not move closer to the Sun. Similarly, when the Earth is farthest from the Sun, Earth's volume decreases to

$$V_{\min} = d^3_{Zsr} \times 0,5236 \times \left[1 - \beta \times (T_{sr} - T_{\min})\right] = \quad \rightarrow$$

$$V_{\min} = (12,736 \times 10^6)^3 \times 0,5236 \times [1 - 0,00038 \times 2,6] = 1.080,6 \times 10^{18} \quad (m^3)$$

And the average diameter to:

$$d_{Z\min} = \sqrt[3]{\frac{V_{\min}}{0,5236}} = \sqrt[3]{\frac{1.080,6 \times 10^{18}}{0,5236}} = 12,73 \times 10^6 \quad (m)$$

So the smallest projection of the Earth's surface is:

$$A_{\min} = d^2_{Z\min}\frac{\pi}{4} = (12,73 \times 10^6)^2 \frac{\pi}{4} = 127,27 \times 10^{12} \quad (m^2)$$

Which is acted upon by the radiated heat of the Sun, with the power of 1312 W/m^2:

$$\Phi_{\min} = 1321 \times A_{nin} = 1.321 \times 127,27 \times 10^{12} = 168,12 \times 10^{15} \quad (W)$$

with a mass:

$$m_{\min} = \frac{\Phi_{\min} \times t}{c^2} = \frac{168,12 \times 10^{15} \times 3.600}{(3 \times 10^8)^2} = 6.724 \quad (kg)$$

and creates a repulsive force

$$F_{\min} = m_{\min} \times c \times f_S = 6.724 \times 3 \times 10^{8} \times 23 \times 10^{14} = 4,6368 \times 10^{27} \quad (kgm / s^2; N) \qquad 8)$$

This force is opposed by the force of gravity of the Sun's mass:

$$F_{g\ nin} = \frac{G \times m_S \times m_Z}{L^2_{Z\ \max}} = \frac{66,74 \times 10^{-12} \times 26,77 \times 10^{34} \times 6 \times 10^{24}}{\left(152 \times 10^{9}\right)^2} = 4,6397 \times 10^{27} \quad (kgm / s^2; N) \qquad 9)$$

which is larger than the repulsive force of radiated heat. This is the reason why the Earth cannot move farther away from the Sun. If the difference in the angle of heat radiation from the Sun and the average repulsive radiated heat is included in the difference of repulsive forces of radiated heats, the differences increases.

The annual change in the Earth's volume amounting to $\pm 1.6 \times 10^{18}$ of the average value, with limit values occurring in months of January and July, has an effect on the movement of tectonic plates (*Mohorovičić Andrija 1857-1936*) which causes ground tremors and occasional earthquakes on the Earth's surface, and generally happen during the spring and autumn months, with smaller or larger intensity. In addition to the annual change in volume, the Earth also reduces its volume due to the loss of heat influx from the Sun, which represents a permanent loss of volume. With the annual heat loss of 0.5×10^{-23} % (see chapter The heat of the Sun) and 3×10^{24} kg heat mass which the Earth contains and the average volume of 1.08×110^{18} m^3, the Earth's volume annually decreases by:

$$\frac{mass\ of\ the\ Eart's\ heat}{total\ mass\ of\ the\ Earth} \times 0,5 \times 10^{-23}\ \% = \frac{3 \times 10^{24}}{6 \times 10^{24}} \times 0,5 \times 10^{-23} = 0,25 \times 10^{-23}\ \% \qquad 10)$$

So here, according to the Boyle-Marriott's law *p*$\times$ *V (pressure* $\times$ *volume) = constant,* pressure within the Earth increases by the same amount every year. Consequence of increased pressure on the runny mass which is located in the interior of the Earth is the cracking of Earth's crust at the weakest point in the form of caverns (volcano) through which the Earth expels some of the internal mass (lava eruption) thereby reducing internal pressure.

Earth's speed and rotation:

According to the official astronomy, circular or orbital speeds of the planets are determined by the following equation:

$$\frac{G \times m_S \times m_Z}{L_Z^{"}} = \frac{m_Z \times v_Z^{2}}{L_Z} \quad \rightarrow \quad G \times m_S = v_Z^{2} \times L_Z \qquad 11)$$

G – gravitational constant *(m^3/kg s^2)*; m_S – mass of the Sun *(kg)*; m_Z – mass of the Earth *(kg)*;
v_Z – average speed of the Earth *(m/s)*; L_Z – distance between the Earth and the Sun *(m)*;

in which $v_Z^{2} \times L_Z$ is the constant defined by know quantities and for Earth it is:

$$(29,76 \times 10^{3})^2 \times 149,5 \times 10^{9} = 132,4 \times 10^{18} = G \times m_S \approx 66,74 \times 10^{-12} \times 2 \times 10^{30} \quad (m^3 / s^2).$$

(The speed of the Earth and the distance of the Earth from the Sun are measured quantities)

From this constant we calculate the speed of the circular motion of all planets if the distance to the Sun is known, which is a measurable quantity. Mercury is at an average distance from the Sun of 58×10^9 (m) and has an orbital speed of:

$$v_{Mer} = \sqrt{\frac{132,4 \times 10^{18}}{57,9 \times 10^{9}}} = 47,82 \times 10^{3} \approx 48 \times 10^{3} \quad (m / s)$$

Venus has an orbital speed of 35×10^3 (m/s), Mars has an orbital speed of 24×10^3 (*m/s*) etc.

The speeds of the planets which have been determined in this manner are not actual speeds with which the planets orbit the Sun except for the speed of the Earth which was measured. Actual speeds of the planets cannot be determined using the speed of a circular motion around the Earth, because the Earth also revolves around the Sun. If speeds of the planets are determined by using the speed of the Earth i.e . by using the constant $v_Z^{2} \times L_Z$ then these are apparent or relative speeds, because the planets do not move in a circle around the Earth, but around the Sun. Additionally, the constant $v_Z^{2} \times L_Z$ is no longer equal to $G \times m_S$ due to a significant increase in the mass of the Sun which includes the heat mass which the Sun contains. Speed of the planets in relation to the speed of the Earth, is therefore proportional to the speed of the Earth and square root of the relationship between the distance of the Earth and the planets from the Sun, or expressed with an equation:

$$v_Z^2 \times L_Z = v_{Planeta}^2 \times L_{Planeta} \quad \rightarrow \quad v_{Planeta} = v_Z \times \sqrt{\frac{L_Z}{L_{Planeta}}}$$

v_Z – speed of the Earth *(m/s)*; L_Z – distance between the Earth and the Sun *(m)*

Relative speeds of the planets are also important because they determine the relationship of the speed against the Earth only from which it is possible to perform observations of the planets' movements. In order to perform observations of the motion of the planets from space, then all the planets, including Earth would have the same speed as the Sun whereas the planets' speeds would be different in relation to the Sun due to different distances and thus would represent the actual speeds. In addition to this, the Earth and the planets in this case no longer describe an ellipse because the Sun also moves circularly in space, but they describe a cycloid, as will be shown later. For determining actual speed of the circular motion of the planets, we must also include the mass of the planets, orbital inclination φ compared to the sun's equatorial plane and relationship of the distance of the Sun from the centre of its circular motion and speed of the Sun, which the constant $v_Z{}^2 \times L_Z$ does not include. These are very important values in the dynamics of circular motion of the body in space and it is not possible to determine actual speed of the planets without taking into account these characteristics. Actual speed of the planets in space can be determined with an equation derived for this purpose, if all values in the equation are reliably known:

$$v_{Planeta} = \frac{G \times L_{Sunca} \times m_{Planeta} \times 2 \times \pi}{L^2_{Planeta} \times v_{Sunca}} = \frac{G \times m_{Planeta} \times \cos\varphi \times 2 \times \pi}{L^2_{Planeta}} \times \frac{L_{Sunca}}{v_{Sunca}} \quad (m / s) \qquad 12)$$

G – gravitational constant *($m^3/k\ s^2$)*; L_{Sunca} – distance of the Sun from the centre of its circular motion *(m)*; φ – planet's orbital inclination *(^{0})*; $m_{Planeta}$ – mass of the planet *(kg)*; L_{Planta} – distance between the planet and the Sun *(m)*; v_{Sunca} - speed of the Sun (m/s)

This equation cannot be used in terrestrial conditions, because it is impossible to ensure non-contact connection between the bodies which will not be under the influence of the Earth's gravity. If the connection between the bodies is mechanical and includes the Earth's gravity, other equations from the kinematics and dynamics are used.

Aforementioned equation in this form is acceptable and realistic because it is not based only on the speed of the Earth and the distance between the Earth and the Sun, but it also includes the cause of circular motion of the planets.
For the needs of establishing the speeds of circular motion of the planets, kinetic values of the Sun are not important, only the relationship $L_{\text{Sun}} / v_{\text{Sun}}$ is important and this is a constant value and its reciprocal value is the Sun's angular speed. This relationship can be easily determined from the derived equation according to the known actual average circular speed of the Earth then actual distance between the Earth and the Sun and the actual known mass of the Earth and measured angle of orbital inclination of the Earth $\varphi = 23.43°$:

$$v_Z = \frac{G \times m_Z \times \cos\ \varphi \times 2 \times \pi}{L_Z^2} \times \frac{L_S}{v_S} = 29{,}76 \times 10^3 \quad (m / s) \quad \rightarrow \quad \frac{L_S}{v_S} = \frac{L_Z^2 \times v_Z}{G \times m_Z \times \cos\ \varphi \times 2 \times \pi} =$$

$$\frac{(149{,}5 \times 10^9)^2 \times 29{,}76 \times 10^3}{66{,}74 \times 10^{-12} \times 6 \times 10^{24} \times \cos 23{,}4^0 \times 2 \times \pi} = 0{,}288 \times 10^{12} \quad (s) \qquad 13)$$

If the value of the expression $L_s/v_s = 0.288 \times 10^{12}\ s$ is multiplied by $2 \times \pi$, we obtain the time necessary for one revolution of the Sun on its path:

$$t_S = 0{,}288 \times 10^{12} \times 2 \times \pi = 1{,}81 \times 10^{12} \quad (s) \qquad !4)$$

or according to the current duration of the Earth year:

$$\frac{1{,}81 \times 10^{12}}{t_Z} = \frac{1{,}81 \times 10^{12}}{365{,}24\ days \times 24\ hours \times 3600\ seconds} = \frac{1{,}81 \times 10^{12}}{31{,}56 \times 10^6} = 57{,}35 \times 10^3 \quad \textit{yaer's} \qquad 15)$$

which means that the Earth with the orbital inclination of $\varphi = 23.43°$ shall orbit the Sun 57.35×10^3 times in one revolution around its centre. According to this relationship and known values, when viewed from the centre of the Sun's circular motion, the tangential velocity of the Sun is:

$$v_{S\ sr.} = \frac{57{,}35 \times 10^3 \times 2 \times \pi \times L_Z}{\cos\varphi \times t_S} = \frac{57{,}35 \times 10^3 \times 2 \times \pi \times 149{,}5 \times 10^9}{\cos 23{,}43^0 \times 1{,}81 \times 10^{12}} = 32{,}43 \times 10^3 \quad (m / s) \qquad 16)$$

Earth would also have this speed if the orbital inclination φ of Earth's path would be $\varphi = 0$. By increasing the orbital inclination of the pat, speed of circular motion of the Earth around its centre decreases. From this it follows that it is impossible to determine the number of years needed for the Earth to circle the Sun in one

revolution around its centre, due to the fact that the orbital inclination of the Earth's path and therefore the speed of circular motion of the Earth is not a constant value.
According to the determined speed of the Sun and the relationship $L_S / v_S = 0,288 \times 10^{12}\ s$, the average distance of the Sun from the centre of the circular motion according to the speed of the Sun is:

$$L_{Ssr.} = 0,288 \times 10^{12} \times 32,43 \times 10^{3} = 9,34 \times 10^{15} \quad (m) \qquad 17)$$

According to the estimate in the official astronomy, the speed of the Sun ranges from 230 to 370 *km/s* and at the distance from the centre of circular motion from 24.000 to 32.000 *ly* (light years), but it is not known in what way this estimate was made and to which celestial body in space it pertains to. The speed of the Sun on its path is not large, because otherwise the planets would not be able to follow the Sun. The planets circle around the Sun at different speeds, but in space they have the same speed as the Sun which dictates the speed of circular motion of the planets.

Orbital inclination of the circular path relative to the Sun's equatorial plane is very important for determining the speed of circular motion of the planets but not on the plane as is shown in literature. In professional astronomical literature, all planets are shown in a single plane on which they are located with their orbital inclination relative to the Earth's orbital inclination, and the plane is directed towards the Sun and further to the zodiac star constellations connecting the lines of solstice and equinox of Earth, as is shown in figure 2). This plane, or ecliptic, as it is called, is also the plane of the Moon's orbit, therefore the phenomenon of the solar eclipse is visible from the Earth when the Moon passes between the Earth and the Sun. This illustration of the position of the planets in space is not accurate. Actual position of the planets in space is shown in figure 3) with the orbital inclination angles relative to the Sun's equatorial plane provided that the inclination angles have been accurately measured.

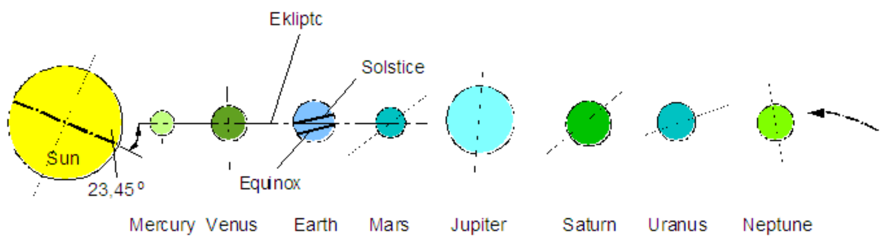

Figure 2

Inclination angle of the Earth's orbit and orbits of other planets is not constant and it changes due to the effect of the force which opposes the cause of its action, and which is generated due to the circular motion of the Sun. In physics, such forces are called "precession forces" and cannot be eliminated until the cause of the action of such force is eliminated. Considering the fact that in space mechanics actions of the forces cannot be removed at will, the Earth and all the planets will continuously change the inclination angle of their orbit relative to the Sun's equatorial plane, and the Earth's rotational axis remains constantly parallel with the rotational axis of the Sun with small deviation caused by other planets. This conforms to the natural rule *tendency to parallelism (Leon Foucault 1852 – compared to a gyroscope!)* as is shown in figure 4).

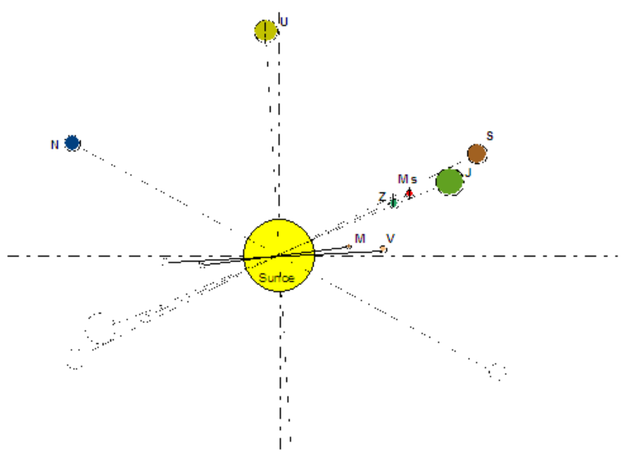

Figure 3

Regularity of the Earth's seasons does not change due to changes in the Earth's orbital inclination angle, unless the orbital inclination angle is $\varphi = 0$. Only the angle of the Earth's geometric axis relative to the Earth's rotational axis changes, and therefore the position of magnetic poles also changes, as is explained further in the text. The change in the Earth's orbital inclination angle also leads to a change in the circular speed of the Earth in its orbit, which according to the above equation, is determined by the *cosine* of the orbital inclination angle. The Earth's circular speed will be the greatest when the orbital inclination angle is $\varphi = 0$ (cos 0° = 1) i.e. if it is in the Sun's equatorial plane. If the orbital inclination angle is $\varphi = 90°$ (cos 90° = 0), the Earth would no longer be moving circularly around the Sun but this is impossible due to the too great centrifugal force created by the circular motion of the Sun. Constant changes of the orbital inclination angle are similar to the harmonic circular motion (oscillation) around point **c** on a circular precession path and the maximum and minimum speed of circular oscillation can be determined if maximum and minimum angle of the Earth's orbit oscillation are known (figureig.4). Maximum speed of circular oscillation is in point **s** (φ=0, sun's equatorial plane) and is proportional with ½ energy of the Earth's dynamic inertia moment whose axis through the centre of the mass is parallel to the Sun's axis (*Steiner theorem!*) then, to the square of the Earth's angular speed, distance between the Earth and the Sun, cosine of inclination angle φ and number of revolutions of the Sun, and is inversely proportional to the momentum, which can be expressed with the following equation:

$$v_{osc.\max} = \frac{(J_Z + m_Z \times L_Z^2) \times \omega_Z^2 \times \cos\varphi}{2 \times M_t} \times L_Z \times n_S = \frac{(2/5 \times m_Z \times r_Z^2 + m_Z \times L_Z^2) \times \omega_Z^2 \times \cos\varphi}{2 \times M_t} \times L_Z \times n_S \qquad 18)$$

If the Earth's (spherical) momentum $J_Z = 2/5 \times m_Z \times r_Z^2$ is left out because it is too small, and the momentum is:

$$M_t = F_Z \times L_Z = \frac{m_Z \times v_Z^2}{L_Z} \times L_Z = m_Z \times v_Z^2 \qquad (kgm^2/s^2;\ Nm)$$

then

$$v_{osc.\max} = \frac{m_Z \times L_Z^2 \times \omega_Z^2 \times \cos\varphi}{2 \times F_Z \times L_Z} \times L_Z \times n_S = \frac{m_Z \times L_Z^2 \times \omega_Z^2 \times \cos\varphi}{2 \times m_Z \times v_Z^2} \times L_Z \times n_S$$

and if the Earth's angular speed is $\omega_Z^2 = \frac{v_Z^2}{L_Z^2}$ and $n_S = \frac{v_S}{2 \times \pi \times L_S} = \frac{\omega_S}{2 \times \pi}$ then the final equation is:

$$v_{osc.\max} = \frac{m_Z \times L_Z^2 \times v_Z^2 \times \cos\varphi}{2 \times m_Z \times v_Z^2 \times L_Z^2} \times L_Z \times \frac{\omega_S}{2 \times \pi} = \frac{L_Z \times \omega_S \times \cos\varphi}{4 \times \pi} \qquad (m/s) \qquad 19)$$

L_Z – distance between the Earth and the Sun *(m)*; *ω_S* – Sun's angular speed *(s^{-1})*; *$\cos\varphi$* – orbital inclination angle *(^{0})*

from which it follows that the maximum oscillation speed in point **s** is:

$$v_{njih.\ \max} = \frac{149,5 \times 10^9 \times 3,47 \times 10^{-12} \times \cos 0^0}{4 \times \pi} = 41,28 \times 10^{-3} \quad (m/s) \qquad 20)$$

The largest oscillation angle of the Earth's orbit is therefore dependant on the angular speed of change of the Earth's orbital inclination angle $\omega_{osc.max.} = v_{osc.\ max} / L_Z$ and angular speed of the Sun's motion ω_S. When these two speeds equalize, for example in point **a**, angle φ no longer increases, but rather it decreases until it reaches $\varphi = 0$ in point s and then it again increases until point **b**, which is a characteristic of precession motion of the body. In this manner, the arth's orbit continuously swings along the circular segment with a length $l_{a,b}$ between point **a** and point **b**. Expressed with an equation, the largest oscillation angle of the Earth's orbit from point s to point **a** or **b** is:

$$\omega_{osc.\max} = \omega_S = \frac{v_{ocs.\max}}{L_Z} = \frac{v_S}{L_S} \times \cos\varphi \quad \rightarrow \quad \cos\varphi = \frac{v_{osc.\max} \times L_S}{L_Z \times v_S} = \frac{41,28 \times 10^{-3} \times 0,288 \times 10^{12}}{149,5 \times 10^9} = 0,0795$$

which corresponds to the angle $\varphi \approx 85^0$ or in total between point a and point b $2 \times 85^0 = 170^0$ and the smallest oscillation speed is in point **a** and point **b** and it is equal to:

$$v_{osc.\min} = v_{osc.\max} \times \cos = 41,28 \times 10^{-3} \times \cos 85^0 = 3,52 \times 10^{-3} \quad (m/s) \qquad \mathbf{21)}$$

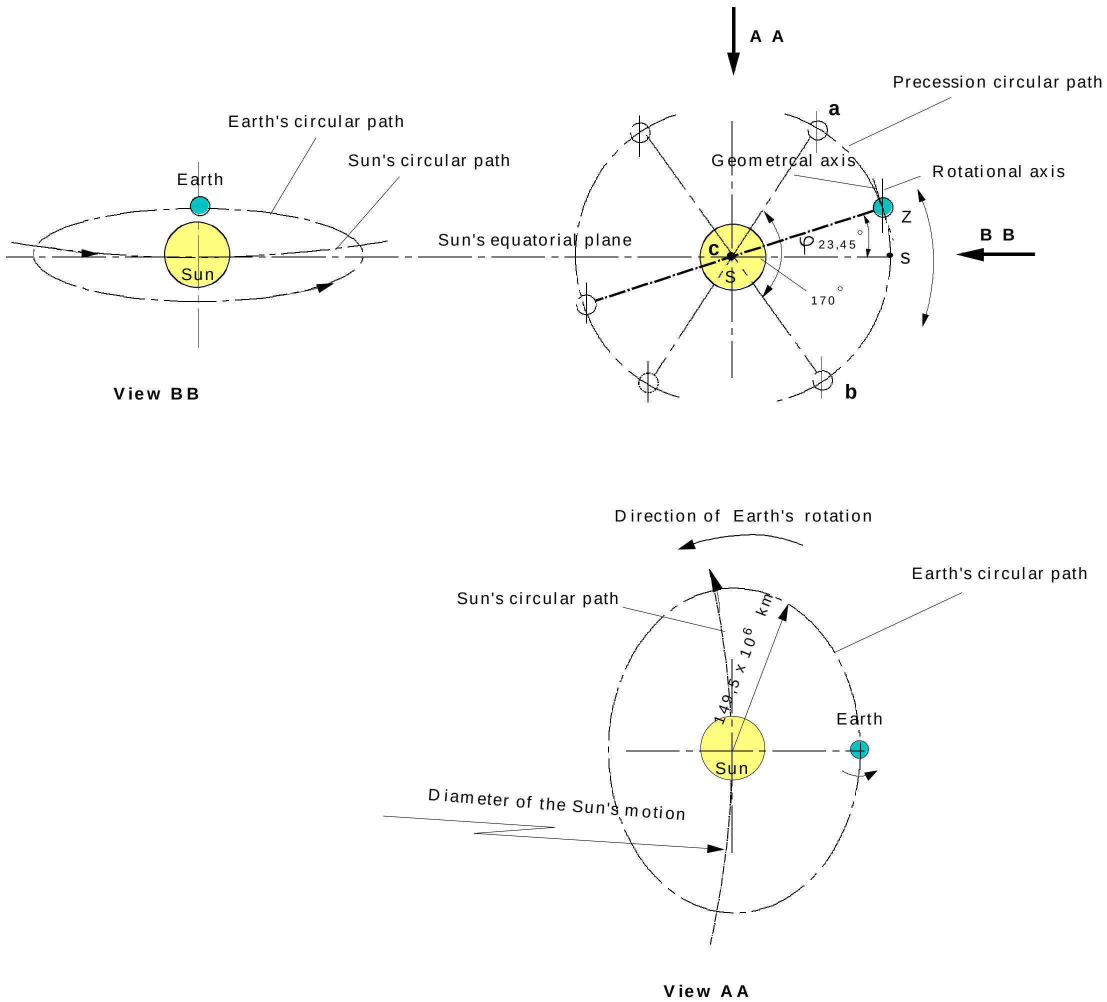

Figure 4
View of the circular motion of the Earth around the Sun

From all of the above, it can be seen that the Earth's speed, but also the speed of all planets in their orbits changes only due to a change in orbital inclination angle relative to the Sun's equatorial plane, and due to this, the duration of one earth year also changes (synodic period), which is determined by the adopted terrestrial manner of measuring time. In addition to this, the change of the Earth's orbital inclination angle also leads to a change in the Earth's period of rotation i.e. length of day (sidereal day) as well as the width of the solstice and equinox, which in turn leads to changes in the seasons and temperature. Therefore, in points **a** or **b**, instead of $31,55 \times 10^6\ s$, which is the current value, one year will last for:

$$\frac{v_z}{v_z \times \cos 85^0} \times t_z = \frac{29,76 \times 10^3}{29,76 \times 10^3 \times 0,0871} \times 31,55 \times 10^6 = 362,22 \times 10^6 \quad (s) \tag{22}$$

or it will be temporaly longer by $330,67 \times 10^6\ s$ which means that one year will be 10.48 times longer than its current duration, and proportionally, there will be fewer days in such a year in which one day will last for more hours because the number of Earth's evolutions around its axis will also change.

When the Earth's orbit is in the Sun's equatorial plane ($\cos\varphi = 0$), one year will last for:

$$\frac{v_z \times \cos 23,43}{v_z} = \frac{29,76 \times 10^3 \times 0,917}{29,76 \times 10^3} \times 31,55 \times 10^6 = 28,93 \times 10^6 \ (s) \tag{23}$$

or it will by $2,62 \times 10^6\ s$ shorter with larger number of days, which will be shorter due to the same reasons.

Using the maximum and minimum Earth's orbital inclination angle it is possible to calculate the distance along the circular section from point s to point a and vice-versa, from angle $\varphi = 0°$ to $\varphi = 85°$ which is equal to:

$$l_{s,a} = \frac{L_Z \times 2 \times \pi \times 85^0}{360^0} = \frac{149,5 \times 10^9 \times 2 \times \pi \times 85^0}{360^0} = 221,78 \times 10^9 \quad (m)$$ 24)

and the oscillation speed of the Earth's orbit at an angle of φ = 23.45°

$$v_{osc.Z} = v_{osc.\max} \times \cos 23,43 = 41,28 \times 10^{-3} \times 0,917 = 37,85 \times 10^{-3} \quad (m / s)$$

so the orbit then travels in a year a distance on the arc section of the precession circular path of φ=23.43°:

$$l_{prec} = v_{njihanja\ Z} \times t_Z = 37,85 \times 10^{-3} \times 31,55 \times 10^6 \ (s / g) \approx 1,2 \times 10^6 \quad (m / year's)$$

or expressed in degrees:

$$\frac{l_{prec} \times 23,45^0}{l_{s,a}} = \frac{1,2 \times 10^6 \times 23,45^0}{221,78 \times 10^9} = 0,127 \times 10^{-3} \ (^0 / year's)$$

which expressed in arc seconds per year equals to:

$$0,127 \times 10^{-3} \ (^0/g) \times 3600" = 468 \times 10^{-3} = 0,457 \quad ("/ annually)$$ 25)

end is almost equal to the measured value of $0,47"$ which proves that the calculation procedure is correct, and the value is smaller due to rounding large number of decimal values or due to rounded values of known orbital characteristics of the Earth. During measurement and monitoring (Astronomical Institute IFA-USA), it was determined that the value of $0,47"$ decreases annually which means that the Earth's orbit is coming closer to the Sun's equatorial plane. By coming closer to the Sun's equatorial plane, the Earth increases its circular (orbital) speed in the orbit which leads to shorter duration of one year and an increase in the number of days in a year which are shorter, which conforms to this elaboration. Except for the change in the inclination of the Earth's orbit, not only does the speed of the Earth changes, but the number of revolutions of the Earth around its axis, which govern the lenght of the day, also changes. The cause of this can be explained in the following manner:
Every geometric body, unless it is homogenous and of a regular geometric form has two axis, geometric and rotational. The Earth is not a fully homogeneous and regular geometric body, so therefore it has two axis, geometric and rotational, and the centres of the poles are the north and the south pole. If the Earth is viewed as a sphere composed of two identical halves, then each half has its own centre of mass. If only one half is heated, that side will increase in size and its centre of mass will move to the side being heated, while the rotational axis will remain in the same location. The centre of mass of the other half which is not being heated will also stay at the same location, so due to this the balance of masses with regard to the previous main rotational axis will be disturbed. If we compare such state to the Earth, a momentum will appear in the centre of mass of the Earth's half being heated, which is oriented in the opposite direction from the direction of the circular motion of the Earth, as is shown in figure 5.

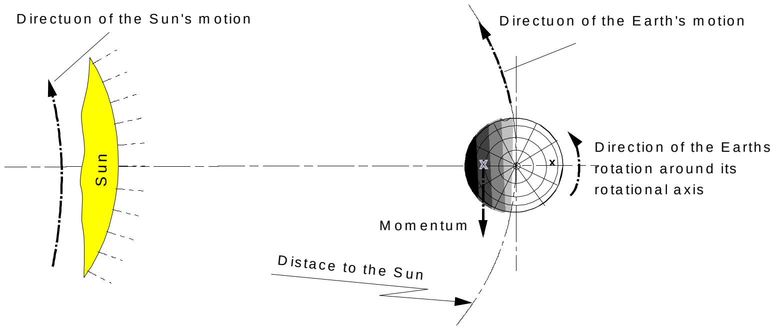

Figure 5

Due to the presence of the momentum, the Earth will turn, thus bringing the second half of the Earth to heating, and the centre of mass of the side which is not being heated will move to the opposite direction and by doing so, it will partly turn the Earth. This process will repeat itself continuously and force the Earth into continuous uniform rotation around the rotational axis, and the speed of rotation (spin) depends on the speed of circular motion of the Earth around the Sun. Without the circular movement of the Earth along its orbit, the Earth would not be turning around its rotational axis. All planets rotate around their rotational axis with a certain speed due to the same reasons, which depends on the mass of the planet, diameter, amount of heat received from the Sun and composition of the ground and heat absorption coefficient.

When viewed from space, perpendicular on the Earth's north pole, the Earth rotates around its rotational axis from the east to the west i.e. counter clockwise, which is also the direction of circular movement of the Earth around the Sun, and geometric and rotational axis of the Earth do not coincide but rather they are tilted so that the geometric axis describes a cone in space. *Ronald Amudsen* was the first to notice that the Earth's axes do not coincide during his expedition to the south pole (*1911*) and that the magnetic pole, through which Earth's geometric axis passes through, is not in the same line with the rotational axis around which the Earth rotates. This tilt of the axis is explained in the official astronomy as precession, as is shown in figure 6, which is wrong.

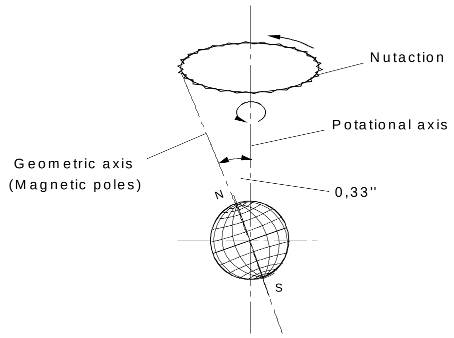

Figure 6

Lateral surface of the cone is not described by the rotational axis, as the astronomical literature claims, but it is described by the geometrical axis, and the nutation at the cone base are vibrations which are generated due to insufficiently centred mass of the Earth around the rotational axis, and it is not a consequence of the influence of the Sun and the Moon on the Earth. The same phenomenon would have also been observed at the second pole, if it would be possible to simultaneously observe both poles from just one pole.

The Sun's radiated heat does not act only mechanically on the planets, but it also causes magnetism on Earth. It is known that the motion of the bodies when they are near a heat source becomes magnetic if they contain a certain amount of iron, and two opposite poles are created, the north and the south. The magnetic induction increases if the body contains more iron or if it is closer to the heat source. Considering the fact that the Earth has a certain amount of iron, magnetic poles appear on the poles of the Earth, through which geometrical axis passes through. By virtue of an international convention it was agreed that the Earth's North Pole would also be the north magnetic pole.

From the previous discussion the following can be concluded: speed in space of the Earth and all the planets is equal to the speed of the Sun, circular speed of the planets in relation to the Sun depends on their distance from the Sun, mass of the planet, orbital inclination angle and constants which define the relationship between the distance of the Sun from the centre of its circular motion and the speed of the Sun in space i.e. $L_S \,/\, v_S$.

With this we answered all previous questions, namely why the Earth and all the planets circle around the Sun at a certain constant distance and why the Earth and all the planets rotate around their rotational axis.

II. CONCLUSION

It is wrongly thought that celestial bodies are comprised exclusively from solid matter. In terrestrial conditions this is not an error, because the share of heat mass compared to the solid matter mass in the total mass of the body is insignificantly small. All celestial bodies, unless they are completely cool, contain a large amount of heat mass, which has a considerable effect on the total mass of the body. Therefore, Earth should be viewed in this manner, as is explained in this article. In addition to the above, when observing the circular motion of celestial bodies, only the object in circular motion with a certain speed is studied, and not the causes of such motion. If we determine the causes of circular motion, then it is easy to determine the kinetic values of celestial bodies around which other celestial body circle. The causes of Earth's circular motion and thereby the fundamental kinetic values of the Sun have been determined by the use of thermodynamics, which is something that is not known in official astrophysics.

REFERENCES

[1]. Fran B (1972). SCIENCE OF HEAT; Part II, Chapter: Heat
[2]. Transfer; Original name:
[3]. Nauka o toplini Drugi dio; (Publisher. „Technical book“ Zagreb) Egon W (1952). ANORGANISCHE CHEMIE Chapter: Science of Atoms and Molecules; Original name.
[4]. Pereljman JI (1965). INTERESTING ASTRONOMY ; Original name: ЗАНИМАТЕЛЬНАЯ АСТРОНОМЯ О Г И З (Москва.)
[5]. Croatian Encyclopedia (1985).Chapter: Heat; (Publisher: „Miroslav

[6]. Krleža“ Lexicographical Institute Zagreb.)
[7]. Šepeljev A (1990). TECHNICAL MECHANICK. Capter. Kinematics and dynamics : (Publisher : „Schoolbook“. Zagreb)

Mr sce. Ivan Medvedovich ing. “ Thermodynamics Effect of the Sun on the Earth.” *IOSR Journal of Humanities and Social Science (IOSR-JHSS)*, 27(02), 2022, pp. 11-21.