General Relativity Theory Failures Nail # 2008
V731Cephei Binary Stars Apsidal Motion solution
By professor Joe Nahhas, 2008
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This is me Joe Nahhas founder of real time physics July 4th 1973.

Here is me in year 2009 showing my 1979 thermo book with my picture stapled next to most notable Physicists of past 350 years whispering; it is not only Einstein is wrong but physics is wrong for past 350 years. It is time for change; regime change. It is time to end the western Royals Imperials and Corporate Physicists monopoly on physics taught and learned in past 350 years is at least 51 % wrong and Modern Physics is at least 88.88 % silly and because there is better physics and better physics is real time physics.
The elimination of relativity theory and annexation of quantum mechanics to classical mechanics is a matter of time and not a matter of science because time is a scale and not a dimension. A measurement is an event taken in present time of an event that happened in the past. We measure what is happening live in present time of what had already happened in past time.

Present time = present time
Present time = past time + [present time - past time]
Present time = past time + the difference between past time and present time
Measurement time = event time + time delays
Experiment = theory + corrections
Real time physics = event time physics + delay time physics

Applied to Planetary motion or star-star motion

An event: \( r(\theta, 0) = \left[ a (1-\varepsilon^2)/ (1+ \varepsilon \cos \theta) \right] \) Planet motion Event

Time factor \( \{e^{\frac{\lambda(r)}{T}} + \omega(r)\} \)

Physics live: \( r(\theta, t) = \left[ a (1-\varepsilon^2)/ (1+ \varepsilon \cos \theta) \right] \{e^{\frac{\lambda(r)}{T}} + \omega(r)\} \)

Perihelion advance corrections:

\[
W''(ob) = \frac{-720x36526x3600}{T} \left\{\sqrt{(1-\varepsilon^2)}(1-\varepsilon) \right\}^2 \left\{(v^* + v^\circ)/c\right\}^2 \\
= 43.11'' \text{ of an arc per century for mercury}
\]

"The silly notion of time as a dimension can be sent back to sender"

Abstract: Eclipsing binary stars has an axial rotation rate given by New Newton's time dependent equation:

\[
W^\circ (obo) = \frac{-720x36526}{T} \times \left\{\frac{1}{2}(1-\varepsilon^2)\right\} \left\{(v^* + v^\circ)/c\right\}^2 \\
\text{With } m = \text{mass } p = \text{primary } s = \text{secondary} \\
\text{Where } T = \text{orbital period} = 6.068456\text{days}; \varepsilon = \text{orbital eccentricity} = 0.0165 \\
\text{And } v^* (p) = \text{primary orbital speed} = 85.6111965 \text{ km/s} \\
\text{And } v^* (s) = \text{secondary orbital speed} = 109.38 \text{ km/s}; \\
\text{And } v^\circ (p) = \text{primary spin speed} = 19 \text{ km/sec}; v^\circ (s) = \text{secondary spin speed} = 18 \text{ km/sec}; \\
\text{And } v^* = v^* (p) + v^* (s); v^\circ = v^\circ (p) + v^\circ (s); \sigma^* = \text{orbit standard deviation} = 11.9288422 \\
\text{And } \sigma^\circ = \text{spin standard deviation. Taking upper limit } U = 10717 \text{ years by Nahhas} \\
\text{This binary star system has an axial rotation period of } U = [7500, 12500] \text{ years} \\
\text{Einstein's space-timers came up with N/A? Astronomers suggested new rigging schemes to match it with observed numbers because the calculations did not match without giving an actual number. }

Introduction: For 350 years Physicists Astronomers and Mathematicians missed Kepler's time dependent equation that changed Newton's equation into a time dependent Newton's equation and together these two equations combine classical mechanics and quantum mechanics into one Universal Mechanics explains "relativistic" as "apparent" visual effects or light aberrations visual effects along the line of sight or as the difference between time dependent measurements and time independent measurements of moving objects and solved all motion puzzles claimed by relativity theory and solved all mechanics motion puzzles posted on Smithsonian NASA website
SAO/NASA as puzzles that Einstein and all 100,000 space-time "physicists" could not solve by space-time physics or said or any published physics.

**Real time universal mechanics solution**

All there is in the Universe is objects of mass \( m \) moving in space \((x, y, z)\) at a location \( \mathbf{r} = r \ (x, y, z) \). The state of any object in the Universe can be expressed as the product 
\[
S = m \mathbf{r}; \text{ State} = \text{mass x location};
\]

\[
P = dS/dt = m \ (dr/dt) + (dm/dt) \ \mathbf{r} = \text{Total moment}
= \text{change of location} + \text{change of mass}
= m \mathbf{v} + m' \mathbf{r}; \mathbf{v} = \text{velocity} = d \mathbf{r}/d t; m' = \text{mass change rate}
\]

\[
F = dP/dt = d^2S/dt^2 = \text{Total force}
= m \ (d^2r/dt^2) + 2(dm/dt) \ (dr/dt) + (d^2m/dt^2) \ \mathbf{r}
= m \gamma + 2m' \mathbf{v} + m'' \mathbf{r}; \gamma = \text{acceleration}; m'' = \text{mass acceleration rate}
\]

In polar coordinates system

We Have
\[
\mathbf{r} = r \ \mathbf{r} \ (1); \mathbf{v} = \mathbf{r}' \mathbf{r} \ (1) + r \ \theta' \ \mathbf{0} \ (1); \mathbf{\gamma} = (r'' - r \theta'^2) \mathbf{r} \ (1) + (2r' \theta' + r \ \theta'') \mathbf{0} \ (1)
\]
\( r = \text{location}; \mathbf{v} = \text{velocity}; \gamma = \text{acceleration} \)

\[
F = m \gamma + 2m' \mathbf{v} + m'' \mathbf{r}
\]

\[
F = m \ [(r'' - r \theta'^2) \mathbf{r} \ (1) + (2r' \theta' + r \ \theta'') \mathbf{0} \ (1)] + 2m' \mathbf{r}' \mathbf{r} \ (1) + r \ \theta' \ \mathbf{0} \ (1) + (m'' \mathbf{r}) \ (1)
\]
\[
= [d^2 (m r)/dt^2 - (m r) \theta'^2] \mathbf{r} \ (1) + (1/mr) \ [d (m^2 r^2 \theta'/d t)] \ \mathbf{0} \ (1)
= [-GmM/r^2] \mathbf{r} \ (1) \ \text{-------------------------- Newton's Gravitational Law}
\]

Proof:

First
\[
\mathbf{r} = r \ [\cos \theta \ \mathbf{i} + \sin \theta \ \mathbf{j}] = r \mathbf{r} \ (1)
\]
Define
\[
\mathbf{r} \ (1) = \cos \theta \ \mathbf{i} + \sin \theta \ \mathbf{j}
\]

Define
\[
\mathbf{v} = d \mathbf{r}/d t = \mathbf{r}' \mathbf{r} \ (1) + r \ d[\mathbf{r} \ (1)]/d t
= \mathbf{r}' \mathbf{r} \ (1) + r \ \theta' [- \sin \theta \ \mathbf{i} + \cos \theta \ \mathbf{j}]
= \mathbf{r}' \mathbf{r} \ (1) + r \ \theta' \ \mathbf{0} \ (1)
\]

Define
\[
\mathbf{\theta} \ (1) = -\sin \theta \ \mathbf{i} + \cos \theta \ \mathbf{j};
\]
And with \( \mathbf{r} \ (1) = \cos \theta \ \mathbf{i} + \sin \theta \ \mathbf{j} \)

Then
\[
d[\mathbf{\theta} \ (1)]/d t = \theta' [- \cos \theta \ \mathbf{i} - \sin \theta \ \mathbf{j}] = - \theta' \mathbf{r} \ (1)
\]
And
\[
d[\mathbf{r} \ (1)]/d t = \theta' [-\sin \theta \ \mathbf{i} + \cos \theta \ \mathbf{j}] = \theta' \mathbf{0} \ (1)
\]

Define
\[
\mathbf{\gamma} = d [\mathbf{r}' \mathbf{r} \ (1) + r \ \theta' \ \mathbf{0} \ (1)]/d t
= \mathbf{r}' \mathbf{r} \ (1) + r \ d[\mathbf{r} \ (1)]/d t + r \ \theta' \ \mathbf{r} \ (1) + r \ \theta'' \mathbf{r} \ (1) + r \ \theta' \ [\theta \ (1)]/d t
= (r'' - r \theta'^2) \mathbf{r} \ (1) + (2r' \theta' + r \ \theta'') \mathbf{0} \ (1)
\]

With
\[
d^2 (m r)/dt^2 - (m r) \theta'^2 = -GmM/r^2 \ \text{Newton's Gravitational Equation} \quad (1)
\]
And
\[
d (m^2 r^2 \theta')/d t = 0 \ \text{Central force law} \quad (2)
\]

(2): \( d (m^2 r^2 \theta')/d t = 0 \)

Then \( m^2 r^2 \theta' = \text{constant} \)
\[ m^2 r^2 \theta' = \text{constant} \]

Differentiate with respect to time:

Then \( 2mm'r^2 \theta' + 2m^2 r' r^2 \theta' + m^2 r^2 \theta'' = 0 \)

Divide by \( m^2 r^2 \theta' \):

Then \( 2 \left( \frac{m'}{m} \right) + 2 \left( \frac{r'}{r} \right) + \frac{\theta''}{\theta'} = 0 \)

This equation will have a solution \( 2 \left( \frac{m'}{m} \right) = 2 \left[ \lambda (m) + i \omega (m) \right] \)

And \( 2 \left( \frac{r'}{r} \right) = 2 \left[ \lambda (r) + i \omega (r) \right] \)

And \( \frac{\theta''}{\theta'} = -2 \left[ \lambda (m) + \lambda (r) + i \left[ \omega (m) + \omega (r) \right] \right] \)

Then \( \frac{m'}{m} = \left[ \lambda (m) + i \omega (m) \right] \)

Or \( \frac{dm}{m} \frac{dt}{t} = \left[ \lambda (m) + i \omega (m) \right] \)

And \( \frac{dm}{m} = \left[ \lambda (m) + i \omega (m) \right] \frac{dt}{t} \)

Then \( m = m(0) e^{\left[ \lambda (m) + i \omega (m) \right] t} \)

With initial spatial condition that can be taken at \( t = 0 \) anywhere then \( m(0) = m(0, 0) \)

And \( m = m(0, 0) e^{\left[ \lambda (m) + i \omega (m) \right] t} \)

And \( m(0, t) = e^{\left[ \lambda (m) + i \omega (m) \right] t} \)

Similarly we can get:

Also, \( r = r(0, 0) \frac{r(0, 0)}{r(0, 0)} = r(0, 0) e^{\left[ \lambda (r) + i \omega (r) \right] t} \)

With \( r(0, t) = e^{\left[ \lambda (r) + i \omega (r) \right] t} \)

Then \( \theta' (\theta, t) = \{H(0, 0)/[m^2(\theta, 0) r(\theta, 0)]\} e^{-2 \left[ \lambda (m) + \lambda (r) \right] + i \left[ \omega (m) + \omega (r) \right]} t \) \( -----I \)

And \( \theta' (\theta, t) = \theta' (0, 0) e^{-2 \left[ \lambda (m) + \lambda (r) \right] + i \left[ \omega (m) + \omega (r) \right]} t \)

And \( \theta' (0, t) = e^{-2 \left[ \lambda (m) + \lambda (r) \right] + i \left[ \omega (m) + \omega (r) \right]} t \)

Also \( \theta' (0, 0) = H(0, 0)/ m^2 (\theta, 0) r^2 (\theta, 0) \)

And \( \theta' (0, 0) = \{H(0, 0)/ [m^2 (0, 0) r(0, 0)]\} \)

With \( I \):

\[
\frac{d^2 (mr)}{dt^2} - \left( \frac{m}{r} \right) \frac{d^2 r}{dt^2} = -GmM/r^2 = -Gm^3 M/m^2 r^2
\]

And \( \frac{d^2 (mr)}{dt^2} - \left( \frac{m}{r} \right) \frac{d^2 r}{dt^2} = -Gm^3 (\theta, 0) m^3 (0, t) M/ (m^2 r^2) \)

Let \( m r = 1/u \)

Then \( \frac{d (mr)}{dt} = -u'/u^2 = - (1/u^2) \frac{d u}{d \theta} = - (\theta'/u^2) \frac{d u}{d \theta} = -H \frac{d u}{d \theta} \)

And \( \frac{d^2 (mr)}{dt^2} = -H \theta' d^2 u/d \theta^2 = -H u^2 [d^2 u/d \theta^2] \)

\[-H u^2 [d^2 u/d \theta^2] - (1/u) (Hu^2)^2 = -Gm^3 (\theta, 0) m^3 (0, t) M u^2\]
\[ \frac{d^2u}{d\theta^2} + u = Gm^3(\theta, 0) M_0^3 (0, t) \frac{M}{H^2} \]

\( t = 0; \quad m^3 (0, 0) = 1 \)
\( u = Gm^3(\theta, 0) M_0^3 \frac{M}{H^2} + A \cos \theta = Gm(\theta, 0) M(\theta, 0)/h^2(\theta, 0) \)

And \( m = \frac{1}{u} = \frac{1}{[Gm(\theta, 0) M(\theta, 0)/h^2(\theta, 0) + A\cos \theta]} \)
\[ = \frac{h^2/Gm(\theta, 0) M(\theta, 0)}{1 + [Ah^2/Gm(\theta, 0) M(\theta, 0)] \cos \theta} \]
\[ = \frac{h^2/Gm(\theta, 0) M(\theta, 0)}{1 + \varepsilon \cos \theta} \]

Then \( m(\theta, 0) r(\theta, 0) = \frac{a(1 - \varepsilon^2)}{1 + \varepsilon \cos \theta} m(\theta, 0) \)
Dividing by \( m(\theta, 0) \)
Then \( r(\theta, 0) = a(1 - \varepsilon^2)/(1 + \varepsilon \cos \theta) \)
This is Newton's Classical Equation solution of two body problem which is the equation of an ellipse of semi-major axis of length \( a \) and semi minor axis \( b = a \sqrt{1 - \varepsilon^2} \) and focus length \( c = \varepsilon a \)
And \( r(\theta, 0) = m(\theta, t) r(\theta, t) = m(\theta, 0) m(0, t) r(\theta, 0) r(0, t) \)
Then, \( r(\theta, t) = \frac{[a(1 - \varepsilon^2)/(1 + \varepsilon \cos \theta)]}{[\lambda(r) + i \omega(r)]} e^{[\lambda(r) + i \omega(r)] t} \)
This is Newton's time dependent equation that is missed for 350 years
If \( \lambda(m) \approx 0 \) fixed mass and \( \lambda(r) \approx 0 \) fixed orbit; then
Then \( r(\theta, t) = r(\theta, 0) r(0, t) = \frac{[a(1 - \varepsilon^2)/(1 + \varepsilon \cos \theta)]}{[\lambda(m) + i \omega(m)]} e^{i \omega(m) t} \)
And \( m = m(\theta, 0) e^{i \omega(m) t} = m(\theta, 0) e^{i \omega(m) t} \)

We Have \( \theta'(0, 0) = h(0, 0)/r^2(0, 0) = 2\pi ab/ Ta^2 (1 - \varepsilon)^2 \)
\[ = 2\pi a^2 \frac{\sqrt{1 - \varepsilon^2}}{T a^2 (1 - \varepsilon)^2} \]
Then \( \theta'(0, t) = \{2\pi [\sqrt{1 - \varepsilon^2}]/T (1 - \varepsilon)^2\} \exp \{-2[\omega(m) + \omega(r)] t\} \)
\[ = \{2\pi [\sqrt{1 - \varepsilon^2}]/(1 - \varepsilon)^2\} \cos[2\omega(m) + \omega(r)] t - i \sin[2\omega(m) + \omega(r)] t \}
\[ = \theta'(0, 0) \{1 - 2 \sin^2 [\omega(m) + \omega(r)] t\} \]
\[ - 2i \theta'(0, 0) \sin[\omega(m) + \omega(r)] t \cos[\omega(m) + \omega(r)] t \]

Then \( \theta'(0, t) = \theta'(0, 0) \{1 - 2 \sin^2 [\omega(m) + \omega(r)] t\} \)
\[ - 2i \theta'(0, 0) \sin[\omega(m) + \omega(r)] t \cos[\omega(m) + \omega(r)] t \]

\( \Delta \theta'(0, t) = \text{Real} \Delta \theta'(0, t) + \text{Imaginary} \Delta \theta(0, t) \)
Real \( \Delta \theta(0, t) = \theta'(0, 0) \{1 - 2 \sin^2 [\omega(m) + \omega(r)] t\} \)

Let \( W(\text{cal}) = \Delta \theta'(0, t) \) (observed) = Real \( \Delta \theta(0, t) - \theta'(0, 0) \)
\[ = -2\theta'(0, 0) \sin^2 [\omega(m) + \omega(r)] t \]
\[ = -2[2\pi [\sqrt{1 - \varepsilon^2}]/T (1 - \varepsilon)^2] \sin^2 [\omega(m) + \omega(r)] t \]
And \( W(\text{cal}) = -4\pi [\sqrt{1 - \varepsilon^2}]/T (1 - \varepsilon)^2 \sin^2 [\omega(m) + \omega(r)] t \)

If this apsidal motion is to be found as visual effects, then

With, \( v^\circ = \text{spin velocity}; \quad v^* = \text{orbital velocity}; \quad v^\circ/c = \tan \omega(m) T^\circ; \quad v^*/c = \tan \omega(r) T^* \)
Where \( T^\circ = \text{spin period}; \quad T^* = \text{orbital period} \)
And $\omega (m) T^o = \text{Inverse tan } \frac{v^o}{c}$; $\omega (r) T^* = \text{Inverse tan } \frac{v^*}{c}$

$W (ob) = -4 \pi \left[ \sqrt{(1-\varepsilon^2)} \right] T (1-\varepsilon)^2 \sin^2 \left[ \text{Inverse tan } \frac{v^o}{c} + \text{Inverse tan } \frac{v^*}{c} \right] \text{ radians}$

Multiplication by $180/\pi$

$W (ob) = \left( \frac{-720}{T} \right) \left[ \sqrt{(1-\varepsilon^2)} \right] (1-\varepsilon)^2 \sin^2 \left[ \text{Inverse tan } \left( \frac{v^o}{c} + \frac{v^*}{c} \right) \right] \text{ degrees}$

and multiplication by 1 century = 36526 days and using $T$ in days

$W^o (ob) = \left( \frac{-720 \times 36526}{T\text{days}} \right) \left[ \sqrt{(1-\varepsilon^2)} \right] (1-\varepsilon)^2 \times \sin^2 \left[ \text{Inverse tan } \left( \frac{v^o}{c} + \frac{v^*}{c} \right) \right] \text{ degrees/100 years}$

**Approximations I**

With $v^o << c$ and $v^* << c$, then $v^o v^* << c^2$ and $[1 - v^o v^*/c^2] \approx 1$

Then $W^o (ob) \approx \left( \frac{-720 \times 36526}{T\text{days}} \right) \left[ \sqrt{(1-\varepsilon^2)} \right] (1-\varepsilon)^2 \times \sin^2 \text{ Inverse tan } \left( \frac{v^o}{c} + \frac{v^*}{c} \right) \text{ degrees/100 years}$

**Approximations II**

With $v^o << c$ and $v^* << c$, then sine Inverse tan $\left[ v^o/c + v^*/c \right] \approx \left( v^o + v^* \right)/c$

$W^o (ob) = \left( \frac{-720 \times 36526}{T\text{days}} \right) \left[ \sqrt{(1-\varepsilon^2)} \right] (1-\varepsilon)^2 \times \left[ \frac{v^o + v^*}{c} \right]^2 \text{ degrees/100 years}$

This is the equation that gives the correct apsidal motion rates -------------------------III

The circumference of an ellipse: $2\pi a (1 - \varepsilon^2/4 + 3/16(\varepsilon^2)^2- -.) \approx 2\pi a (1-\varepsilon^2/4)$; $R =a (1-\varepsilon^2/4)$

Where $v (m) = \sqrt{\left[ GM^2/ (m + M) a \right]} (1-\varepsilon^2/4)$

And $v (M) = \sqrt{\left[ Gm^2 / (m + M) a \right]} (1-\varepsilon^2/4)$

Looking from top or bottom at two stars they either spin in clock (↑) wise or counter clockwise (↓)

Looking from top or bottom at two stars they either approach each other coming from the top (↑) or from the bottom (↓)

Knowing this we can construct a table and see how these two stars are formed. There are many combinations of velocity additions and subtractions and one combination will give the right answer.

1- Advance of Perihelion of mercury. [No spin factor] Because data are given with no spin factor

$G=6.673 x 10^{-11}; M=2x10^{30}\text{ kg}; m=.32x10^{24}\text{ kg}; \varepsilon = 0.206; T=88\text{days}$

And $c = 299792.458\text{ km/sec}; a = 58.2\text{km/sec}; 1-\varepsilon^2/4 = 0.989391$

With $v^o = 2\text{meters/sec}$

And $v^* = \sqrt{\left[ GM/a (1-\varepsilon^2/4) \right]} = 48.14\text{ km/sec}$

Calculations yields: $v = v^* + v^o = 48.14\text{km/sec (mercury)}$

And $\left[ \sqrt{(1-\varepsilon^2)} \right] (1-\varepsilon)^2 = 1.552$

$W'' (ob) = \left( \frac{-720\times 36526x3600}{T} \right) \left[ \sqrt{(1-\varepsilon^2)} \right] (1-\varepsilon)^2 \left( v/c \right)^2$

$W'' (ob) = \left( \frac{-720\times 36526 \times 3600}{88} \right) x (1.552) (48.14/299792)^2 = 43.0’’/\text{century}$

This is the rate of for the advance of perihelion of planet mercury explained as "apparent" without the use of fictional forces or fictional universe of space-time confusions of physics of relativity.
Venus Advance of perihelion solution:

\[ W'' (ob) = (-720 \times 36526 \times 3600 / T) \times [\sqrt{(1 - \varepsilon^2)}] / (1 - \varepsilon)^2 \times [(v^o + v^*) / c]^2 \text{ seconds}/100 \text{ years} \]

Data: \( T = 244.7 \text{ days} \quad v^o = v^o (p) = 6.52 \text{ km/sec}; \quad \varepsilon = 0.00068; \quad v^*(p) = 35.12 \)

Calculations

\[ 1 - \varepsilon = 0.0068; \quad (1 - \varepsilon^2/4) = 0.99993; \quad [\sqrt{(1 - \varepsilon^2)}] / (1 - \varepsilon)^2 = 1.00761 \]

\[ G = 6.673 \times 10^{-11}; \quad M(0) = 1.98892 \times 10^{30} \text{kg}; \quad R = 108.2 \times 10^9 \text{m} \]

\[ V^* (p) = \sqrt{GM^2 / (m + M) a (1 - \varepsilon^2/4)} = 41.64 \text{ km/sec} \]

Advance of perihelion of Venus motion is given by this formula:

\[ W'' (ob) = (-720 \times 36526 \times 3600 / T) \times [\sqrt{(1 - \varepsilon^2)}] / (1 - \varepsilon)^2 \times [(v^o + v^*) / c]^2 \sin^2 \left[ \text{Inverse tan } 41.64/300,000 \right] \]

\[ = (-720 \times 36526 \times 3600/224.7) \times (1.00762) \times (41.64/300,000)^2 \]

\[ W'' (\text{observed}) = 8.2''/100 \text{ years}; \text{ observed 8.4''}/100 \text{years} \]

This is a proof that not only space-time physicists are incompetent liars but it does not require fictional forces or universes to example an insignificant issue of advance of perihelion which says that every \( 301395.3488 \text{ years} \) Mercury does one extra run around mother sun

Looking from top or bottom at two stars they either spin in clock (↑) wise or counter clockwise (↓)

Looking from top or bottom at two stars they either approach each other coming from the top (↑) or from the bottom (↓)

Knowing this we can construct a table and see how these two stars are formed. There are many combinations of velocity additions and subtractions and one combination will give the right answer.

The circumference of an ellipse: \( 2\pi a (1 - \varepsilon^2/4 + 3/16(\varepsilon^2)^2 - - -) \approx 2\pi a (1 - \varepsilon^2/4) \); \( R = a (1 - \varepsilon^2/4) \)

From Newton's laws for a circular orbit: \( m v^2 / r \text{ (cm)} = GmM/r^2; \text{ (cm)} = [M/m + M] r \)

Then \( v^2 = [GM \text{ r (cm)}/ r^2] = GM^2 / (m + M) r \)

And \( v = \sqrt{GM^2 / (m + M) r} = a (1 - \varepsilon^2/4) \)

And \( v^* = v \text{ (m)} = \sqrt{GM^2 / (m + M) a (1 - \varepsilon^2/4)} \)

Where \( v^* \text{ (m)} = \sqrt{GM^2 / (m + M) a (1 - \varepsilon^2/4)} \)

\[ = v^* (p) = \text{ orbit velocity of primary w. r. t Center of mass} \]

And \( v^* \text{ (M)} = \sqrt{GM^2 / (m + M) a (1 - \varepsilon^2/4)} \)

\[ = v^* (s) = \text{ orbit velocity of secondary w. r. t Center of mass} \]
Looking from top or bottom at two stars they either spin in clock (↑) wise or counter clockwise (↓)

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**V 731 Cephei:**

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<tr>
<th>Primary → Secondary ↓</th>
<th>$v^\circ (p) \uparrow + v^\star (s) \uparrow$</th>
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</tbody>
</table>

Next the same equation will be used to find the advance of Periastron or "apparent" apsidal motion of V731 binary stars system.

**2-V731Cephei Apsidal Motion Solution**

$$W^\circ (ob) = \left( -720 \times 36526 / T \right) \left[ \sqrt{\left( 1 - \varepsilon^2 \right)} / \left( 1 - \varepsilon \right) \right]^2 \left[ \left( v^\circ + v^\star \right) / c \right]^2 \text{ degrees/100 years}$$

<table>
<thead>
<tr>
<th>$v^\circ$</th>
<th>$v^\star$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$v^\circ (p)$</td>
<td>$v^\circ (s)$</td>
</tr>
<tr>
<td>$v^\star (p)$</td>
<td>$v^\star (s)$</td>
</tr>
</tbody>
</table>

**V731data [see below]**

<table>
<thead>
<tr>
<th>$T$</th>
<th>m= 2.577 M (0); M = 2.577 M (0); $[v^\circ (m), v^\circ (s)] = [19 +/- 3, 18 +/- 3]$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\varepsilon$</td>
<td>a = 23.27x R (0)</td>
</tr>
<tr>
<td>Calculations</td>
<td>$M + m = 2.738; 1-\varepsilon=0.9835; 1-\varepsilon^2/4=0.9999$</td>
</tr>
<tr>
<td>With $v^\circ$ [21, 28] = $[19 +/- 3] + [18 +/- 3] = 37 +/- 6$</td>
<td></td>
</tr>
</tbody>
</table>
| With $v^\star (p)$ = $\sqrt{\left[ GM^2 / (m + M) a \right]} (1-\varepsilon^2/4)$ = 85.6111965 km/sec

With $v^\star (s) = \sqrt{\left[ GM^2 / (m + M) a \right]} (1-\varepsilon^2/4)$ = 85.6111965 km/sec
\[ v^* (M) = \sqrt{\frac{Gm^2}{(m + M) a (1-\varepsilon^2/4)}} = 109.38 \text{ km/sec} \]

Also, \[ \left[ \sqrt{1-\varepsilon^2} \right] / (1-\varepsilon)^2 = 1.033694356 \]

With \[ v^* (cm) = 2\Sigma m \Sigma/v = 96.46688 \text{ km/sec} \]

And \[ \sigma = \sqrt{\frac{\sum (v^*-v^* (cm))^2}{2}} = \sqrt{\frac{[96.46688 - 85.6]^2}{2}} + \frac{[109.38 - 96.46688]^2}{2} \]
\[ = 11.9288422 \text{ km/sec} \]

With \[ v^* (p) = 85.6111965 \text{ km/sec} \pm 11.9288422 \text{ km/sec} \]

And \[ v^* (s) = 109.38 \text{ km/sec} \pm 11.9288422 \text{ km/sec} \]

Then \[ v^* (p) + v^* (s) = [192.9337619 \pm \ldots] \times 2 = 23.8567844 \text{ km/sec} \]

Then \[ v^* + v^0 = 229.9288422 \text{ km/sec} \pm 29.8567844 \text{ km/sec} \]

Now: Taking the upper limit

Then \[ v^* + v^0 = 229.9288422 \text{ km/sec} + 29.8567844 \text{ km/sec} = 259.7856266 \text{ km/sec} \]

\[ W^o (obo) = (-720 \times 36526/T) \times \left[ \sqrt{1-\varepsilon^2} \right] / (1-\varepsilon)^2 \times \left[ (v^* + v^0) / c \right]^2 \]

\[ W^o / \text{century} = (-720 \times 36526/6.068567) \times (1.033694356) \times (259.7856266 / 300,000)^2 = 2.91^\circ / \text{century} \]

\[ W^o / \text{century} = 3.35914177^\circ / \text{century} = 0.0335914177^\circ / \text{year} \]

\[ U = 360/0.0335914177^\circ = 10717 \text{ years} \]

Observed values are \[ U = 10000 \pm 2500 \]

References: 1- Absolute dimensional and apsidal motion of V731Cep
V. Batkis; M. Zejda; I. Bülut; M. Wolf; S. Bilir; H. Bakis; O. Demircan; J. W. Lee; M. Slecha; B. Kucerova. 2008

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