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Global Positioning Systems for Grand Dummies with PhD's in Physics

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Abstract: The Global Positioning System or GPS 45 micro seconds per day time delays have nothing to do with Einstein's relativity theory time travels confusions of physics and they are a consequence of Satellite orbital speed and Earth rotational speed given by this formula

W" (ob) = (-720x3600/T) {[√ (1-ε²)]/ (1-ε) ²]} [(v° +/- v*)/c] ² degrees/100 years
T = period; ε = eccentricity; v° = spin velocity of earth; v*= orbital velocity of satellite
And v* = 14000km/hr = 3.88888888889 km/s; ε = 0; T = 0.5 days and v° = 0.465km/s

U = W" x (24/360) = 45.016microsecond per day Nahhas'

Universal Mechanics Solution:

For 350 years Physicists Astronomers and Mathematicians and philosophers missed Kepler's time dependent Areal velocity wave equation solution that changed Newton's classical planetary motion equation to a Newton's time dependent wave orbital equation solution and these two equations put together combines particle mechanics of Newton's with wave mechanics of Kepler's into one time dependent Universal Mechanics equation that explain "relativistic" as the difference between time dependent measurements and time independent measurements of moving objects and in practice it amounts to light aberrations visual effects along the line of sight of moving objects

All there is in the Universe is objects of mass m moving in space (x, y, z) at a location
r = **r** (x, y, z). The state of any object in the Universe can be expressed as the product

S = m **r**; State = mass x location:

P = d **S**/d t = m (d **r**/d t) + (dm/d t) **r** = Total moment
= change of location + change of mass
= m v + m' r; v = velocity = d r/d t; m' = mass change rate

F = d **P**/d t = d²**S**/dt² = Total force
= m (d²**r**/dt²) +2(dm/d t) (d **r**/d t) + (d²m/dt²) **r**
= m **γ** + 2m'**v** +m'' **r**; γ = acceleration; m'' = mass acceleration rate

In polar coordinates system

$\mathbf{r} = r\,\mathbf{r}_{(1)}$; $\mathbf{v} = r'\,\mathbf{r}_{(1)} + r\,\theta'\,\boldsymbol{\theta}_{(1)}$; $\boldsymbol{\gamma} = (r'' - r\theta'^2)\mathbf{r}_{(1)} + (2r'\theta' + r\,\theta'')\boldsymbol{\theta}_{(1)}$

$\mathbf{r}$ = location; $\mathbf{v}$ = velocity; $\boldsymbol{\gamma}$ = acceleration

$\mathbf{F} = m\,\boldsymbol{\gamma} + 2m'\mathbf{v} + m''\,\mathbf{r}$

$\mathbf{F} = m\,[(r''-r\theta'^2)\,\mathbf{r}_{(1)} + (2r'\theta' + r\,\theta'')\,\boldsymbol{\theta}_{(1)}] + 2m'[r'\,\mathbf{r}_{(1)} + r\,\theta'\,\boldsymbol{\theta}_{(1)}] + (m''\,r)\,\mathbf{r}_{(1)}$

$= [d^2 (m\,r)/dt^2 - (m\,r)\,\theta'^2]\,\mathbf{r}_{(1)} + (1/mr)\,[d\,(m^2r^2\theta')/d\,t]\,\boldsymbol{\theta}_{(1)}$

$= [-GmM/r^2]\,\mathbf{r}_{(1)}$ ------------------------------- Newton's Gravitational Law

Proof:

First $\mathbf{r} = r\,[\text{cosine}\,\theta\,\hat{\imath} + \text{sine}\,\theta\,\hat{J}] = r\,\mathbf{r}_{(1)}$

Define $\mathbf{r}_{(1)} = \text{cosine}\,\theta\,\hat{\imath} + \text{sine}\,\theta\,\hat{J}$

Define $\mathbf{v} = d\,\mathbf{r}/d\,t = r'\,\mathbf{r}_{(1)} + r\,d[\mathbf{r}_{(1)}]/d\,t$

$= r'\,\mathbf{r}_{(1)} + r\,\theta'[-\,\text{sine}\,\theta\,\hat{\imath} + \text{cosine}\,\theta\hat{J}]$

$= r'\,\mathbf{r}_{(1)} + r\,\theta'\,\boldsymbol{\theta}_{(1)}$

Define $\boldsymbol{\theta}_{(1)} = -\text{sine}\,\theta\,\hat{\imath} + \text{cosine}\,\theta\,\hat{J}$;

And with $\mathbf{r}_{(1)} = \text{cosine}\,\theta\,\hat{\imath} + \text{sine}\,\theta\,\hat{J}$

Then $d\,[\boldsymbol{\theta}_{(1)}]/d\,t = \theta'\,[-\,\text{cosine}\,\theta\,\hat{\imath} - \text{sine}\,\theta\,\hat{J} = -\,\theta'\,\mathbf{r}_{(1)}$

And $d\,[\mathbf{r}_{(1)}]/d\,t = \theta'\,[-\text{sine}\,\theta\,\hat{\imath} + \text{cosine}\,\theta\,\hat{J}] = \theta'\,\boldsymbol{\theta}_{(1)}$

Define $\boldsymbol{\gamma} = d\,[r'\,\mathbf{r}_{(1)} + r\,\theta'\,\boldsymbol{\theta}_{(1)}]\,/d\,t$

$= r''\,r_{(1)} + r'd\,[\mathbf{r}_{(1)}]/d\,t + r'\,\theta'\,\mathbf{r}_{(1)} + r\,\theta''\,\mathbf{r}_{(1)} + r\,\theta'd\,[\theta_{(1)}]/d\,t$

$\boldsymbol{\gamma} = (r'' - r\theta'^2)\,\mathbf{r}_{(1)} + (2r'\theta' + r\,\theta'')\,\boldsymbol{\theta}_{(1)}$

With $d^2 (m\,r)/dt^2 - (m\,r)\,\theta'^2 = -GmM/r^2$ Newton's Gravitational Equation (1)

And $d\,(m^2r^2\theta')/d\,t = 0$ Central force law (2)

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

Then $m^2r^2\theta'$ = constant

$= H\,(0, 0)$

$= m^2\,(0, 0)\,h\,(0, 0)$; $h\,(0, 0) = r^2\,(0, 0)\,\theta'(0, 0)$

$= m^2\,(0, 0)\,r^2\,(0, 0)\,\theta'(0, 0)$; $h\,(\theta, 0) = [r^2\,(\theta, 0)]\,[\theta'(\theta, 0)]$

$= [m^2\,(\theta, 0)]\,h\,(\theta, 0)$; $h\,(\theta, 0) = [r^2\,(\theta, 0)]\,[\theta'(\theta, 0)]$

$= [m^2\,(\theta, 0)]\,[r^2\,(\theta, 0)]\,[\theta'(\theta, 0)]$

$= [m^2\,(\theta, t)]\,[r^2\,(\theta, t)]\,[\theta'\,(\theta, t)]$

$= [m^2(\theta, 0)\,m^2(0,t)][\,r^2(\theta,0)r^2(0,t)][\theta'(\theta, t)]$

$= [m^2(\theta, 0)\,m^2(0,t)][\,r^2(\theta,0)r^2(0,t)][\theta'(\theta, 0)\,\theta'\,(0, t)]$

With $m^2r^2\theta'$ = constant

Differentiate with respect to time

Then $2mm'r^2\theta' + 2m^2rr'\theta' + m^2r^2\theta'' = 0$

Divide by $m^2r^2\theta'$

Then $2\,(m'/m) + 2(r'/r) + \theta''/\theta' = 0$

This equation will have a solution $2\,(m'/m) = 2[\lambda\,(m) + \grave{\imath}\,\omega\,(m)]$

And $2(r'/r) = 2[\lambda\,(r) + \grave{\imath}\,\omega\,(r)]$

And $\theta''/\theta' = -2\{\lambda (m) + \lambda (r) + i [\omega (m) + \omega (r)]\}$

Then $(m'/m) = [\lambda (m) + i \omega (m)]$
Or $d m/m d t = [\lambda (m) + i \omega (m)]$
And $dm/m = [\lambda (m) + i \omega (m)] d t$
Then $m = m (0) \text{Exp} [\lambda (m) + i \omega (m)] t$
$m = m (0) m (0, t); m (0, t) \text{Exp} [\lambda (m) + i \omega (m)] t$
With initial spatial condition that can be taken at $t = 0$ anywhere then $m (0) = m (\theta, 0)$
And $m = m (\theta, 0) m (0, t) = m (\theta, 0) \text{Exp} [\lambda (m) + i \omega (m)] t$; Exp = Exponential
And $m (0, t) = \text{Exp} [\lambda (m) + i \omega (m)] t$
Similarly we can get
Also, $r = r (\theta, 0) r (0, t) = r (\theta, 0) \text{Exp} [\lambda (r) + i \omega (r)] t$
With $r (0, t) = \text{Exp} [\lambda (r) + i \omega (r)] t$

Then $\theta'(\theta, t) = \{H(0, 0)/[m^2(\theta,0) r(\theta,0)]\}\text{Exp}\{-2\{[\lambda(m) + \lambda(r)]t + i [\omega(m) + \omega(r)]t\}\}$ -----I
And $\theta'(\theta, t) = \theta' (\theta, 0)]\} \text{Exp} \{-2\{[\lambda (m) + \lambda (r)] t + i [\omega (m) + \omega (r)] t\}\}$ --------------------I
And, $\theta'(\theta, t) = \theta' (\theta, 0) \theta' (0, t)$
And $\theta' (0, t) = \text{Exp} \{-2\{[\lambda (m) + \lambda(r)] t + i [\omega (m) + \omega(r)] t\}$
Also $\theta'(\theta, 0) = H (0, 0)/ m^2 (\theta, 0) r^2 (\theta, 0)$
And $\theta'(0, 0) = \{H (0, 0)/ [m^2 (0, 0) r (0, 0)]\}$

With (1): $d^2 (m r)/dt^2 - (m r) \theta'^2 = -GmM/r^2 = -Gm^3M/m^2r^2$
And $d^2 (m r)/dt^2 - (m r) \theta'^2 = -Gm^3 (\theta, 0) m^3 (0, t) M/ (m^2r^2)$
Let $m r =1/u$
Then $d (m r)/d t = -u'/u^2 = - (1/u^2) (\theta') d u/d \theta = (- \theta'/u^2) d u/d \theta = -H d u/d \theta$
And $d^2 (m r)/dt^2 = -H\theta'd^2u/d\theta^2 = - Hu^2 [d^2u/d\theta^2]$

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

$t = 0; m^3 (0, 0) = 1$
$u = Gm^3 (\theta, 0) M/ H^2 + A \text{ cosine } \theta =Gm (\theta, 0) M (\theta, 0)/ h^2 (\theta, 0)$

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

Then $m (\theta, 0) r (\theta, 0) = [a (1-\varepsilon^2)/ (1+\varepsilon\cos\theta)] m (\theta, 0)$
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 $m r = m (\theta, t) r (\theta, t) = m (\theta, 0) m (0, t) r (\theta, 0) r (0, t)$
Then, $r (\theta, t) = [a (1-\varepsilon^2)/ (1+\varepsilon\cos\theta)] \{\text{Exp} [\lambda(r) + i \omega (r)] t\}$ ----------------------------------- II
This is Newton's time dependent equation that is missed for 350 years

If λ (m) ≈ 0 fixed mass and $\lambda(r) \approx 0$ fixed orbit; then
Then $r(\theta, t) = r(\theta, 0)\, r(0, t) = [a(1-\varepsilon^2)/(1+\varepsilon \text{ cosine } \theta)] \text{ Exp } i\, \omega(r)\, t$
And $m = m(\theta, 0) \text{ Exp } [i\, \omega(m)\, t] = m(\theta, 0) \text{ Exp } i\, \omega(m)\, t$

We Have $\theta'(0, 0) = h(0, 0)/r^2(0, 0) = 2\pi ab/ Ta^2 (1-\varepsilon)^2$
$= 2\pi a^2 [\sqrt{(1-\varepsilon^2)}]/T a^2 (1-\varepsilon)^2$
$= 2\pi [\sqrt{(1-\varepsilon^2)}]/T (1-\varepsilon)^2$

Then $\theta'(0, t) = \{2\pi [\sqrt{(1-\varepsilon^2)}]/ T (1-\varepsilon)^2\} \text{ Exp } \{-2[\omega(m) + \omega(r)]\, t$
$= \{2\pi [\sqrt{(1-\varepsilon^2)}]/ (1-\varepsilon)^2\} \{\text{cosine } 2[\omega(m) + \omega(r)]\, t - i \sin 2[\omega(m) + \omega(r)]\, t\}$

And $\theta'(0, t) = \theta'(0, 0) \{1 - 2\sin^2 [\omega(m) + \omega(r)]\, t\}$
$- i\, 2i\, \theta'(0, 0) \sin [\omega(m) + \omega(r)]\, t \text{ cosine } [\omega(m) + \omega(r)]\, t$

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

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

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

$W(ob) = -4\pi \{ [\sqrt{(1-\varepsilon^2)}]/T (1-\varepsilon)^2] \}\text{sine}^2 [\omega(m)\, t + \omega(r)\, t]$

If this apsidal motion is to be found as visual effects, then
With, $v°$ = spin velocity; v^* = orbital velocity; $v°/c = \tan \omega(m)\, T°$; $v^*/c = \tan \omega(r)\, T^*$
Where $T°$ = spin period; T^* = orbital period

And $\omega(m)\, T° = \text{Inverse tan } v°/c$; $\omega(r)\, T^* = \text{Inverse tan } v^*/c$
$W(ob) = -4\pi [\sqrt{(1-\varepsilon^2)}]/T (1-\varepsilon)^2] \text{ sine}^2 [\text{Inverse tan } v°/c + \text{Inverse tan } v^*/c]$ radians
Multiplication by $180/\pi$

$W(ob) = (-720/T) \{[\sqrt{(1-\varepsilon^2)}]/ (1-\varepsilon)^2\} \text{ sine}^2 \{\text{Inverse tan } [v°/c + v^*/c]/ [1 - v° v^*/c^2]\}$ degrees and multiplication by 1 century = 36526 days and using T in days

$W°(ob) = (-720\text{x}36526/\text{Tdays}) \{[\sqrt{(1-\varepsilon^2)}]/ (1-\varepsilon)^2\}$ x
$\text{sine}^2 \{\text{Inverse tan } [v°/c + v^*/c]/ [1 - v° v^*/c^2]\}$ degrees/100 years

<u>Approximations I</u>

With $v° \ll c$ and $v^* \ll c$, then $v° v^* \lll c^2$ and $[1 - v° v^*/c^2] \approx 1$
Then $W°(ob) \approx (-720\text{x}36526/\text{Tdays}) \{[\sqrt{(1-\varepsilon^2)}]/ (1-\varepsilon)^2\}$ x $\text{sine}^2 \text{ Inverse tan } [v°/c + v^*/c]$ degrees/100 years

Approximations II

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

$W° (ob) = (-720x36526/Tdays) \{[\sqrt{(1-\varepsilon^2)}]/ (1-\varepsilon)^2\} \times [(v° + v^*)/c]^2$ degrees/100 years
This is the equation that gives the correct apsidal motion rates -----------------------III

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

From Newton's laws for a circular orbit: $m v^2/ r (cm) = GmM/r^2$; $r (cm) = [M/m + M] r$
Then $v^2 = [GM r (cm)/ r^2] = GM^2/ (m + M) r$

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

And $v^* = v (m) = \sqrt{[GM^2/ (m + M) a (1-\varepsilon^2/4)]}$ = 48.14 km [Mercury] = $v^*(p)$
And $v^* (M) = \sqrt{[Gm^2 / (m + M) a (1-\varepsilon^2/4)]} = v^* (s)$

1- Planet Mercury 43" seconds of arc per century elliptical orbit axial rotation rate
[No spin factor]; data supplied does not include spin factor

$W (obo) = (-720x36526x3600/T) \{[\sqrt{(1-\varepsilon^2]}/ (1-\varepsilon)^2\} (v/c)^2$ seconds of arc per century

The circumference of an ellipse: $2\pi a (1 - \varepsilon^2/4 + 3/16(\varepsilon^2)^2 - --.) \approx 2\pi a (1-\varepsilon^2/4)$; $R = a (1-\varepsilon^2/4)$
$v = \sqrt{[G m M / (m + M) a (1-\varepsilon^2/4)]} \approx \sqrt{[GM/a (1-\varepsilon^2/4)]}$; $m << M$; Solar system

G =6.673x10^-11; M=2x10^30kg; m=.32x10^24kg
ε = 0.206; T=88days; c = 299792.458 km/sec; a = 58.2km/sec

Calculations yields:
v =48.14km/sec; $[\sqrt{(1- \varepsilon^2)}] (1-\varepsilon)^2 = 1.552$

$W (ob) = (-720x36526x3600/88) \times (1.552) (48.14/299792)^2 = 43.0''$/century
This is the solution to Mercury's 43" seconds of arc per century without space-time fictional forces or space-time fiction

2- Venus Advance of perihelion solution:

$W'' (ob) = (-720x36526x3600/T) \{[\sqrt{(1-\varepsilon^2)}]/ (1-\varepsilon)^2\} [(v°+ v^*)/c]^2$ seconds/100 years

Data: T=244.7days $v°= v° _{(p)}]$ = 6.52km/sec; ε = 0.0.0068; $v^*(p)$ = 35.12
Calculations

$1-\varepsilon = 0.0068$; $(1-\varepsilon^2/4) = 0.99993$; $[\sqrt{(1-\varepsilon^2)}] / (1-\varepsilon)^2 = 1.00761$
G=6.673x10^-11; $M_{(0)}$ = 1.98892x19^30kg; R = 108.2x10^9m

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

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

W" (ob) = (-720x36526x3600/T) $\{[\sqrt{(1-\varepsilon^2)}]/(1-\varepsilon)^2]\}$ $[(v^\circ + v^*)/c]^2$ seconds/100 years

W" (ob) = (-720x36526x3600/T) $\{[\sqrt{(1-\varepsilon^2)}]/(1-\varepsilon)^2\}$ sine^2 [Inverse tan 41.64/300,000]
= (-720x36526/10.55) (1.00762) $(41.64/300,000)^2$

W" (observed) = 8.2"/100 years; observed 8.4"/100years
This is an excellent result within the scientific errors

Data: T = 0.5 days satellite orbital Period; $\varepsilon = 0$
And v° = 0.465km/sec Earth spin speed;
And v^* = 14,000 km/hr = 35/9 km/second

Then $v^* +/- v^\circ$ = 35/9 = 3.88888889km/sec - 0.465km/second
We subtracted because satellite and motion and spin orientations are opposite
GPS time delays are given by this formula per day in seconds of an arc

W" (ob) = (-720x3600/T) $\{[\sqrt{(1-\varepsilon^2)}]/(1-\varepsilon)^2]\}$ $[(v^\circ +/- v^*)/c]^2$ degrees/100 years

W" (ob) = (-720x36/0.5) (1) $[3.423888889/300,000]^2$ seconds of arc /1 day
W" (ob) = 0.000675246"/day

U [seconds] = 0.000675246 x [24/360] seconds/day

U = 0.00045016 seconds/day = 45 micro seconds /day

Can it get any better?

Conclusion: GPS satellites turn around Earth with a speed of 14000km/hr and Earth Spin is 465 meters per second. If Earth Spin and Satellite Orbit are taken into account the 45" time delays per day is given by Universal Mechanics without the magic sock ideas of Harvard MIT Cal-Tech and NASA of space-time confusions of physics and without the addition of fictional forces or academic fiction of four dimensional self inflected maze of Modern Physics where Physicists can be sent to work at Macdonald's with any loss to the subject of Physics

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