Accelerating solar system and its effects on the revolutational path of the planets around the sun

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Contents;

1. Abstract;

All the natural system of the universe was formed by the condensation of fundamental tiny particles. These fundamental particles were formed by the condensation of energy which was formed by the Big Bang theory of infinitely dense point mass. All the systems in the universe are moving in free space and some of them radiate energy in the form of heat and light, these are called luminous bodies like sun and stars while rest of systems are absorbing energy in the form of light as well as heat energy and these are called non-luminous body like planets and meteorites. In general, most of non-luminous body move around the luminous body in open imaginary circular or elliptical path.

As all luminous body radiate heat energy by the nuclear fusion of light elements, so that the whole mass of the luminous body decreases continuously while all the non-luminous body absorb light and heat energy and further reradiate in the form of long wavelength. Since it is well accepted that absorbed energy and radiated energy is strictly equal for a non-luminous body, but it is an ideal concept, in fact this is not happened in real life. All the natural systems move around other natural luminous system. The momentum of all the systems are remains constant, due to decreasing mass the velocity is increases and rate of change of velocity is called acceleration.

The mass of all the systems is change, so the velocity is changed of all the systems; these are called accelerating natural body.

2. Introduction;

All the natural system of the universe is formed by the fundamental particles, which was formed by condensation of energy in billions of year ago. All the systems are moving in either free space or in some manner like open and close path round any huge mass body. Those natural systems move around any huge body, they are exactly balance with gravitational force and centripetal force. With the balancing both forces natural systems move around that body for infinite time and it is possible when the mass and velocity is always constant. In this manner those systems whose move around that central body, the angular momentum of these systems are remains constant for infinite time. In this pattern the linear momentum of central body.

All the systems of the universe is having fixed linear momentum as well as angular momentum depending on their nature of motion in the free space.

Linear momentum;

it is define as the product of mass and its velocity is called linear momentum of that body. in this condition the body moves on straight line with a constant velocity.
Let the mass of the body is m and velocity of that system is v,

Then,

According to definition,

Linear momentum $p = m.v$

Conservation of linear momentum;

If the two systems are moving in a straight line and they are colliding each other, then the sum of their linear momentum is remains constant.

If the two systems are having mass M_1 and M_2 and they are moving with initial speed U_1 and u_2 respectively and after colliding the velocity are V_1 and V_2 respectively.

Then according to conservation of linear momentum,

Sum of initial momentum = sum of final momentum

$$M_1.U_1 + M_2.U_2 = M_1.V_1 + M_2.V_2$$

It is also define as with decreasing mass of any system its velocity is increased continuously. This decreasing mass may be convert in to either energy or may be in the form of broken part, and this system is also fallow the law of conservation of linear momentum.

Let the mass of the system is M and velocity be V then,

Momentum P = M.V = constant

Differentiating partially in both favours, keeping momentum P is constant,

$$M.dV + V.dM = 0$$

$$dV = -V.\frac{dM}{M} \text{ .... (1)}$$

This can also be written as

$$dM = -M.\frac{dv}{V} \text{ ....(2)}$$

and again it can be divide by dt,

we get,

$$\frac{dM}{dt} = -(M/V).\frac{dv}{dt} \text{ .... (3)}$$

Where the dM is decreased mass and dv is increased velocity.

It can be vice –versa if the mass of the system is increase by accretion of that from another system and in this manner mass increases, then velocity decreases.

Let the decrease mass be dM and due to this decrement increased absolute velocity be dv,

Then, according to definition

Conservation of linear momentum,

$$M.V = (M - dM).(V + dv)$$

$$0 = M.dv - V.dM - dM.dv$$

$$dM.dv = M.dv + V.dM$$

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Angular momentum;

It is define as the product of the moment of inertia and angular velocity of that moving system which is moving around a central system. It is represented by J. It is applicable for rotating body in an either open path or close path.

If the mass of rotating body is M, distance from the centre of that path is r and the angular velocity be w, then angular momentum,

$$J = M.r^2.w$$

Conservation of angular momentum;

It is define as the if there is no external torque is acting working on any rotating body around another body, the angular momentum of that rotating body is remains constant.

It can be represented mathematically as follows;

$$\frac{dJ}{dt} = 0$$

it means all the rotating natural system always maintain their angular momentum, so far this they change their path in the form of distance from the central body about which they move about that.

Since it is clear that all the luminous body decaying their mass and it is just because of the nuclear fusion, due to conservation of linear momentum, the product of mass and its corresponding velocity is remains constant.

Let the velocity of decaying mass is v' and let the initial velocity of that luminous body be v.

Let the amount of acceleration is 'a' and taken time is t.

Then according to Newton's first law of motion

$$V = u + a.t$$

$$v' = v + a.t$$

$$a = (v' - v)/t \quad .... (4)$$

Here (v'- v) is the difference between final velocity and initial velocity and it can be written as dv.

So from equation (1)

We can write as fallows;

$$a = \frac{dv}{dt}$$

$$a = - V.\{(\frac{dM}{dt})\}/M$$

Here dM/dt is negative, let $\frac{dM}{dt}$ is – K,

So,

$$a = V.\frac{K}{M}$$

Since the mass of the stars is continuously change in the form of energy in the form of light energy and heat energy. So definitely the mass of the luminous body is continuously decrease consequently the velocity of that system is increased.

Hence it is clear that all the luminous body of the universe is accelerating continuously.

3. ***Effects of the decreasing mass of the stars on the path of the rotating system;***

As it is clear that the all the luminous body is accelerating in the universe continuously and it is well clear this thing is just because of the decreasing mass.

As there are many systems in the universe which are moving around the luminous body, like all the planets of our solar system. All the planets moving around the sun, which is a luminous body called star. Sun is the parental body of our solar systems according to Nebular Hypothesis. Sun is a bright stars and the mass & shape of that luminous body is decreased continuously. All the planets move around it by the balancing of gravitational force and centrifugal force. All the planets fallow the conservation of angular momentum during rotating around that particular body.

Gravitational force;

It is define as the a force acting between two body by which both is attracted each other and it is propotional to the product of mass and inversely propotional to the square of distance between both object.

Gravitational force $F_g = \frac{G.M_1 M_2}{r^2}$ ………………….................. (5)

This force is acting between both mass.

Where M_1 is the mass of luminous body about which planets are moving and M_2 is the mass of rotating body and r is the distance between both bodies.

Centrifugal force;

It is a fictitious force which is acting on a rotating body and this force is always acting towards outside of that path. This centripetal force is propotional to the mass of rotating body, distance from the centre of that path and square of angular velocity.

Centripetal force $F_c = M_2.r.w^2$ .... (6)

Since all the rotating system are moving around one particular body and they are exactly balance by the gravitational force and centripetal force.

So equating eq. (5) and (6),

$$F_g = F_c$$

$$\frac{G.M_1 M_2}{r^2} = M_2.r.w^2$$

$$\frac{G.M_1}{r^2} = r.w^2$$

$$G.M_1 = r^3.w^2$$

$$r = \left(\frac{G.M_1}{\omega^2}\right)^{1/3} \text{ .... (7)}$$

differentiating eqn. (7) with respect to t

we get,

$$\frac{dr}{dt} = \frac{1}{3}.\left(\frac{G}{\omega^2}\right)^{1/3}.M_1^{-2/3}.\frac{dM}{dt} \text{ .... (8)}$$

where dr/dt is the rate of change of path (increase) and dM/dt is negative and it is just because of the reduction of mass of luminous central body.

Putting the value of dM/dt in eqn. (8),

We get,

$$\frac{dr}{dt} = \frac{1}{3}.\left(\frac{G}{\omega^2}\right)^{1/3}.\frac{M_1^{\frac{1}{3}}}{V}.\frac{dV}{dt}$$

$$\frac{dr}{dt} = \frac{1}{3}.\left(\frac{GM_1}{\omega^2}\right)^{1/3}.\frac{1}{V}.\left(\frac{dV}{dt}\right) \quad ....(9)$$

Hence it is clear that the path of the rotating body about the luminous body is continuously decreased with time.

4. ***Effect on the path of the planets in our solar system due to acceleration of sun.***

Our solar is a huge system in which eight planets and their respective natural satellite, a number of meteorites and star in which sun is the star and it is the central body of our solar system. The sun is containing more than 99.85% of our whole solar system. All the planets of our solar system are moving around the sun. As all the systems moving in the universe with some speed likewise sun (central body) is continuously radiating light energy as well as heat energy. This energy is formed by the nuclear fusion of light gaseous elements. Sun is moving in our solar system with some speed.

As the conservation of linear momentum, the product of mass and respective velocity of the sun is remains constant.

As in the sun, it is reduces its mass in to two way first one is solar wind nuclear fusion. Nuclear fusion is continuously going on, so the total mass of the sun is decreases due to conservation of linear momentum, the initial velocity of the stars is increased continuously and it is called accelerating luminous body. Due to the high surface temperature of the sun, so that protons and electrons boil from the surface and stream away from the sun.

Sun loses its mass 5.5×10^9 kg per second by nuclear fusion and 1.5×10^9 kg per second. Thus the sun loses mass 6.0×10^9 kg per second.

The mass of the sun is M_s is 1.98×10^{30}kilogram and its velocity is 29.6 km/sec or 9.3449×10^8 km/year

According to the conservation of linear momentum,

Momentum $P = M_s.V$

$$P = 1.989\times10^{30}\times9.3449\times10^8 \text{ kg-km/year}$$

As we know the loss of mass per second $\frac{dM}{dt}$ = - 6.0 ×10^9 kg/sec

$$\frac{dM}{dt} = -1.8942336\times10^{17} \text{ kg/ year}$$

And let the change in velocity be $\frac{dv}{dt}$ is.

So according to conservation of linear momentum,

M.V = K (constant).......... (10)

Differentiating above eqn. (8) with respect to t,

We get,

$$V.\frac{dM}{dt} + M.\frac{dV}{dt} = 0$$

$$V.(-1.8942336\times10^{17}) + 1.989\times10^{30}\times\frac{dV}{dt} = 0$$

$$1.989\times10^{30}\times\frac{dV}{dt} = 9.3449\times10^{8}\times1.8942336\times10^{17}$$

$$\frac{dV}{dt} = 1.8587\times10^{26}/1.989\times10^{30}$$

$$\frac{dV}{dt} = 0.9345\times10^{-4} \text{ km/year}^2 \text{ .... (11)}$$

Hence it is clear that the sun is continuously accelerating with the 9.345×10^{-5} Km per year^2 or 9.345×10^{-2} m per year^2.

Since it is clear from the above eqn. (10), our sun (luminous body) is continuously accelerating in that system called solar system.

As the mass of the sun (luminous body) decreases continuously so the gravitational force between the earth and planets decrease. As whole solar system is balancing by the exactly balance by centripetal force and this also decrease for counter balancing of gravitational force. With weaking force the distance of the sun and planet decreases.

From eqn. (9),

We know,

Rate of change of the path

$$\frac{dr}{dt} = \frac{1}{3}.\left(\frac{G}{\omega^2}\right)^{1/3}.M_1^{-2/3}.\frac{dM}{dt} \quad \ldots\ldots\ldots\ldots.. (8)$$

this can be written as;

$$\frac{dr}{dt} = \frac{1}{3}.\left(\frac{G}{M_1^2\omega^2}\right)^{1/3}.\frac{dM}{dt} \quad \ldots\ldots\ldots\ldots.. (9)$$

from eqn. (14)

$$\frac{dM}{dt} = \quad -1.8942336 \times 10^{17} \text{kg/year} \ldots\ldots.. (11)$$

where

M_1 mass of the earth is $= 5.96\times10^{24}$kg

V velocity of the sun with respect to the earth = 9.3449×10^{8} km/year.

W is angular velocity with respect to the earth = 2π/365.4 radian/day

Or = 2π radian/year.

6.28 rad/year.

Gravitational constant G = 6.65×10^{-5} kg^{-1} -km^3year^{-2}

And $\frac{dV}{dt}$ = 0.9345×10^{-4} km/$year^2$.

Putting these values in eqn. (11)

$$\frac{dr}{dt} = (1/3).\ (G/M_1^2.w^2)^{1/3}.\left(\frac{dM}{dt}\right)$$

$$\frac{dr}{dt} = -(1/3).\ \{6.65\times10^{-5}/(5.96\times10^{24})^2.(6.28)^2\}^{1/3}.(1.8942336 \times10^{17})$$

$$\frac{dr}{dt} = -(1/3).\ \{47.47\times10^{-57}\}^{1/3}.(1.8942336 \times10^{17}$$

$$\frac{dr}{dt} = -(1/3).(3.62\times10^{-19}).(1.8942336 \times10^{17})$$

$$\frac{dr}{dt} = -2.286\times10^{-2} \text{ km/year} \ldots\ldots\ldots\ldots\ldots\ldots\ldots(12)$$

Hence it is clear the path of the rotating body (planets) is continuously increasing with 2.286×10^{-2} km/ year from the centre of the sun.

As our sun is accelerating and mass is decreasing. Due to decreasing mass of the sun the gravitational force between planets and sun is decreasing continuously.

Gravitational force between the planet and the sun,

$$F = \frac{G.M_1M_2}{r^2} \text{ .... (13)}$$

Here mass of the sun and distance of the sun from the planet (earth) decreases with respect to time. So here it is consider force f is the function of f = f(M_s, r)

Now differentiating eqn. (10) partially with respect to time t

We get,

$$\frac{\partial f}{\partial t} = G.M[(1/r^2).(\frac{\partial M}{\partial t}) - 2M_s.r^{-3}.(\frac{\partial r}{\partial t})]$$

$$\frac{\partial f}{\partial t} = (G.M/r^2)[(\frac{\partial M}{\partial t}) - 2M_s.r^{-1}.(\frac{\partial r}{\partial t})] \text{..............(14)}$$

From the equations above we have,

$\frac{\partial r}{\partial t}$ = -1.8942336×10^{17} kg/ year

And $\frac{\partial r}{\partial t}$ = -2.286×10^{-2} km/year km/ year,

M is the mass of the earth = 5.96×10^{24} kg.

G = 6.65×10^{-5} kg-km^{3}year^{-2}

Average distance of the sun from the earth r = 1.5×10^8 km.

For the earth Sun relationship,

$$\frac{\partial f}{\partial t} = (G.M/r^2)[(\frac{\partial f}{\partial t}) - 2M_s.r^{-1}.(\frac{\partial r}{\partial t})]$$

$$\frac{\partial f}{\partial t} = (6.65\times10^{-5}\times5.96\times10^{24})/(1.5\times10^8)^2.[-1.8942336\times10^{17} - 2.(5.96\times10^{24}).(1.5\times10^8)^{-1}.(-2.286\times10^{-2})]$$

$$\frac{\partial f}{\partial t} = (17.615\times10^3).[-1.8942336\times10^{17} + 2.(5.96\times10^{24})(1.5\times10^8)^{-1}.(2.286\times10^{-2})]$$

$$\frac{\partial f}{\partial t} = (17.615\times10^{3}).[-1.8942336\times10^{17} + 18.16608\times10^{14}]$$

$$\frac{\partial f}{\partial t} = (17.615\times10^{3}).[-1.8942336\times10^{17} + 0.0186608\times10^{17}]$$

$$\frac{\partial f}{\partial t} = -(17.615\times10^{3}).[1.875573\times10^{17}]$$

$$\frac{\partial f}{\partial t} = -33.038.615\times10^{20}\ \text{kg- km-year}^{-2}. \ldots\ldots\ldots\ldots\ (15)$$

Here negative sign is representing that the gravitational force of the sun is continuously decreasing. Hence gravitational force between the sun and the earth decreases with respect to the time and it is called reducing intensity of gravitational force of sun.

From above equation (15) due to losing mass, the gravitational force of the sun reducing on the earth but at the same time the for the counter balancing centripetal force the distance of the planet from the centre of the sun reducing consequently rate of change of distance also negative which shows the distance between both system decreases, it means the gravitational force will increase but the affects of reducing mass is much more than the affects of decreasing distance. So clearly the gravitational force of the sun on the rotating body decreases.

Although it is well known that everything in the universe is continuously changing with time and space but with different rate for different physical and chemical phenomena and this will continue for till their spoiled from the space and time.

Calculating the initial stage of sun and earth from their origin related to mass and its distances from each other;

Initial Mass of the sun;

According to the nebular hypothesis, our solar system is formed by the condensation of the light and dust particle before 5 billion years ago.

According to the radiometric dating the age of the sun is 5×10^{9} year while our earth was formed 4.56×10^{9} years ago. But the initial distance between the sun and the earth is still unknown. But by inversion th of the rate of change of the path length and mass, it can be calculate.

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5. Mass of the sun;

Although it is well known sun is the biggest massive body of our solar system while it is continuously reducing it mass and it is just because of the nuclear fusion and solar wind. As it is continuous process of decreasing mass, so it can be calculated by the initial value problem as fallows;

Here it is consider as the rate of change of the sun is constant, so it can be consider as $\frac{dM}{dt}$ = k

Rate of change of mass of the sun is $K = \frac{dM}{dt}$ = - 1.8942336×10^{17} kg/ year

Since our sun was formed $t_1 = 0$, $t_2 = 5.0\times10^9$ year

Initial mass (integral constant at today) of the sun I =1.989×10^{30} Kg.

So the mass M' = $\int_0^{5\times10\text{^}9}(\frac{dM}{dt}).dt$

$$M' = \int_0^{5\times10\text{^}9} K.dt$$

$$M' = k.[t]_0^{5\times10\text{^}9} + I$$

$$M' = 1.8942336\times10^{17}\times[5\times10^9 - 0] + 1.989\times10^{30}$$

$$M' = 9.4712\times10^{28} + 1.989\times10^{30}$$

$$M' = 0.094712\times10^{30} + 1.989\times10^{30}$$

$$M' = 2.0837\times10^{30} \text{ kg.}$$

Percentage of decrease of the mass of the sun in the whole life

% loss = decreased mass/initial mass

$$\% \text{ loss} = \frac{decreased\ mass}{initial\ mass} \times 100$$

$$\% \text{ loss} = \frac{0.094712\times10\text{^}30}{2.083710\text{^}30} \times 100$$

% loss = 4.54%

Distance of the earth from the sun;

As it has already clear that the sun is continuously accelerating in the solar system due to due to losing mass this acceleration is generated in the sun by the changing velocity to conserving linear momentum. Due to losing mass of the gravitational field of the sun decreases with a constant rate.

By inversion of the behaviour, the path length this can be measure by using initial value problem as fallows;

Here it is consider as the rate of change of the path length of the sun is constant, so it can be consider as $\frac{dr}{dt}$ = k

Rate of change of mass of the sun is $K = \frac{dr}{dt}$ = 2.286×10^{-2} km/ year

Since our sun was formed t_1 = 0, t_2 = 5.0×10^9 year

Average initial path length (integral constant at today) of the sun r =1.5×10^9 km.

So the mass I' = $\int_0^{5\times10^9}(\frac{dr}{dt}).dt$

$$I' = \int_0^{5\times10^9} K.dt$$

$$I' = k.[t]_0^{5\times10^9} + I$$

$$I' = 2.286\times10^{-2}\times[5\times10^9 - 0] + 1.5\times10^9$$

$$I' = 11.43\times10^7 + 1.5\times10^9$$

$$I' = 0.1143\times10^9 + 1.5\times10^9$$

$$I' = 1.6143\times10^9 \text{ km.}$$

Percentage of decrease of the path length of the earth in the whole life

% loss = decreased path/initial path

$$\% \text{ loss} = \frac{decreased\ mass}{initial\ mass} \times 100$$

$$\% \text{ loss} = \frac{0.1143\times10^9}{1.6143\times10^9} \times 100$$

% loss = 9.817%

As above relation it is clear that mass is the fundamental thing on which depends all the physical and all possible mechanism of the universe. In our universe all the celestial bodies are either increasing decreasing mass.

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6. Discussion

From the above result it is clear that the mass of some celestial bodies in the universe decrease by heat radiation while mass of some celestial body increases due to accretion of mass. Due to change in the mass of systems their velocity change consequently planets are accelerating. All the planets all the planets are revolving around the sun but not in fix orbit. The distances of the planets from the sun varies by the time and it decreases towards the sun. Consequently the magnitude of velocity of planets around the sun changes by time and it increases. The velocity of the planets increase due to decrease mass by time and it is because of conservation of momentum.