

Venus Transition: (A Complete Solution with an Otherwise Explanation)

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Abstract: Venus transition is an eclipse type astronomical observation which occurs regularly in 121.5 year time interval along with 8 year earlier or later respectively. As it is well known that planets of solar system make revolution around the Sun on its own orbit, therefore in process orbital revolution when earth & Venus come together in front of the Sun in such way that all these three bodies become collinear then this occurrence takes place. In this situation Venus looks like a black spherical spot and seems to transit the surface of the Sun from one edge to another. This occurrence is called VENUS TRANSITION OR TRANSIT OF VENUS. However the periodic interval this occurrence is very regular 121.5 year but besides the same one time it occurred 8 year earlier and next time 8 year later than 121.5 year too. Which make these data irregular & create complication to search the basic cause behind this? However efforts have been taken by several scientists time to time since its 1st occurrence on 7th Dec 1631 to 8th occurrence on 5th June 2016 but it could not be able to explain till date. In this research paper a very peculiar effort towards this direction is described in detail keeping overlap formula in center formulated by Copernicus for needles of ordinary watch. Presently known synodic period (584 day) calculated by Copernicus with the help of same formula and made tally the same with observation of maximum elongation period of Venus. And since then maximum elongation and overlap of earth and Venus defined as the same phenomena, but in this research paper this argument is denied, it has been concluded in this paper that maximum elongation and overlap of Venus and earth is quite different phenomena in term of astronomical observation but related each other in natural way. As per available data so far since 7th Dec 1631, 8 year is a common overlap period for each pair of occurrence, hence this period is utilized as an overlap period in overlap formula of Copernicus and with some logical and mathematical formulation orbital period of earth and Venus are derived and on the basis of those orbital period, explanation for each occurrence is done step by step. Because the derived orbital period of earth is different than the existing orbital period 365.2422 day, hence another formulation is done to introduce the phenomena which possibly followed by earth in 365.2422 day called oscillation, as well as the observation of sidereal year is also utilized to explain another phenomena which earth possibly follow in 365.2422 day called annual rotation, those are seems to require for explanation maximum elongation. This way this research paper is fully capable to explain all most all characteristic feature of Venus transition as a solution of this astronomical puzzle.

Keywords: Venus transition

1. Introduction

As per existing assumption regarding revolution of planet around the sun. Planets make revolution around the sun with different orbital period in near about same plane, hence in process of their revolution when two planets become coplanar and collinear then an eclipse type observation takes place. One of these type of observation is called Venus transition, in this situation earth and Venus become coplanar in line with the sun in such way that Venus seems like a black sphere and transit the surface of the sun from one edge to another. In general the periodic interval of this occurrence is 121.5 year but besides the same it also occurred 8 year earlier and later than 121.5 year, therefore it always occurred in pair with 8 year interval.

However, since its first recorded occurrence on 7th Dec - 1631 to its 8th occurrence on 5th June 2012 the exact causes behind these occurrence could not be able to define and explained exactly because at the time of its first occurrence the modern science was in its very early stage, Kepler law of planetary motion was just introduced, the heliocentric theory of solar system just came in existence with very acute and crucial condition. The orbital period of Venus calculated by Nicolas Copernicus in same contemporary period which became the basic fact, and planetary science came in existence in its current shape. Therefore the description of this research paper is initiated with the Copernicus derived formula for overlap of hour and minute needle of ordinary watch to calculate orbital period of Venus and even Earth using available data of transit. Even earth means we required

to calculate orbital period of earth also, because 365.25 day is only a traditional knowledge for orbital period of Earth and utilizing the same, orbital period of Venus calculated by Copernicus. On the basis of that formula we can also calculate the orbital period of earth 32.375 year and orbital period of Venus 6.4 year. But whether and how this orbital period of earth is related with 3rd formula of Kepler law is introduced by another formulation in which distance of the sun is determined by a newly introduced method called direct observation method, substituting this value for distance of the sun in derived formula orbital period of earth is derived which very accurately comply with orbital period derived by COPERNICUS FORMULA. After that another explanation is done for periodic meaning of 365.2422 day with the help of SIDEREAL DAY in which earth completes its rotation only in 23h 56 min 04 sec due to which longitudinal surface of earth move forward 59.13 arc minute per day and in 364 day it completes another rotation. After finding conclusion that earth completes its revolution in 32.375 year and after each 8 year interval it overlap with Venus explanation for transit of Venus is done.

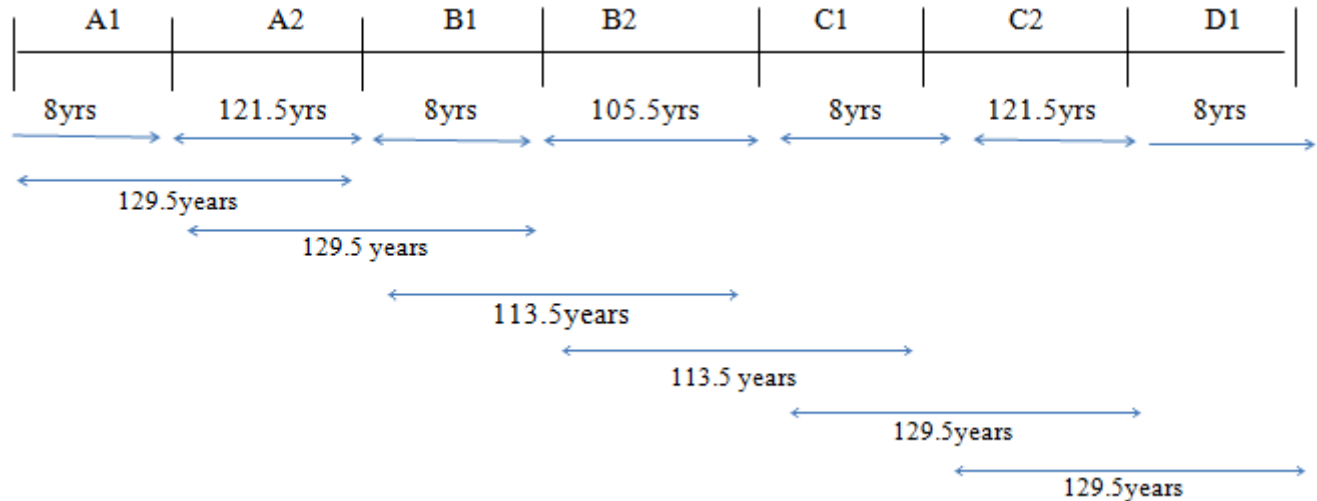
Now effort has been taken to analyze the data of maximum eastern elongation and maximum western elongation to explain on the basis of 365 days rotational phenomena. The $23\frac{1}{2}^\circ$ declination of Sun is taken as main tool and on the basis of classical mechanic based mathematical formula another phenomena of earth is introduced, due to which Earth oscillates $23\frac{1}{2}^\circ$ on its axis in 365.2422 days, and on the basis of one year's rotation and one year's oscillation phenomena of earth explanation for all event of

Venus transition is done step by step.

Finally a very newly & specific observation called SCHROTER'S EFFECT is describe to explain, in which telescopic observers often find that straight terminator takes place several day earlier or later than the maximum elongation date, date of dichotomy is usually reported early

in evening apparitions and later in morning apparition. In this paper effort has been also taken to describe possible cause behind earlier and later apparition of maximum western elongation and maximum eastern elongation respectively and to explain SCHROTER'S EFFECT.

Explanation for Venus Transition (table of previous occurrence)



Location on line	Date on which transition had taken place
A1	7 th Dec -1631
A2	4 th Dec-1639
B1	6 th june-1761
B2	3 rd & 4 th june-1769
C1	9 th Dec -1864
C2	6 th dec-1882
D1	8 th june-2004
D2	5 th June -2012

Difference between consecutive occurrences

A1 to B1	129.5 years
A2 to B2	129.5 years
B1 to C1	113.5 years
B1 to C2	113.5 years
C1 to D1	129.5 years
C2 to D2	129.5 years

Table 1: Chart of previous occurrence since 1631

2. Description

Watching Venus over several years and noting down the period of maximum elongation NICOLUS COPERNICUS at first become capable to determine the orbital period of Venus as well as overlap period of earth and Venus by the help of derived formula for overlapping period of ordinary watch described as follow. If we consider that minute needle and hour middle overlapping at 12:00 hours then, when will be next overlap again?

The answer of this question may be given by following formula derived as follow.

Let the period of revolution of hour needle is T_1 means it cover 360° in T_1 .

Let the period of revolution of minute needle is T_2 means it cover 360° in T_2 .

Therefore, in time interval 't', hour needle will be cover angle $360^\circ t/T_1$ and minute needle will be cover angle $360^\circ t/T_2$ and overlap will be only possible when the difference in the cover angle will be 360°

$$360^\circ t/T_1 - 360^\circ t/T_2 = 360^\circ \text{ or } t = T_1 T_2 / T_2 - T_1$$

We know that $T_1 = 12$ hour

$T_2 = 1$ hour

$$t = T_1 T_2 / T_2 - T_1 \text{ or } t = 12 - 1/12 - 1 = 12/11 = 1.05 = 65.47 \text{ minutes.}$$

It means after overlap by hour needle and minute needle on 12 hours the next overlap will be occurred after 1 hour 5.47 minute.

The same formula is utilized for overlap period of earth and Venus, as

$$t = T_e T_v / T_e - T_v \text{ (1)}$$

However the orbital period of earth 365.25 (T_e) days was known but the orbital period of Venus (T_v) was unknown that time.

Therefore COPERNICUS extended this formula as following way to determine the orbital period of Venus.

By watching Venus several year and recorded number of maximum elongation (N) in number of year(n).

In an interval 't' the angle covered by Venus is $360^\circ t/T_v$ in an interval 't' the angle covered by earth is $360^\circ t/T_e$ now. It may be write $t = n T_e$.

Since the number of maximum elongation also implies the number of overlap (the difference now will be not 360° , another constant angle like $360^\circ N$. $360^\circ t/T_v - 360^\circ t/T_e = 360^\circ N$

Here $t = nT_e$.

Therefore, the above equation will

$$\begin{aligned} 1/T_v - 1/T_e &= N/nT_e \\ 1/T_v &= N/nT_e + 1/T_e \\ 1/T_v &= N + n/nT_e \end{aligned}$$

$$T_v = nT_e / (N + n) = T_e \cdot n / (N + n) \dots \dots \dots (2)$$

$$T_v = T_e \cdot 8 / 5 + 8$$

(Note-Copernicus observed 5 maximum elongation in 8 year)

$$T_v = T_e \cdot 8 / 13$$

$$T_v = T_e \cdot 61538$$

$$T_v = 224.7 \text{ day}$$

Substituted $T_v = 224.7$ and $T_e = 365.25$ in equation (1)

Value of overlap of earth and Venus derived $t = 584$ days

Since then orbital time of Venus stabilized 224.7 day and overlap period 584 day.

The overlap is complied with (period of one maximum elongation to another in same direction whether eastern maximum elongation to eastern maximum elongation or western maximum elongation to western maximum elongation).

On the basis of these explanation it is very clear that period interval between two maximum elongation in same directions considered as the overlap of earth and Venus but in practical observation and analyzing every and each data of these type of transition, we find that every transit takes place in pair with 8 year time interval, then how could we say that periodic interval of two consecutive same direction maximum elongation is a real overlap period of earth and Venus?

Another point is needed to note that at the time of calculation the orbital period of Venus the orbital period of earth also considered 365.25 day.

Whether this is a scientific true or only it is a traditional assumption?

It is also interested to recall that to be determining the distance of the Sun from the earth by 3rd Kepler's law of planetary motion the same orbital period of earth utilized.

But now in 21st century it is indispensable and strictly necessary to discuss the appropriation and justification of this traditional knowledge for orbital period of earth, because a lot of astronomical physical observation are still undefined those should be defined on the basis of the contemporary law of this field. Venus transition, Mercury transition, Sidereal day, Secular variation of geometric elements, astronomical precession, astronomical nutation etc. But all these astronomical puzzle and still undefined.

Now let us start our discussion with 8 year overlap period of earth and Venus by a new assumption.

If 8 year is a common overlap period of Venus transition (in pair) then why not we utilize this periodic interval in Copernicus formula to determine the orbital period of earth and Venus in following way?

$$8 = T_v T_e / (T_e - T_v) \dots \dots \dots (3)$$

Because difference between revolution angle covered by earth and Venus is always 360° .

Hence we may imagine the following different condition for overlap

Condition (1) 30° & 390° angle covered by earth and Venus respectively

Condition (2) 60° & 420° angle covered by earth and Venus respectively

Condition (3) 90° & 450° angle covered by earth and Venus respectively...

Condition (4) 120° & 480° angle covered by earth and Venus respectively...

Condition (5) 180° & 540° angle covered by earth and Venus respectively...

Case 1- If earth completes 30° in 8 year then orbital period for earth will be 96 year and if Venus completes 390° in 8 year then orbital period for Venus will be $96/13 \text{ year} = 7.384 \text{ year}$

Case 2- If earth completes 60° in 8 year then orbital period of the earth should be 48 year.

If Venus completes 420° in 8 year orbital period of the Venus should be $48/7 \text{ year} = 6.859 \text{ year} \dots$

Case 3- If earth completes 90° in 8 year then orbital period of earth should be 32 years.

If Venus completes 450° in 8 year then orbital period of Venus should be $32/5 = 6.4 \text{ year} \dots$

Case 4- If earth completes 120° in 8 year then orbital period of earth should be 24 year.

If Venus completes 480° in 8 year then orbital period of Venus should be $8 \times 360^\circ / 480^\circ = 6 \text{ years}$

Case 5- If earth completes 180° in 8 years then orbital period of earth should be 16 year.

If Venus completes 540° in 8 year then orbital period of Venus should be $8 = 5.33 \text{ year} \dots$

Among above (v) conditions for overlap of earth and Venus, we find that 3rd condition is more appropriate than the other because this condition is directly related with the synodic period 584 day as follow.

$$584 \times 4 = 6.395 \text{ years}$$

$$584 \times 5 = 2920 \text{ day} = 8 \text{ year}$$

$$584 \times 20 = 11680 \text{ day} = 32 \text{ year}$$

Hence we take in consideration the 3rd condition for analysis the available data of Venus transition.

However orbital period for earth (32) years and Venus (6.4) years is nearby approximate.

Hence we analyze the centurion overlap period of Venus transition 129.5 year, 113.5 year, 121.5 year respectively (table-1), then we find the following if we divide these dates by 32 years

$$129.5 \div 32 = 4.04687 \dots (a)$$

$$113.5 \div 32 = 3.54 \dots \dots \dots (b)$$

$$121.5 \div 32 = 3.79 \dots \dots \dots (c)$$

Now we find that all these outcomes are numerically .04 more than its round number 4, 3.5 and 3.75 respectively. If these outcomes represent number of revolution of earth then we may derive the orbital period of earth as follow,

129.5 ÷ Te = 4 or Te = 32.375
 113.5 ÷ Te = 3.5 or Te = 32.428
 121.5 ÷ Te = 3.75 or Te = 32.40

Hence average of above three are equal to = 32.40 year
 Now if we consider the orbital period of earth 32.40 year and overlap period with Venus is 8 year then we may calculate the value of orbital period of Venus by equation (3)
 $T = T_e T_v / (T_e - T_v)$
 $8 = 32.4 T_v / (32.4 - T_v)$
 $T_v = 6.4158$ year

3. Mathematical Evidence for 32.40 Years Orbital Period of Earth

Let us consider that a spherical body of mass 'm' (very small in compare to central body) making revolution around a central body with linear velocity which is situated at R distance.

Hence the acceleration adopted by this spherical body will be as follow see Figure- 1

$$A_s = v^2/R \dots\dots\dots (4)$$

If the body spinning on its axis also in such way that its direction of rotation and direction of revolution become perpendicular to each other than the expression for linear velocity in derivative form will be ds/dt

As per differential calculus any derivative represents a tangent form of curve.

Hence its normal form is also possible as - 1/ds/dt

If ds/dt represents a tangent form of velocity whose direction of movement is perpendicular to it (means rotation)

Hence -1/ds/dt = -dt/ds represent a normal form of Velocity whose direction of movement is parallel to it (means revolution).

If this spherical body is Earth,

Hence the linear velocity of the earth for a particular direction will be

$$ds/dt = 2\pi r/t \dots\dots\dots (5)$$

Where r = radius of earth & t = periodic time for rotation of earth.

$$ds/dt = 2 \times 3.14 \times 6370 / 86400 = 40000 / 86400 \text{ km/sec} = 0.46 \text{ km/sec}$$

The normal form of velocity may be represents as

$$-1/ds/dt = -dt/ds = 86400 / 40000 \text{ sec/km} \dots\dots\dots (6)$$

Because this is an expression of velocity of revolution for earth, hence its dimension should also be km/sec. But the equation (6) represents sec/km (just reverse to the dimension of velocity.)

Hence earth does not adopt this magnitude of velocity until its dimension become dimension of velocity like km/sec which may only possible when magnitude became unit,

If magnitude became 86400/86400 or 40000/40000

Then in both condition magnitude became unit. But because the time quantity is independent variable for velocity and displacement is dependent quantity of velocity derivative. Hence we replace the 40000 by 86400, So that the magnitude of this velocity became unit. And if now dimension became reverse then meaning of expression will not change.

$$86400/86400 \text{ km/sec or } 86400/86400 \text{ sec/km}$$

This expression (86400/86400 km/sec) represents velocity with respect to sun.

The expression (86400/86400 sec/km) represents velocity with respect to earth.

$$(86400/86400 \text{ km/sec}) = 1/1 \text{ km/sec} \ \& \ (86400/86400 \text{ sec/km}) = 1/1 \text{ sec/km}$$

Hence earth adopt 1 km/sec as the velocity of the derivative expression dt/ds for revolution around the sun.

Note-

(1) This logic may be possible because the acceleration due to sun may displace the earth 86400 km in 86400 sec

(2) Any other explanation is also possible because it is a natural phenomenon but it seems true for derive Kepler's expression as well as useful to determine the distance of the Sun and orbital period of earth.

If T is periodic time of revolution for earth and R is the distance between earth and the Sun.

$$\text{Hence } dt/ds = 1 \text{ sec/km} = T/2\pi R = 1 \text{ km/sec} = dT/dS \text{ linear velocity of revolution by earth.}$$

If earth adopts velocity 1 km/sec with expression dt/ds = T/2πR.

(Note- because minor and major axis is ≈ 1)

Then the acceleration due to sun for revolution of earth will be.

$$A_s = 1^2/R = (T/2\pi R)^2/R = T^2/4\pi^2 R^3 \text{ (as per equation 4)}$$

$$A_s = T^2/4\pi^2 R^3$$

$$T^2 = A_s 4\pi^2 R^3 \dots\dots\dots (7)$$

$T^2 \propto R^3$ which is Kepler's third law

Where T is the periodic time for revolution of earth around the Sun, however expression of equation 7 is very similar to the Kepler's third law of planetary motion, hence the orbital period for the earth can be derive, if we have a correct determined distance of the sun from the earth. As we are familiar with the existing knowledge of the distance from the earth 149.6 Million km but the same is not utilized for derive the orbital period of earth in this research paper. A separate method is introduced here for determine the distance of the sun as follow.

4. Direct observation Method to determine the Distance of the Sun from Earth

If we observe carefully the rising interval of the sun daily with following described way then we find that rising period of the sun is 182 sec to 183 sec or between them on horizon

at the time of rising, which may be verified easily daily wise by direct observation method. See figure -2

If we imagine a linear plane in east horizon at time of rising the sun in morning in such way that just when the sun seems to be rise, the upper edge of the sun touches the imagined linear plane and switched on a stopwatch and now observe carefully the rising event of the sun until the bottom edge of the sun coincide with the imagined linear plane like given in figure no 2 and note down the periodic interval of this event by switch off the stopwatch .If we repeat same observation many times then we will find that interval would be 182 sec or 183 sec or any other between them.

As we are familiar that the sun is concentrated on a particular place or having negligible displacement in space and rising event takes place due to spine of earth about its axis, therefore in which time period the sun seems to cross the linear plane earth spin some degree about its axis, the value of this angle in 182.5 sec will be 0.7604166° (see Fig-2 & Fig-3)

If line AC and CD are drawn on above and bottom edge of the sun respectively then we find a triangle ACD .Now If a straight line CB drawn on AD in such way that it bisect the angle ACD and meet on line AD on B point then angle ABC will be 90° and triangle formed will be right angle triangle in which side $AB=690200$ (Radius of the Sun)
 $\angle ACB=0.3802083^\circ$
 $\angle CAB=89.619792^\circ$

If these values are placed in equation for law of triangle then the value of other sides can be determine as follow and these will be minimum and maximum distance of the sun from observe location.

$$\frac{a}{A} = \frac{b}{B} = \frac{c}{C}$$

$$\frac{89.619792^\circ}{a} = \frac{90^\circ}{b} = \frac{0.3802083^\circ}{690200}$$

$$a = 162688660 \text{ km}$$

$$b = 163378850 \text{ km}$$

Minimum distance of the sun is 162688660 km
 According to equation no 7
 $T^2 = 4\pi^2 R^3 / As$
 $T^2 = 4\pi^2 R^3 / 1/R$ (As per equation 4)..... (8)
 $T^2 = 4\pi^2 R^2$
 $T = 2\pi R$ (9)
 $T = 2\pi 162688660 \text{ sec} / 60 \times 60 \times 24 \times 365.2422$
 $= 32.405385 \text{ years}$

5. Logical Explanation for 32.4 Years Orbital Period Of Earth

AS we are familiar that earth makes rotation on its axis once in 24 hour covering 360° of its rotational angle due to which the sun seems apparently to make revolution around the earth in 24 hours and again rise in east horizon next day transiting a specified line of reference called Greenwich line or tropical zodiac.

This line of reference is situated at 0° or 360° on equator circle of earth however earth rotate on its axis in 24 hours but as per practical observation its rotation cycle completes just in 23 H 56 min 04 sec approximate....means 3 minute 56 sec earlier than 24 h.

This 23h56 minute 04 sec periodic time for rotation of earth is called sidereal day and 24 hours rotational period of earth means solar day because the time circle of 24 hour for earth is equal to 360° for means solar day, therefore the time circle for 23h 56 min 04 sec of earth will be equal to 359.0167°

Hence when earth completes its rotation of 360° in 24 hours it move forward 59.13 arc minute about axis of rotation because its cycle of rotation completes in 23H 56 min 04 sec. When it completes nearly 359.0167°
 The cause behind this may be as follow

The axis of rotation is straight line for earth and must have to coincide with orbital line of revolution which is not a straight line but a curvature. Hence when rotation of earth completes in 24 hour the tropical zodiac move forward 59.13 arc minute about axis of rotation but it does not move forward 59.13 arc minute on its orbit of revolution about the center of orbit (Central body). Reference line of rotation and reference point for revolution is quite different.

As per present knowledge of astronomy earth move forward 59.13 arc minute /day on its path of revolution, but in real fact the tropical zodiac move forward 59.13 arcminute/day with respect to its reference line of rotation. Earth does not move forward 59.13 arc minute/day on its path of revolution, Earth move forward only $59.13 \div 32.375 = 1.826$ arc minute/day (fig-4). Hence due to rotation of tropical zodiac $360^\circ @ 59.13$ arc minute per day Earth completes another rotation in 365.2422 day which is apparently visible as a ecliptic path of the sun. In this process the Sun seems to rise every day 59.13 arc minute or 3 minute 56 second earlier than previous day, but in real fact this Ecliptic path of the Sun does not indicate the orbital path of revolution ,because shape of Ecliptic is wave like .Now let us see another very important observation, If we observe the rising location of the Sun daily wise, then we find that rising location of the Sun shift @15 arc minute /day in north or south direction on horizon respectively up to 23.5° with respect to earth's equator circle in 365.2422 days. However as per existing assumption Earth is permanently tilted 23.5° about its axis of rotation but it may be also possible if Earth would have a natural tendency to oscillate about its axis of rotation up to 23.5° in 365.2422 days, which is also possible to explain by mathematical formulation.

6. Description Available in Text Book of Classical Mechanics and Finally Formulation of Periodic Time of Small Oscillation

If we draw a careful scrutiny attention on some specific condition of effective potential energy in chapter of motion under central body of classical mechanics then we find that

The equation of effective potential energy is derived as....

$$V' = -\int k/r^2 dr + l^2/2mr^2 \dots\dots\dots (10)$$

$$V'(r) = -k/r + l^2/2mr^2 \dots\dots\dots (11)$$

Note-Here r is distance of the sun...

When the graph of different case of K is drawn then no any bounded and periodic path are obtained for attraction force, repulsion force or no force $k>, k<0, k=0$ respectively but in case of $k<0$ and $l \neq 0$ if energy is negative and greater than minimum potential energy $v'(r) = \frac{1}{2}k^2m/l^2$ then the path of motion exist between 0 and $-\frac{1}{2}k^2m/l^2$ which represents two turning points having bounded and unclosed path of motion. This path of motion exist between two circle of radius r_1 and r_2 (fig-5&6). However this type of path had not been taken in consideration for Kepler's formulation because it did not comply with Kepler's first law of planetary motion. As the path represents a bounded periodic and unclosed path between two circles, and equation of effective potential energy follows the condition of small oscillation, therefore it may be possible that periodic time of small oscillation would be 365.2422 days. In this condition number of small oscillation in one revolution would be equal to 32.375 and proposed figure of this type of orbit will be like figure no-(7). If we study carefully the method for formulation of Kepler's formula then we will find that in particular situation total energy becomes equal to effective potential energy and its expression is utilized to derive the eccentricity of Kepler's ellipse. But if we consider that this expression of total energy acts as an effective potential energy in same way, then both type of orbit may be possible 1st is an ellipse and 2nd is an unclosed path of small oscillation having periodic interval 365.2422 days. Let us see how this may be possible.

Derivation of kepler's formula on the basis of inverse square law and possible condition under which the path represents a small oscillation.

$$f(r) = -k/r^2$$

Here k is constant corresponding potential energy

$$V(r) = -k/r$$

The equation of orbit

$$d^2u/d\theta^2 + u = -m/l^2u^2 f(1/u)$$

$$\text{Putting } f(r) = f(1/u) = -k/r^2 = -ku^2$$

$$\text{We get } d^2u/d\theta^2 + u = mk/l^2$$

Let us put $y = u - mk/l^2$ so that

$$d^2y/d\theta^2 = d^2u/d\theta^2$$

$$\text{Equation become } d^2y/d\theta^2 + y = 0$$

The general solution of this equation

$$y = u' \cos(\theta - \theta')$$

$$u = mk/l^2 + u' \cos(\theta - \theta')$$

$$u = 1/r = mk/l^2 + u' \cos(\theta - \theta') \text{ ----- (12)}$$

Where u' and θ' are constant, for simplicity if we orient our co-ordinate system so that.

$$\theta' = 0 \text{ then } 1/r = \frac{1}{r} = \frac{mk}{l^2} + u' \cos\theta$$

$$r = \frac{l^2/mk}{1 + u'l^2 \cos\theta/mk} \text{ ----- (13)}$$

If equation(13) compared with equation of conic section

$$r = p/1 + \epsilon \cos\theta \text{ ----- (14)}$$

Where $p = l^2/mk$ and $\epsilon = u'l^2/mk$

In this case for attraction force $k > 0$ all type of orbit are possible. Therefore to explore the shape of orbit expression p and ϵ are required in terms of known constant which has been done by taking the equation of total potential energy in consideration

$$E = \frac{1}{2}mv^2 + \frac{l^2}{2mr^2} + V(r) \text{ ----- (15)}$$

Where $V(r) = -k/r$

$$\text{Therefore } E = \frac{1}{2}mv^2 + \frac{l^2}{2mr^2} - k/r \text{ ----- (16)}$$

Now because E is constant, we can evaluate at any convenient point of the orbit, suppose we take the turning point at which r is minimum say r_{min} . This at the turning point \dot{r} will be zero. Equation now become

$$E = 0 + \frac{l^2}{2mr^2}_{min} - k/r_{min} \text{ ----- (17)}$$

Substituting the value of r_{min} in shape of

$$r_{min} = p/1 + \epsilon \text{ from equation no(14) to}$$

$$r_{min} = l^2/mr/(1 + \epsilon)$$

The value of E determines and expression for ϵ is derived as $\epsilon = 1 + (2El^2/mk^2)^{1/2}$ substituting the value of ϵ and p in equation (14)....

The shape of orbit has explored in process of keplar's formulation (detailed available in any text book of classical mechanics...)

But if we consider the equation (17)

$$E = 0 + \frac{l^2}{2mr^2}_{min} - k/r_{min}$$

And compare the same with equation of effective potential energy equation no.... (11)

$$V'(r) = -k/r + l^2/2mr^2 \text{}$$

Then we find that expression of both these equation are same. Therefore possible condition represents by equation no(11) is also possible for equation no... (17)

As given earlier the effective potential energy represents bounded and unclosed path of motion therefore the equation (17)... will also represents the same type of path for motion which will be path of small oscillation.

Now this equation no(17) compared with Lagrangian equation of simple harmonic motion, then the expression for periodic time of one oscillation can be determine

$$\text{In } E = \frac{l^2}{2mr^2}_{min} - k/r_{min}$$

$$\text{If substitute } l = mr^2 \theta$$

$$E = m^2 r^4 \min \theta^2 / 2mr_{min}^2 - k/r_{min}$$

$$E = mr_{min}^2 \theta^2 / 2 - k/r_{min} \text{ ----- (18)}$$

The equation of Lagrangian equation of simple harmonic motion

$$L = T - V$$

$$L = \frac{1}{2}ml^2\theta^2 - mgl(1 - \cos\theta) \text{ ----- (19)}$$

where l = distance of bob from the zero level or reference line.

If earth is considered as a bob and its center as reference point then the radius of earth will be equal to l and if the radius of earth is equal to n th part of minimum distance of the Sun then

$$\text{Radius of earth } rE = r_{min}/n$$

$$r_{min} = nrE$$

(Note- rE = radius of earth & n = Constant natural number)

If substituted value of r_{min} in equation(18).

Then the equation will be

$$E = \frac{1}{2}m(nrE)^2 \theta^2 - k/rEn \text{ ----- (20)}$$

If compare this equation with equation no19 then only the expression of potential energy is different. Now if we consider earth oscillates 23.5° (approximate 15 arc minute per rotation) about its axis of rotation and k is equal to $r_{min} \text{Asgml} (1-\cos\theta)$ because $k < 0$

Then $k/r_{min} = \text{Asgml} (1-\cos\theta)$
 Then $V(r) = k/r_{min} = m \text{As} g r_{min}/n(1-\cos\theta)$ ----- (21)

Therefore a simple harmonic form of equation 20 will be
 $E = \frac{1}{2} m (r_{En})^2 \theta^2 - m \text{As} g r_{min}/n (1-\cos\theta)$ -----(22)

Now $\delta E/\delta\theta = m(r_{min}/n)^2 \theta$
 $\delta E/\delta\theta = -m \text{As} g (r_{min}/n) \sin\theta$

If these value are substituted in lagrangianequation

$$\begin{aligned} d/dt(\delta E) /(\delta\theta) - \delta E/\delta\theta &= 0 \\ d/dt m(r_{min}/n)^2 \theta + m \text{As} g (r_{min}/n) \sin\theta &= 0 \\ m(r_{min})^2 \theta + m \text{As} g (r_{min}/n) \sin\theta &= 0 \\ \theta + \text{As} g (n/r_{min}) \sin\theta &= 0 \end{aligned}$$

If the amplitude of the path is very small then $\sin\theta = \theta$
 $\theta + \text{As} g (n/r_{min}) \theta = 0$ ----- (23)

Which are an equation of periodic path and its equation of periodic time is

$$T = 2\pi \sqrt{r_{min}/n \text{As} g}$$
 ----- (24)

If $r_{min}/n = 6360 \text{ Km}$ (Radius of Earth)
 And $\text{As} = 1/R$ According to equation no(4) where
 $R = 162688660 \text{ Km}$ & $g = 10 \text{ mt/s}^2 = 10/1000 \text{ Km/s}^2$
 $T = 2(31951774.074) \text{ sec}$

Note:- In process of calculation the periodic time unit Second by Pendulum formula $t = 2\pi \sqrt{l/g}$, We find that periodic time t for one oscillation = 2 sec ,hence 1 sec = 1/2 oscillation, means $t = 1 \text{ sec} = \text{period of half oscillation}$, similar way we may determine the periodic time T for oscillation of earth half of $2(31951774.074) \text{ sec} = 31951774.074 \text{ sec}$
 31951774.074 divided by $60 = 532529.5679$ Minute again divided by $60 = 8875.4928$ Hours again divided by $24 = 369.81$ days

Here we find that oscillation period for Earth is 369.81 days which should be 365.2422 days

But if we consider the distance of the Sun $R = 162688660 - 690200$ (Radius of the sun) = 161998460 Km & radius of earth = 6230 Km (possibly polar radius of the earth) and

$$T = \pi \sqrt{r_{min}/n \text{As} g}$$

Then we find, $T = 31573026.2606 \text{ sec} / 86400 = 365.42$ days

On the basis of above explanation we find that besides the revolution in 32.375 year and rotation in 365.2422 day, earth also make one oscillation about its axis of rotation $23\frac{1}{2}^\circ$ in 365.2422 day, due to which sun apparently seems to rise daily with declination 15 arc minute either in north or south direction maximum up to $23\frac{1}{2}^\circ$

Because earth makes sidereal rotation once in 365.2422 days and along with same it also oscillates $23\frac{1}{2}^\circ$ in south and north direction hence due to this phenomena equator of earth come on a particular day in line of the sun and on that day sun rises in exact east inline of equator and after that equator

of earth start to oscillates 15 arc minute per day either in north or in south direction

When equator start to oscillates in north direction then sun apparently seems to inclined in south direction and rises next day in same location shifting 15 arc minute/day up to $23\frac{1}{2}^\circ$ in south direction up to 3 month, but on that day the Sun rises in east from 90° of longitudinal circle ,on which day sun rises from $23\frac{1}{2}^\circ$ south of the equator and it set in west $23\frac{1}{2}^\circ$ north of equator, after that the Sun seems to rises in reverse direction @ 15 arc minute/day up to 0° (mean position of oscillation) and at that day the rising location of the Sun become inline of 180° longitudinal circle and the Sun continue to rise shifting 15 arc minute/day up to $23\frac{1}{2}^\circ$ in north direction, but at that day the Sun rises from east inline 270° of longitudinal circle , which takes 9 months of sidereal rotation, and after that rising location of the Sun again become reverse in south direction up to mean position 0° oscillation and 360° sidereal rotation and similar way sidereal rotation and $23\frac{1}{2}^\circ$ oscillation takes place in one year .Hence due to sidereal rotation of earth the Sun apparently seems to make revolution in 365.2422 day passing 12 horoscopic houses of 30° each , but due to oscillation of earth in 365.2422 day planets and stars apparently seems to follow retrograde motion. Besides the same earth also cover a particular angular distance 11.11° of its orbit in 365.2422 day.

This way the tropical zodiacs also make one rotation on its axis due to sidereal rotation of earth in one year.

Now let see the visibility situation of Venus from earth, Venus is visible from two situation one situation, before raising the sun in east and second situation after setting of sun in west. In one synodic periodic time (584 day) Venus neither visible in east nor visual in west.

These two types for visibility of Venus are called dawn and dusk. When it visible in morning time then it called dusk, and when it visible in evening after sun set it called dawn. Venus in general becomes invisible for someday 54 days when it shift from dusk to dawn or vice versa. In our earlier description we have derived that orbital period of earth is 32.375 year and orbital period of Venus is 6.4138 year, hence at the path of revolution earth will be arrived at B in 8 year (2 day less) Fig-8 and cover its orbital angle $88.896624^\circ @ 11.119652^\circ/\text{year}$ and Venus will be complete 444.4° instead of $448.896624^\circ (360^\circ + 88.896626^\circ)$ of its path of revolution, and overlap takes place. The cause behind this difference may be possible that orbital period of Venus is approximate 1/5 of the orbital period of earth, hence angular velocity of Venus will be 5 times more than the earth, for exact overlap earth must be cover 90° and Venus must be cover $450^\circ (360^\circ + 90^\circ)$ of its path, but in this case earth completes only $88.89^\circ, 1.11^\circ$ less than 90° . Hence in which period earth cover 1.11° , Venus will be cover 5.55° path of its orbit and this measurement will be reduced from overall revolution of Venus 450° means $450^\circ - 5.55^\circ = 444.45^\circ$. Therefore in which period earth will be completes its 88.89° path Venus will complete 444.45° of its path and rate of revolution per year for earth and Venus will be 11.11° and 55.55° respectively and on the basis of these data, calculation is done for its overlap periodic table which

completely comply with all previous data of Venus transition since June 1631 (see Table -2)

7. Explanation For Maximum Elongation

If Venus completes its revolution around the Sun in 6.4138 years and overlap with earth after 8 year then why maximum elongation in eastern and western direction in 584 days interval take place. Now let us see the figure-9. If we consider the data of overlap on 8 June/2004 & next overlap of 5 June/2012 then we may very clearly identify the followed path by Earth and Venus respectively and possible 5 locations of Earth and Venus on its path of revolution in 8 year time interval. But if we remind the date of maximum elongation before 8 June/2004 then the eastern maximum elongation observed on 2 April/2004 and maximum western elongation observed on 21 August/2004 of 142 days interval and after 442 day later next eastern maximum elongation occurred, and with same sequence of interval occurrence of maximum elongation were taken place up to 2 April/2012, addition of these both interval 142 & 442 = 584 day is called synodic period. However as per Copernicus explanation number of maximum elongation implies the number of overlap by earth & Venus but in case of maximum elongation constant angle between earth and Venus not become 360° but any other angle, but in this paper it has been shown that maximum elongation of Venus is quite different than overlap of earth and Venus, the maximum elongation takes due to sidereal rotation & oscillation of earth in 365 day as well as latitude of observer but overlap of Venus and earth takes place due to become collinear of Venus & earth with the Sun in 8 year, 121.5, 113.5, 129.5 year etc.

Let us see figure-8. In this figure position of earth shown of 8 year interval, E_1, V_1 & S are in line at its first position. Similarly E_6, V_6 & S are in line after 8 year, but these two situation only represent the circumstances of transition or overlap these are not a date maximum elongation in between 8 year periodic interval 5 eastern maximum elongation & 5 western maximum elongation are occurred in 584 day periodic interval. The day on which occurrence of transit or overlap take place is neither date of eastern maximum elongation nor a date of western maximum elongation, 584 day synodic period cannot be called a periodic interval of transitor overlap.

Because rising of the Sun takes place due to rotation of earth and declination of the Sun takes place due to oscillation of earth, Hence in process of rotation & oscillation of earth, which longitudinal semicircle come in front of the Sun on this longitudinal line mid-day or 12 o'clock takes place, if the longitude of that semicircle is 180° then observer from 90° observes the rising of the Sun on east horizon and observer from 270° longitude semicircle observes Sun set (figure-10) on western horizon. Hence rising and setting of the Sun can be observe at same moment from two different location, but visibility of Venus is only possible from one location and observation of eastern and western maximum elongation take place due to following cause. If we see figure-9 very carefully then we find that in 8 year orbital revolution Venus comes on five point V_2, V_3, V_4, V_1, V_2 respectively in 584 day interval and earth comes on $E_2, E_3,$

E_4, E_5, E_6 , from E_1 respectively covering $17.77^\circ @ 11.11^\circ/\text{Year}$, but maximum elongation does observed from a particular latitude of earth at the time of sun rise and sun set. Hence due to combined effect of rotation, sidereal rotation, oscillation, revolution of earth & Venus as well as latitude of observer occurrence of maximum elongation takes place one time after sunset and next time before sunrise in between 584 day. As per existing assumption period of eastern maximum elongation to western maximum elongation is 142 day and western maximum elongation to eastern maximum elongation is 442 day but if we consider two year periodic time of earth ($365 \times 2 = 730$) day and divide 730 day by 5 then we find 146 day and 3 times of 146 equal to 438 and addition of 146 & 438 is equal to 584 day, if we consider 730 days, 2 sidereal rotation in term of 720° & divide by 5 then we find 144° rotation for earth in 146 day, now we subtracted 144° from 360° then we find 216° which is 17° more than sunset observation latitude & 17° less than sunrise observation latitude these are 287° & 73° respectively, if we consider mid-day at 180° , hence these are locations from where maximum western & eastern maximum observation are observed when sidereal longitudinal semicircle of observer coincide with the same. The observer does not observe both maximum elongation after each & every 146 day interval covering 144° of sidereal rotation, it only observes western maximum elongation after 146, after then making 432° sidereal rotation in 438 day it observes Venus at eastern maximum elongation. (If we analyze carefully the before and after maximum elongation date than 8 June/2004 transition then we find that eastern maximum elongation was taken 68 day earlier and western maximum elongation was taken place 74 day later than 8 June/2004, but how and why these occurrence maximum elongation takes place 68 day earlier and 74 day later than transition date is directly related with correct time interval for transit of Venus and correct data regarding sidereal rotation as well oscillation phenomena of earth also which is not possible to procure at present because these type of phenomena are introduced first time in this research paper, but these introduced phenomena are most valuable assumption for explain the Venus transition in this research, hence can not ignore easily its importance.) On the basis of this relation we may easily say that from eastern to western maximum elongation periodic interval should 146 day, and from western to eastern maximum elongation periodic interval should be 438 day. Possibly due to this cause observer observes western maximum elongation 4 day later than 142 day & eastern maximum elongation 4 day earlier than 442 day, which is called SCHRODER'S EFFECT.

This is the position of earth and Venus on its orbit of revolution in 8 year periodic time in which E_1, V_1 and S are line at its first position, when overlap takes place. It may be in either June or December, In general occurrence of December takes place when Venus shift from western elongation to eastern elongation, but in its reverse occurrence of June takes place when Venus shift from eastern elongation to western elongation.

As per figure no-9 in between 8 year 5 maximum eastern elongation and 5 maximum western elongation takes place and period of maximum western elongation to maximum

eastern elongation is 442 day and period of maximum eastern elongation to maximum western elongation is 142 days, and from one maximum western elongation to next maximum western elongation is 442+142=584 day and vice versa.

Hence within 584 days one maximum western elongation and one maximum eastern elongation takes place. The day on which occurrence of transit takes place is neither a day of maximum western elongation nor a day of maximum eastern elongation hence 584 days synodic cannot be called a period of overlap.

As the synodic period is 584 day hence in between Venus once reach on its eastern maximum elongation and then on its western maximum elongation and again reach on its maximum eastern elongation point ,but how this observation takes place let us see the 8 year periodic interval earth comes on 5 location of its orbit

From E1, to E2 ,E2 to E3 ,E3 to E4 ,E4 to E5 and E5 to E6 in 584 day and in this periodic interval earth covers 17.79° path of its orbit , Similarly in same period 584 day Venus reaches V1 to V2, V2 to V3, V3 to V4 and V4 to V1 or V5 and V1 or V5 to V6 or V2...

But orbital distance covered by earth or Venus are different on their orbits, earth cover only 17.69° whereas Venus cover 88.88° of its path of orbit in same direction but in this periodic interval earth oscillates also about its axis of rotation accordingly .Therefore If we analysis a graph of Venus in evening sky at 30 minutes after sunset from any latitude(let 55°north) then we find that for each 584 days apparition graph of Venus represents different shape for 5 synodic period up to 8 year, and after that it become cyclic and similar to each 5 synodic period just same shape shown by fig -13a,b,c,d,e respectively.

Explanation of Causes behind Occurrence of Transit of Venus

As per table No-1
 Difference between consecutive occurrences
 A1 to B1 -----129.5year
 A2 to B2 -----129.5 year
 B1 to C1 -----113.5 year

B2 to C2 ----- 113.5 year
 C1 to D1 ----- 129.5 year
 C2 to D2 ----- 129.5 year

If occurrence of transit follow the same sequence the next pair of transit will be taken place possibly on 9th December/2117 & 6th December/2025 but forecasting of next occurrence is not a purpose of the research paper , the purpose of this paper is search out the relevant and exact cause behind this happening , if we analysis the data so far available since 1631 to 2012 we find that each occurrence takes place in pair having 8 year periodic interval , that's why this periodic interval 8 year is considered as overlap period of earth and Venus and substituted in Copernicus formula for overlap of ordinary watch needle to determine the orbital period of earth& Venus.

If we consider any one line to occurrence of overlap as a reference (0°,0°) for revolution of earth and Venus to make a table for each 8 year 's revolution angle for earth and Venus respectively @ 11.1196° for earth& 4.997 times more for Venus then we find that data available for 8, 113.5, 121.5, 235 and 243 years revolution of both ,then we find that data of revolution for earth & Venus does tally with the occurrence 1769, 1874 ,1882, 2004 and 2012 as follow, see Table no-2

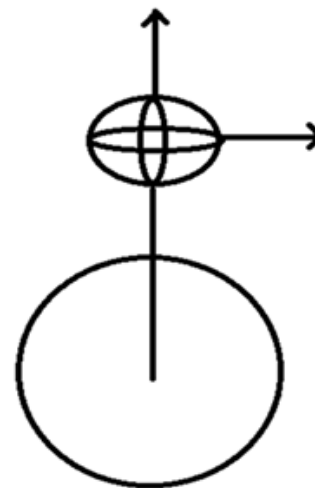


Figure 1

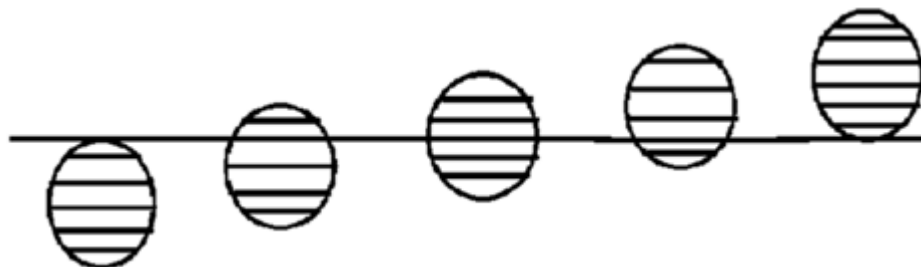


Figure 2

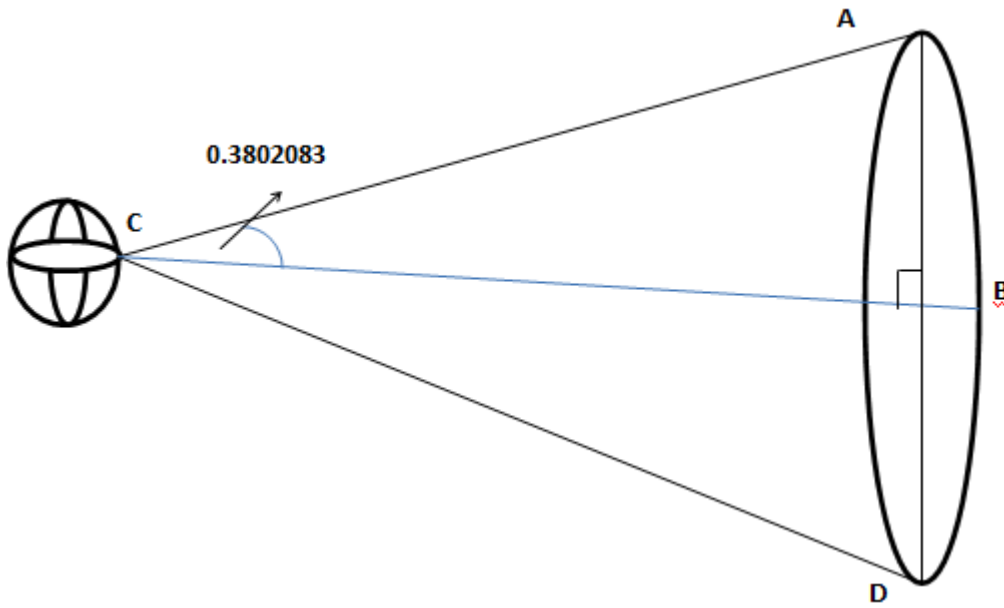


Figure 3

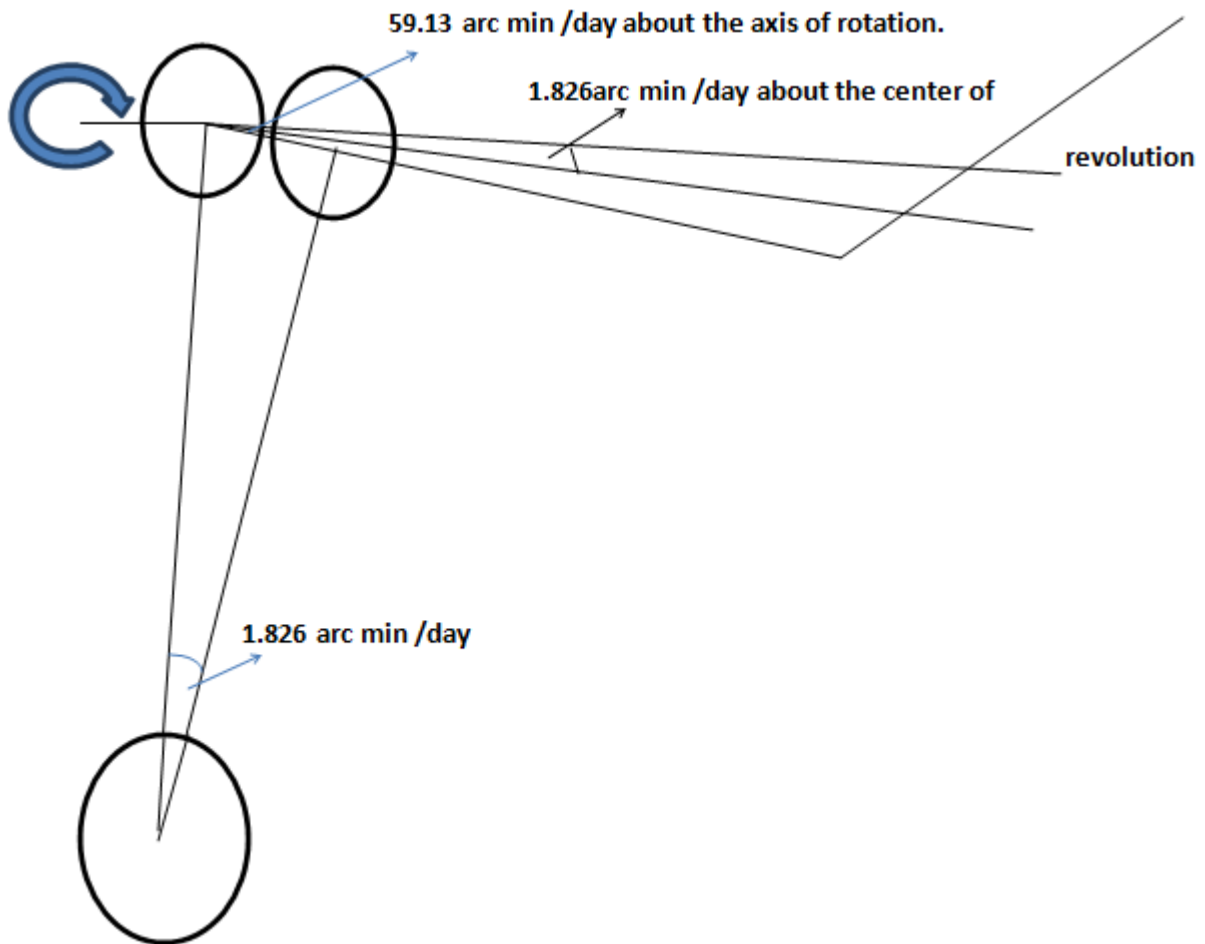


Figure 4

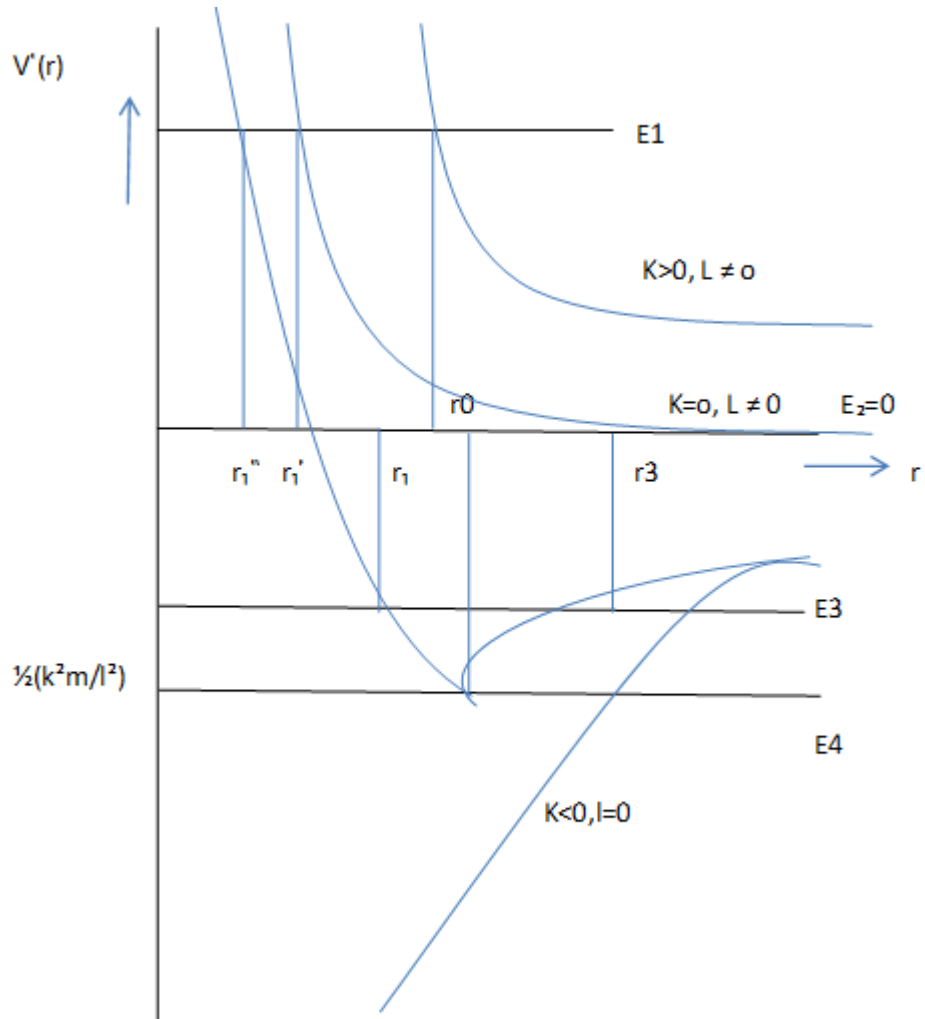
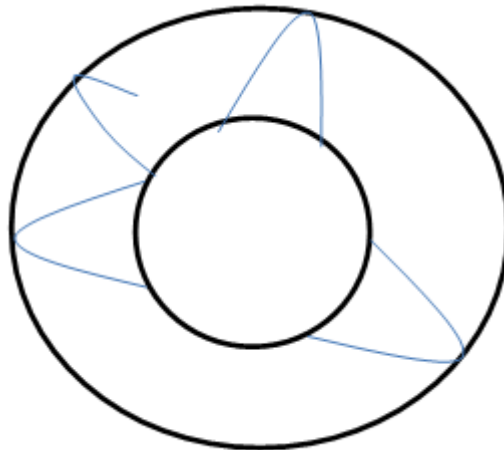


Figure 5



Nature of orbit for bounded motion

Figure 6

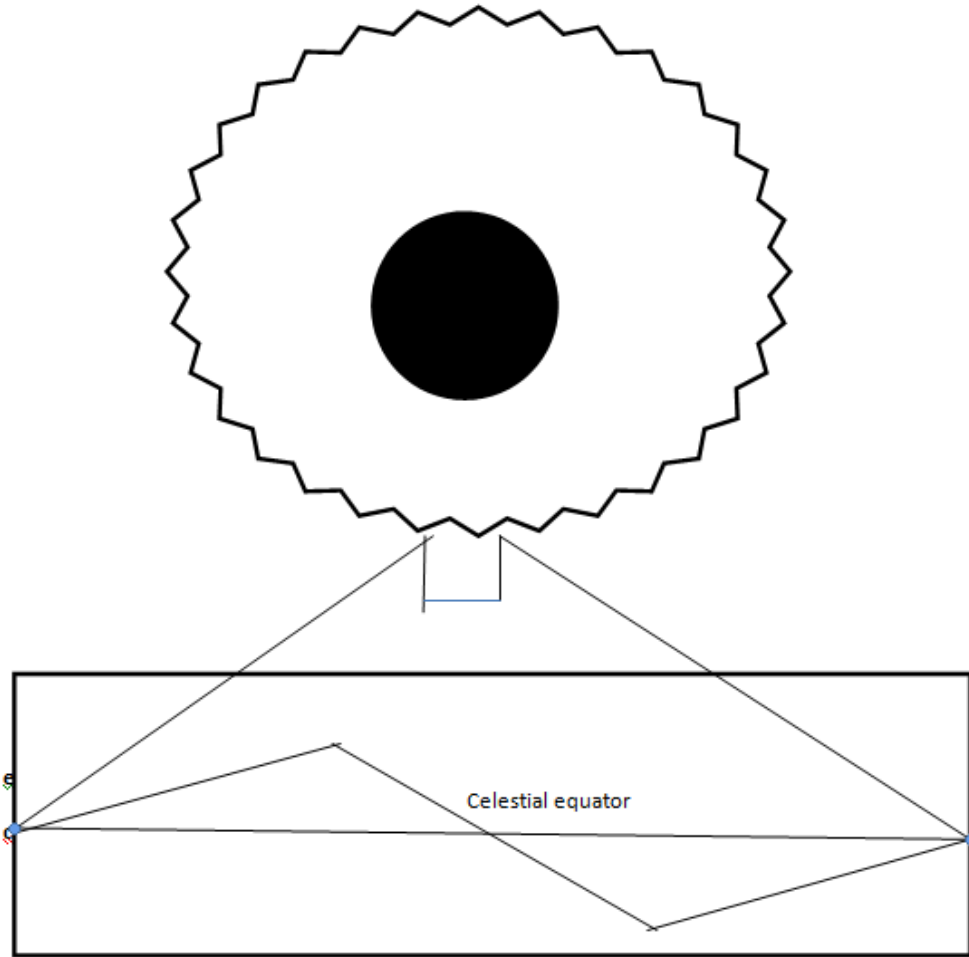


Figure 7

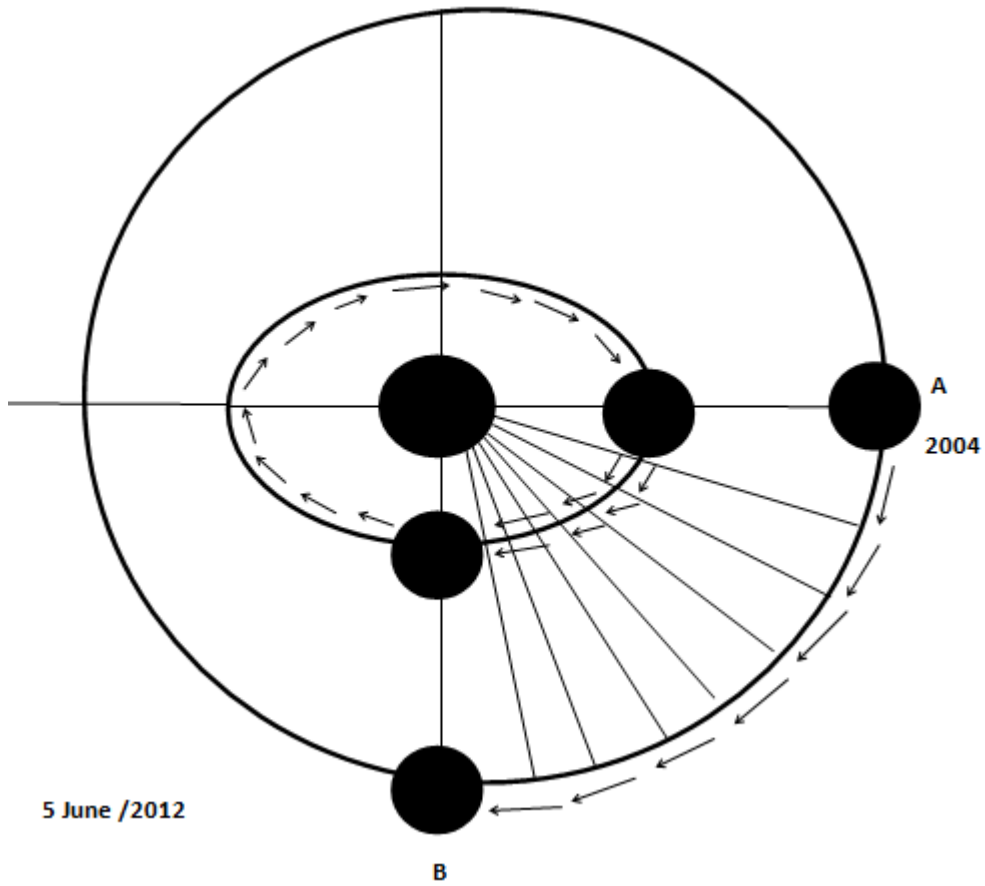


Figure 8

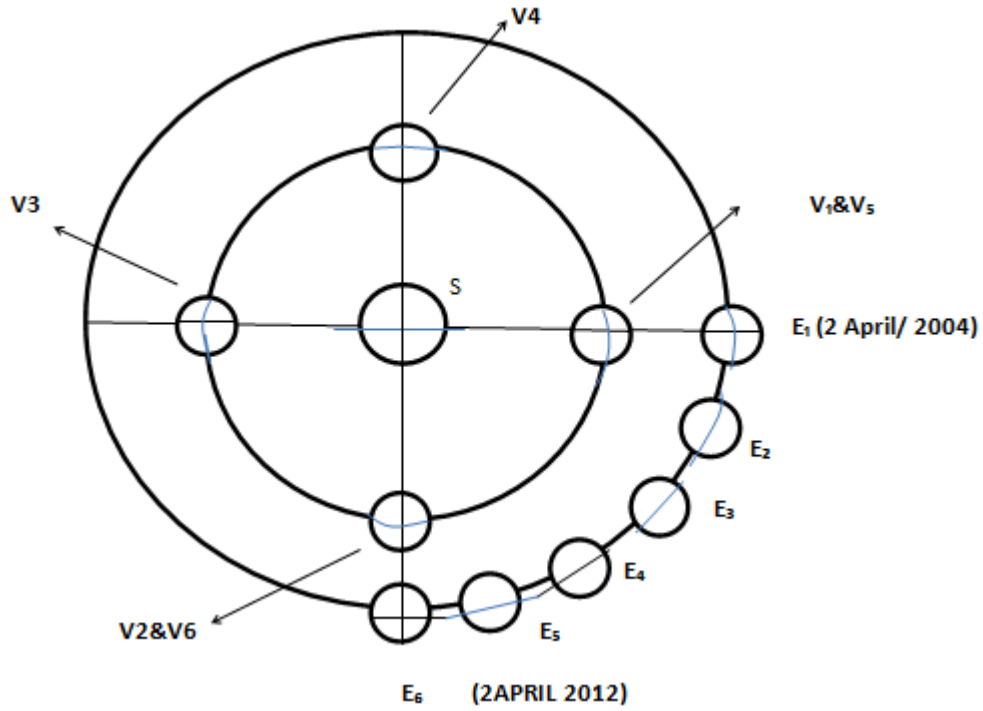


Figure 9

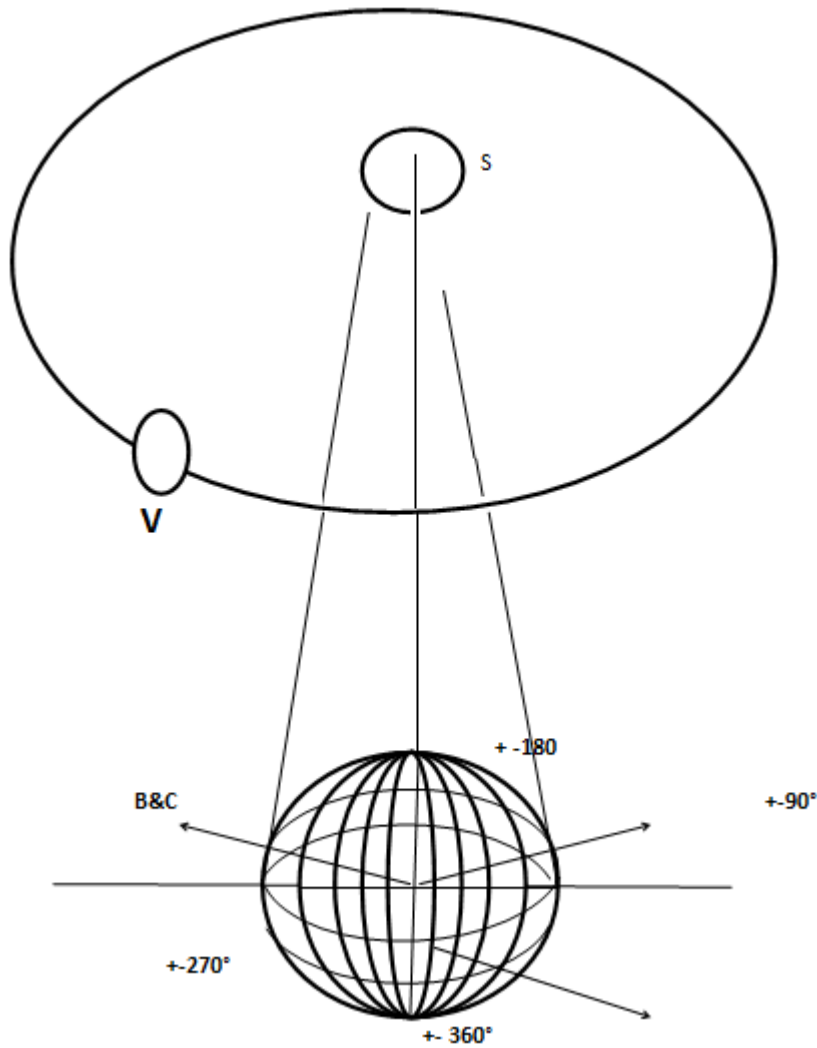


Figure 10

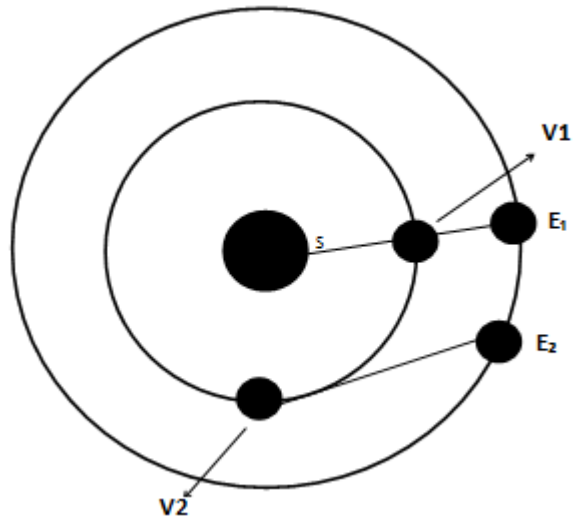


Figure 11A

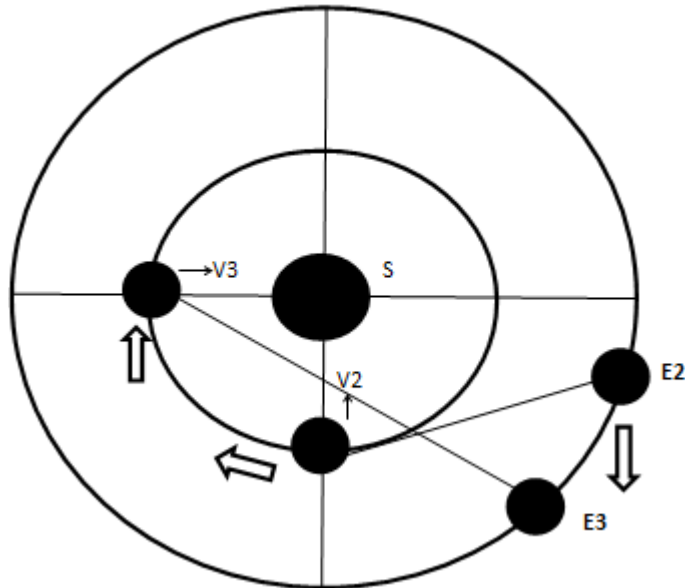


Figure 11B

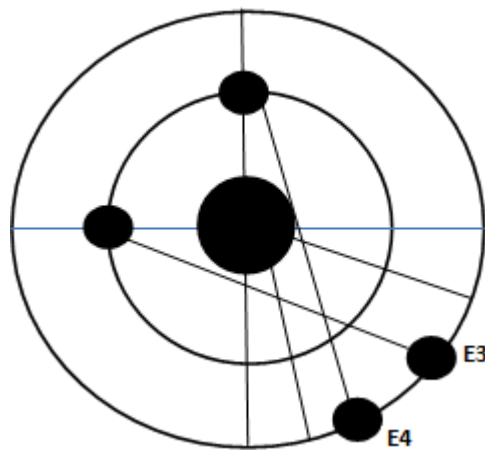


Figure 11 C

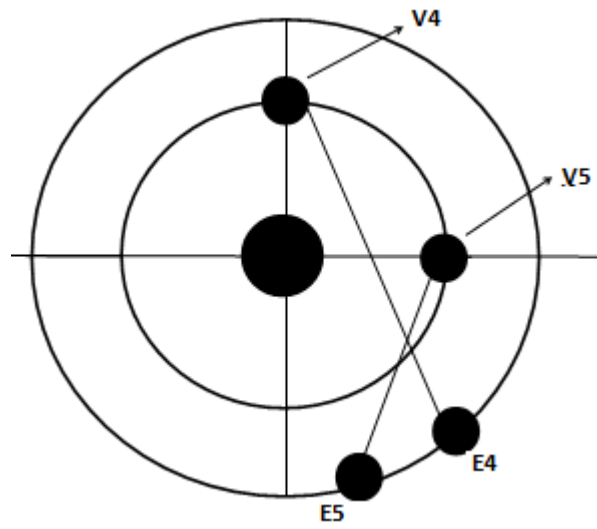


Figure 11D

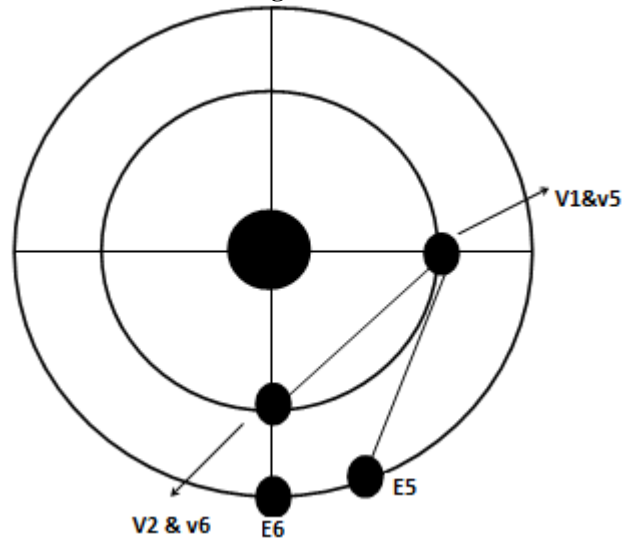


Figure 11E

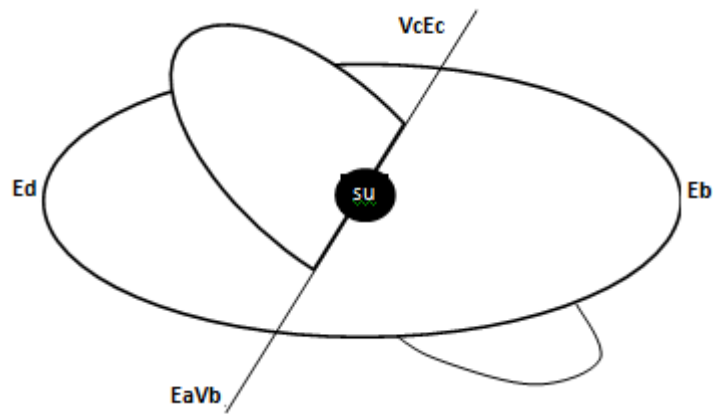


Figure 12

Table 2: Explanation for occurrence happening

Sno	period	revolution of earth	revolution of venus	difference in last revolution	date of occurrence
1	0	0	0	0	7th dec 1631
2	8 yrs	88.95753	444.5207		
		0+88.9575	1+84.5207	-4.4368	7th dec 1631
3	113.5 yrs	1262.085	6306.638		
		3+182.0849	10+5+2+186.637	4.552846	
4	121.5yrs	1351.042	6751.159		
		3+271.04	10+5+2+1+271.159	0.119	
5	129.5yrs	1440	7195.679		
		4	19+355.679	-4.32	6th june 1761
6	137.5 yrs	1528.958	7640.201		
		4+88.957512	20+80.20	-8.75	3rd&4th june 1769
7	243yrs	2702.085	13502.32		
		7+182.084913	20+10+5+182.3183	0.233	9th dec 1864
8	251 yrs	2791.042	13946.84		
		7+271.042441	20+10+5+2+1+266.839	-4.2	6th dec 1882
9	372.5yrs	4142.085	20698		
		11+182.0848975	20+20+10+5+177.998	-4.08	8th june 2004
10	380.5yrs	4231.042	21142.52		
		11+271.04242	20+20+10+5+2+1+262.5190	-8.521	5th june 2012
11	486 yrs	5404.17	27004.64		
		10+5+4.169826	20+20+20+10+4.6366	0.46	9th dec 2117
12	494yrs	5493.127	27449.16		
		15+93.127354	20+20+20+10+5+1+89.15	-3.9699	6th dec 2125
13	615.5yrs	6844.17	34200.32		
		10+5+4+4.1698	20+20+20+20+10+5+0.3164	-3.8534	8th june 2247
14	623.5yrs	6933.127	34644.84		
		10+5+4+93.127	20+20+20+20+10+5+1+84.83	-8.297	5th june 2255

- 1) If we analyze the data of abovementioned periodic time then we find that in maximum case difference in orbital angle from earth to Venus is negative. Hence 1st condition for occurrence to be take place is difference should be negative
- 2) If we take example of 243 year and 486 year then we find that in these cases difference are positive, but we observe occurrence of transit. Against the same, in condition of 121.5 year where difference is positive but we find no occurrence takes places, the cause behind this discrimination (see fig 12) the location of 121.5 year is Ed and Vd (270° of orbit) at this location orbit of earth and Venus would be vertically up or down from each other hence occurrence does not take place. But in case of 243 year junction location Dc and Vc of earth and Venus intersect each other .hence despite a positive difference too occurrence takes place 3 day earlier.
- 3) If we take case of 113.5 year of chart then we find that this is a location of orbit intersection Ec and Vc. but the positive value is more 4.55°, hence when earth comes in line of overlap after 113.5 year at that day Venus move forward 4.55° ahead then possible occurrence location,

due to this reason occurrence of transit does not take place.

- 4) If we analyze any period of 8 year's interval than the occurrence day, we find that either the difference covered by earth & Venus is positive value with location of Vd and Eb or Va&Eb ,hence due to this cause at each 8 year interval occurrence does not take place.

8. Conclusion

On the basis of above description we come on a conclusion. (1) The orbital period of earth is 32.375 year. (2) Earth make one another rotation called sidereal rotation on its axis of rotation in 365.2422 day as well as also oscillate about it axis in 365.2422 day. (3) Earth rotate on its axis in such way that axis of rotation always coincide with the tangent of revolution in 24 hour and along with every rotation of earth it also cover a path of revolution 1.826 arc minute/day. (4) The orbital period of Venus is calculated 6.41 year. (5) On the basis of above assumption a complete solution for TRANSIT OF VENUS is possible. (6) As per description of this paper elongation and overlap are quite

different in term of astronomy. (7) The possible cause behind SCHROTER'S EFFECT is possible to identify.

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