

30 December 2009

Three conditions that confirm the existence of the Ether/ESF and validate the UDS as a viable relativity theory (Including a secret, built in the GPS, which is exploiting a notable coincidence)

The three well known phenomena presented here, are claimed to be fundamental on demonstrating the existence of the ESF.

Generation of Force and movement through interaction between physical masses (containing gravitational m-e M_0) distant from each other cannot happen without the intermediate presence of substance, (called Ether/ESF).

The phenomena imposed in the ESF by presence of a physical mass have the capacity to produce and extend physical reactive effects through presence of a field of depression and flow of the ESF, in such a way that another physical mass immersed in that field is forced to be subjected to internal transformation-degradation of gravitational mass-energy, inside it, whose external effect is in most cases corresponding to emergency of Force and movement (dynamism), readily measurable.

We then define "gravitational" these interactions between physical masses and the phenomena associated are also defined gravitational.

As I present here formulations representing energy values, commonly used by scientists for practical exercises, and by industry for applications, one can see that that to these formulations of energy belonging to a physical mass M (proper of Classic Mechanics) is added the novelty of their equivalence to an amount of m-e present inside the same physical mass M and to increase of energy values of M correspond m-e increases inside M , (as formulated by Einstein), and in these formulations must be accepted as an absolute necessity the intermediate reactive presence of the (gravitational) field of Ether/ESF between masses capable to react with the m-e transforming-degrading it into Force and movement of M (causing dynamism of it).

Note: that the three sets of formulations presented below, are related to the phenomena just mentioned, and are based on the hypothesis that the movements of physical gravitational masses M along circular or near circular orbits around a physical M_{LGM} are ruled by equilibrium between Forces released by the reactive gravitational field of the ESF and Forces opposed by reaction to movement generated by the physical inertial character of the physical mass M .

The presence of interaction between gravitational masses (or gravitational systems) is considered to be of relevance only in regard of what has been called General Relativity.

The effort towards a better understanding consists on making a synthesis grouping the three phenomena presented, within a unique general theoretical and more consistent explanation, which can only be obtained recognizing the necessary presence in the Euclidean space of a substance, the "Ether/ESF" having active characters, and permitting to extend the physical formulations of natural phenomena to a level of knowledge going beyond the Classic Mechanics.

Once the advances proposed will be accepted, further developments of technical nature may be facilitated.

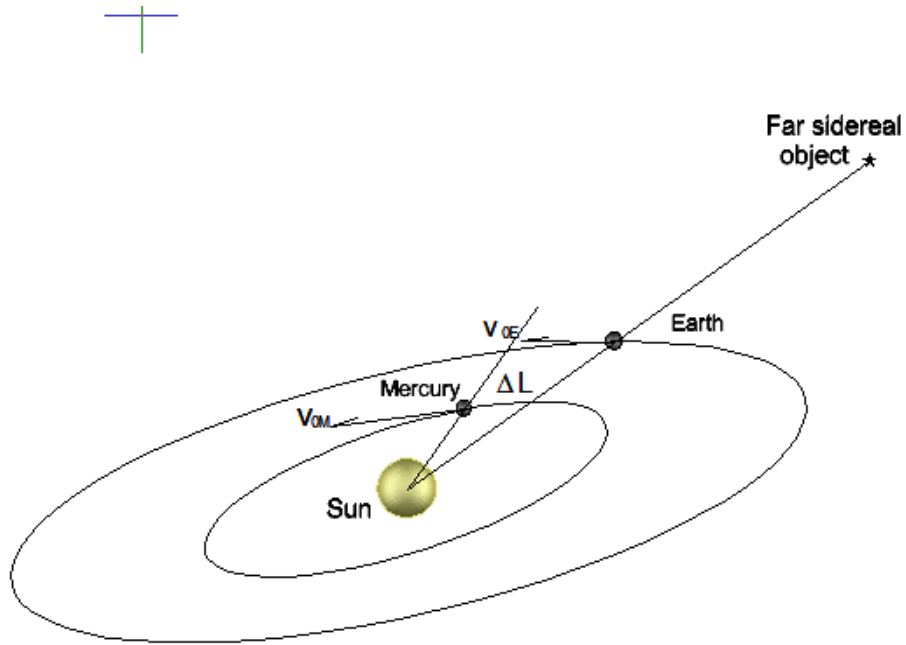
As a matter of fact, in this paper, few important physical development of intuitive nature will directly follow these three examples.

1) The temporal relativistic phenomenon between Earth and Mercury over 100 years

a) Inertial formula of time delay, based on physical measurements of velocities each corresponding to different presences of inertial m-e in the physical mass of the clock affected, in it we suppose to transfer a clock from Earth to Mercury after having synchronized the said clock, on Earth, with an identical clock which remains behind (under the basic condition that both clocks were originally measuring the Newton's time) gives a difference Δt due to different inertial contents in the masses affected (difference of Total Forces or kinetic Energy possessed by each and not presuming to measure Total Force as related to relative velocity):

the term $(\Delta v)^2$ representing relative velocity cannot be used since reference must be made to an hypothetic point in absolute quiet and within a gravitational system reference must be made to the center of the M_{LGM} in local condition of quiet:

$$a) \frac{\Delta t_{IM}}{100y} = - \frac{v_{0M}^2 - v_{0E}^2}{2c^2} \cdot 100 \cdot 365 \cdot 86400 = -24.6'' \quad \frac{\text{sec}}{100y}$$



Collimation at 100 years Newton's time, showing the precession
 Note: ΔL is the precessional advance at 100years return of collimation from the instant of intersection



Figure 1 (Precession)

b) Time Gravitational formula affecting the same clock as in a), strictly dependent from gravitational difference of depression on the ESF caused by the absorption of it, originated in the Sun:

$$b) \frac{\Delta t_{GM}}{100y} = - \frac{v_{OM}^2 - v_{OE}^2}{c^2} \cdot 100 \cdot 365 \cdot 86400 = -49.2'' \frac{sec}{100y}$$

Geometric precession observed in full at collimation of the system Sun-Earth- and a fixed star, at 100 years Newton's time recurrence when Mercury results in precession:

$$\frac{\Delta L_M}{100y} = 2\pi v_0 \frac{v_0^2}{2c^2} \cdot 100 \cdot 365 \cdot 86400 = 1.208e7 \frac{m}{100y}$$

Note: the above formula of precession is empirical and presumably correct but will be better justified if we can tie up precession not only to inertial content but also to the value of gravitational depression of the field of ESF along the orbit. (I reserve to do so in future).

Note: the multiplication by v_0 in the above formula, is geometric amplification of elastic unstoppable cyclical radial movement of the mass in orbit, due to crossing of the ESF at v_0 .

One possible interpretation is that the phenomenon of transformation-degradation of cyclical elastic nature, from m-e M_{RM} to m-e M_{ESCM} in conditions of rest is gravitational and represented by a sum of cyclical virtual vibrations per unit of time:

$$\frac{2dr}{\text{sec}} = \frac{v_0^2}{c^2}$$

These elastic cyclical radial deformations per unit of time, happening under the effect of the Starter Force \mathbf{F} (radial, expressed by the Newtonian ULG) belong to the dynamism acting over the physical mass and are opposed by the contact Force generated by inertial opposition of the mass M to the elastic radial deformation.

These dynamisms only express a measure of transformation-degradation of gravitational m-e tied up to the effect produced, along the radial line, by the **reactive character of the gradient of the gravitational depression on the ESF, which is $v(r)_0^2/c^2$** against the gravitational component M_{RM} of the mass M in radial movement. And due to the fact that the phenomenon is cyclical the return phase causes inverse gravitational transformation which being also degradation returns the original m-e ΔM_{RM} transformed inside the mass M to a gravitational-inertial status, but as a degraded ΔM_{ESCM} (“unbundling”).

Note: in orbit the phenomenon is to be interpreted in similar manner, and the effect of gravitational compression over the elastic mass is identical, (what changes is the opposing Force which is generated by inertial opposition to change of direction of velocity v_0 orbital (and is a mass Force), the fact that these forces in equilibrium over an elastic mass generate an unstoppable radial cyclical phenomenon must be added the static effect of compression and over and above that presence of movement at v_0 through depression of ESF amplifies v_0 times the transformation-degradation (in respect of the same happening inside a mass resting in local quiet above the surface of a M_{LGM}).

Note: the phenomena of dynamism in local quiet and in orbit are not exhausted here but I found that in these two cases other phenomena are to be overlooked.

Under the above considered conditions the elastic dynamism originated by gravitational **depression in orbit produces vibrations whose causing radial displacements whose sum is $2dr'/1''$ m/sec whilst a vibration starts from a condition of quiet and ends in quiet the internal effect over the mass affected is only internal degradation of m-e (from M_{RM} to M_{ESCM}) whose gravitational character remains.**

The virtual component of the elastic dynamism originated by gravitational **compression orbit is $2dr'/sec$** and the transformation-degradation is represented by: $F_{Starter} 2dr'$ with:

$$\frac{2dr'}{1''} = v_0 \frac{v_0^2}{c^2}$$

We see that the sums of the cyclical radial deformations of elastic nature per $1''$ second of time are amplified v_0 times and the opposing contact Force is substituted by a mass Force supplied by the inertial opposition of the mass M to development of cyclical deformation.

To this phenomenon corresponds a not better identified but amply documented geometric phenomenon of temporal nature named precession:

$$\Delta L_{P/sec} = 2(2\pi dr'/sec) - (2\pi dr'/sec) = (2\pi dr'/sec)$$

Note: the term 2π is in relation to a behavior which is not well understood. But corresponds to presence of opposite effects both causing temporal retardations with increase of velocity v_0 and with the increase of depression of the ESF but when it comes to precession the depression of the ESF causes a positive precession value $2(2\pi dr'/sec)$ adding a length $2(2\pi dr'/sec)$ to the geometric displacement v_0 in orbit and the compression due to presence of v_0 causes a negative precession $(-2\pi dr'/sec)$, summing the effects the precession $\Delta L_{P/sec}$ will be a geometric advance:

$$\Delta L_{P/sec} = (2\pi dr'/sec)$$

Note: the physical mass (Mercury in this case) in geometric precession carries a clock whose internal content of inertial mass (when collimation is made) has changed from what it was when from Earth was sent to Mercury and now measures a delay of the Newton's time in relation of the surface of Earth (we overlook Earth rotation which in this case amounts to a perturbation).

Newton's time is an absolute local measure related to the whole system and dependent from the gravitational m-e M_{OLGM} (belonging to the M_{LGM}) but measured on the clock on Earth (which is loaded of inertial m-e due to the orbital movement), and when collimation is repeated in succession, the planet Mercury has already overshoot the point of collimation, where it was expected to be, (is in geometric precession) and can be found at a point along the orbit whose distance in meters from the point of collimation is $\Delta L \cong 1.208 e 7 m$ which

measured as time precession at v_0 velocity (measured at temporal geometric precession since moves at $v_{0M} = 47887$ m/sec) will be :

$$\frac{\Delta t_{\text{PRECESS}}}{100y} = \frac{\Delta L_{\text{PRECESS}/100Y}}{v_{0M}} = 2\pi \frac{v_0^2}{2c^2} \cdot 100 \cdot 365 \cdot 86400 = 252.3'' \quad \frac{\text{sec}}{100y}$$

The above value is the measure of time distance at the orbital velocity v_0 , since $(v_{0M} \cdot \Delta t_P)/100y = \Delta L/100y$ from the line of collimation, the above formulae (inertial and gravitational in **a** and **b** of time difference) can calculate the reading in conditions of simultaneity at the clock in Mercury, compared to the reading at the clock on Earth at the return in collimation, but the clock is at a time distance of 253" sec from the line of collimation (run at v_0) .

For the Gravitational time differences we must establish and accept that only the gravitational depression $v_0^2(r)/c^2$ in local absolute terms respect to the central M_{LGM} ($R_{LGM} < r_M < r_E$) is directly responsible for the time delay between the two clocks, and for larger values of the gravitational depression in the ESF caused by the M_{LGM} in the ESF, like in our case, the time phenomenon slows down.

Note: the time, tied up to depression of the ESF, from a maximum retardation at the surface of the M_{LGM} (of radius R) gradually advances towards the center, where reacquires the local absolute value (Newton's time of the system), since the local absolute value of depression of the ESF is zero on that point.

Note: a clock in the center of the M_{LGM} is just an intellectual exercise, since it would be impossible to put a clock there given the enormous hydro-compressions existing in that point.

Note: the unbundling inside a physical mass resulting from the vibrations causing the strictions (in quiet dr and in orbit $dr' = v_0 dr$) has no effect on the time advance phenomena since along a cycle of "unbundling" there is time retardation and time advance always cancelling each other.

We must now point that the clock was sent on Mercury from Earth where as said was synchronized to our local absolute clock measuring Newton's time, but this is a basic information since what is required is that at the first collimation the time should be $t=0$ in both clocks (the time, for the purpose of this exercise, should be again synchronized at the first collimation).

At that moment $t=0$ of collimation the clock on Earth is measuring the local absolute Newton's time of the Sun whilst in possession of inertial m-e corresponding to the orbital velocity v_{0E} and corresponding time retardation and gravitational depression corresponding to time retardation on Earth respect to the center of the system, and the same applies to Mercury.

If the two clocks originally registered to measure the local Newton's time of the system, are synchronized into showing $t=0$ at the moment of collimation the time discrepancies measured between Earth and Mercury will respect the formulas **a** and **b** above and will show a:

$$\frac{\Delta t_{\text{TOTAL}}}{100y} = (-24.6'' - 49.2'') = -73.8'' \frac{\text{sec}}{100y}$$

Whilst at return of collimation, precession is observed in full (see Fig.1) the clock, inside Mercury, will physically precede along the orbit of a $\Delta L/100y$, as above described.

Therefore in the new advanced position at the expected instant of successive collimation the clock is positively offset of $\Delta L/100 y = 253.2'' \text{ sec}/100y$ whilst is in retardation of $\Delta t_{\text{TOTAL}}/100y = - 73.8'' \text{ sec}/100y$

The Ether ESF entrained by the solar system and creating a composite field (an alloy) with the field of inertial mass M_{ESCE} of the Sun is moving with the Sun around another center of gravitational physical mass (presumably the center of our Galaxy, the Via Lactea).

Both Earth and Mercury and their respective surrounding fields, as alloys of “inertial field of m-e ΔM_{ESCE} and the surrounding ESF (which by the way is also in conditions of gravitational depression and flow) ” are sweeping their respective orbits, absorbed at their respective orbital velocities, by the field (alloy) ΔM_{ESCE} -ESF, belonging to the Solar system which is immobile relatively to the center of the Sun and moving with it (whilst, as said, the solar system is orbiting, possibly, another M_{LGM}).

See [Appendix I](#) to this paper.

In Brief: our clock on Earth when collimation takes place (at 100 years intervals measures Newton’s time (referred to the center of the Sun and the clock on Mercury having been synchronized with our clock is in the conditions above described but having been carried forward by precession of a

$\Delta L/100y = 1.208 \text{ e } 7 \text{ m}$ is present geometrically advanced of a $\Delta L/100y$ which at the orbital velocity of Mercury is a time “distance” of $252.3'' \text{ sec}/100y$, when we make the collimation we will find Mercury on the point just described containing a clock showing a time retardation $\Delta t_{\text{TOTAL}} = -73.8'' \text{ sec}/100y$ in respect to our clock on Earth.

Note: the geometric value of the precession has been measured but the time phenomenon (as presented here) in Mercury has not been verified, nevertheless the above expression and justifications seem to be verified when we check the data available through the GPS and through the Hafele-Keating experiment.

2) The Global Positioning System (GPS)

The GPS is contemplating Earth as central Large Gravitational Mass (M_{LGM}) of the system and the Ether in this case is alloyed with the field of inertial mass-energy corresponding to the Total Force or kinetic energy of the Earth in orbit at velocity v_0 , the situation of the Earth in orbit is similar to the one of all the other

satellites of the Sun, but now the Earth is the central gravitational mass M_{LGM} of the system under scrutiny and the artificial satellite sweeps the alloy made up by the inertial m-e of Earth in movement as a system and the gravitational field of ESF which surrounding the Earth determines the condition of local immobility, permitting the establishment of a permanent local gravitational field of depression and flow (of the said alloy) referred to Earth as center of gravitation, in which a true orbital movement can take place.

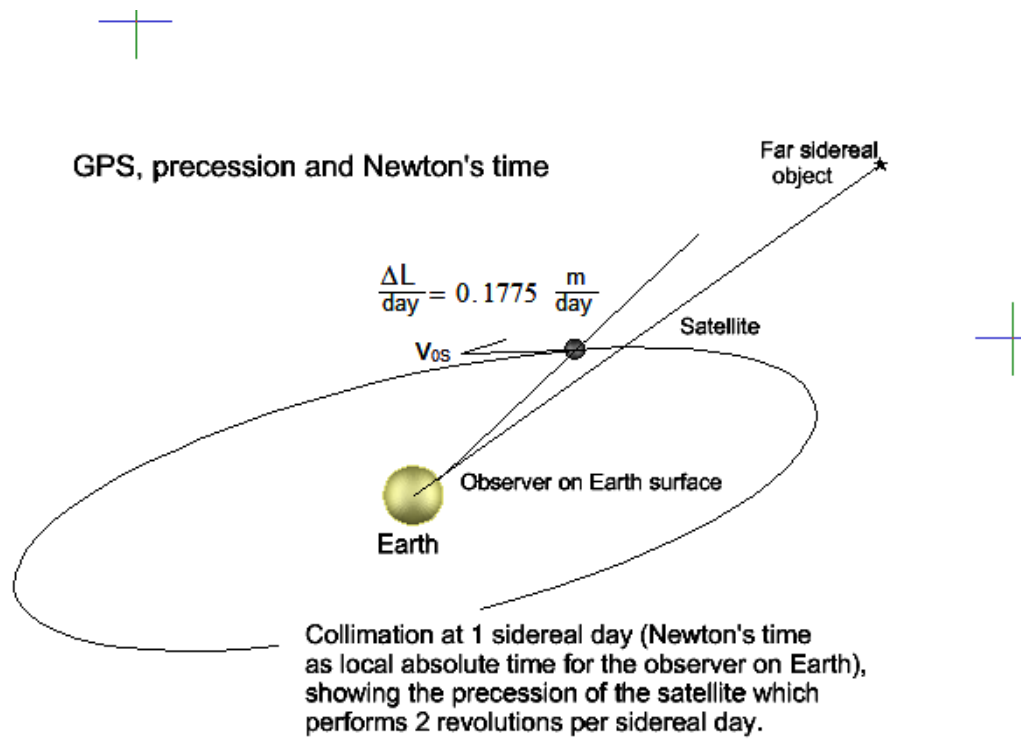
What makes the difference is that we, the observers, are not observing an object moving in orbit around the Sun (like it happens to us observing Mercury from Earth) but from our residence on Earth rotating around its axis we observe the satellite orbiting the center of Earth.

Earth in rotation in this case is an extra phenomenon to be considered since the system Earth not only, as described, entrains the inertial m-e field alloyed with the ESF, that permits the establishment of a local status of quiet whilst the system is in orbital movement around the Sun, but is endowed of an internal inertial rotating field of m-e alloyed with the ESF which is present on it up the highest layers of the atmosphere (as will be presented in the H-K experiment in better detail) .

The formulations ruling the GPS foresee like in the case 1) above, two identical clocks measuring Newton's time (which in this case is local absolute in respect to Earth and is measured through the time interval elapsed between the repetition of two successive collimations (at the vertical of the observer), of the satellite with a sidereal object (far enough that we can consider it immobile), this interval of time which is the sidereal day, being an excessive value is split into a fixed amount of equal units each permitting reference to the geometrical movement of rotation of the Earth (the velocity of rotation of Earth as space run at the equator by the tip of the average Earth's radius over a time interval of one second) .

Time of collimation used for the GPS is therefore the sidereal 1 day = 23hrs 56' 3.55" = 86163.55 sec (see [Ruggeri19](#) page 4) .

Note: since the time is a local absolute within an inertial system, to go from one system to the other requires adjustment.



Note: ΔL is the precessional advance of the satellite from the point of intersection at 1 day when the Earth is returning in collimation

Note: the alignment is between the center of the Earth the observer and the far object and due to precession there cannot be real alignment in the terms assigned between the observer the satellite and the far object.



Figure 2 (GPS)

The adoption of the time interval of a second is a representation easily manageable and made visible through the display of a movement copied by the dial of a "clock" which reproduces an entire circular movement .

The two clocks used for the GPS are identical and synchronized and whilst one stays with the observer, the other is sent in orbit with the artificial satellite.

The satellite is inserted into an orbit that returns to sidereal collimation over the vertical after about 86163.55" sec (sidereal day), after having circumsolved Earth two times.

The clock contained in the satellite was synchronized with the one of the observer and difference of velocity of rotation of the Earth at the observer and orbital velocity at the satellite is reflected on a time retardation of the clock in the satellite respect to the clock of reference on Earth, whereas the reduction of gravitational depression of the ESF produces a time advancement.

The satellite is also subjected to geometric precession which is also a relativistic phenomenon and can be expressed in temporal terms (as seconds run in the clock of the observer whilst the object moves at his own orbital velocity (see fig 2) :

The radius R_E of the Earth 6372000 m

The orbital velocity of the satellite at radius R_S of the orbit of the satellite

$$R_S = R_E + \Delta \quad \text{for } \Delta = 20,000,000 \text{ m is } v_{0S} = 3890 \text{ m/sec}$$

The velocity of rotation of the Earth at the Equatorial plan is $v_{RE} \sim 463 \text{ m/sec}$

Inertial (delay) formula of time:

$$\frac{\Delta t_i}{\text{day}} = -\frac{v_{0S}^2 - v_{RE}^2}{2c^2} \cdot 86,163.55 = -7.14 \quad \frac{\mu\text{sec}}{\text{day}}$$

Note: the time formula gives a delay based on true velocity values in the above conditions.

The R_E is the radius of the Earth to which corresponds an orbital velocity $v_{0E} = 7913.13 \text{ m/sec}$, and we can see that no such a velocity is occurring, therefore the use of a v_{0E}^2 used (in the gravitational formula of time), must have a different physical explanation, as indeed is the case since v_{0E}^2/c^2 is the value of depression of the ESF at Earth surface level (at radius R_E).

Gravitational formula of time using the local values of gravitational depression of the ESF:

$$\frac{\Delta t_G}{\text{day}} = -\frac{v_{0E}^2 - v_{0S}^2}{c^2} \cdot 86,163.55 \cong 45.5 \quad \frac{\mu\text{sec}}{\text{day}}$$

Note: this formula is offering one of the crucial demonstrations that the ULG can be interpreted through the physical effects that the gravity produces in the ESF, since the expression of time phenomenon, which it underlies, is based on the **gravitational depression** of the ESF produced by the gravitational absorption of ESF by the central M_{LGM} .

Gravity in the other hand is the one that gives a time advance effect only in the clock transferred inside the satellite in orbit which, is subjected as a whole to the relativistic phenomenon described as Precession:

$$\frac{\Delta L_P}{\text{day}} = 2\pi v_{0S} \frac{v_{0S}^2}{2c^2} \cdot 86,163.55 = 0.177 \quad \frac{\text{m}}{\text{day}}$$

And to Precession corresponds a geometric-temporal advance (drift in sec) from the line of collimation

$$\frac{\Delta t_P}{\text{day}} = \frac{\Delta L_P}{v_{0S}} = \pi \frac{v_{0S}^2}{c^2} \cdot 86,163.55 \cong 45.5 \frac{\mu\text{sec}}{\text{day}}$$

Note: the above coincidence of the temporal advance due to gravity and of the geometric-temporal advance at orbital v_0 caused by precession (very important , see [Appendix II](#)).

On Earth surface the Newton's clock which is synchronized to Earth orbit has been adapted to the sidereal measurement of the time and the Earth rotation cannot be assimilated to an orbital movement since Earth is turning with the ESF (the ESF is trapped by Earth up to the highest levels of the atmosphere and therefore the clock moving at v_{RE} is not subjected to precession) this makes the measure of Newton's time acceptable as measure of reference, (the two successive sidereal collimations by definition exclude precession).

The sum of the relativistic phenomena gives a time advance at the clock of the satellite:

$$\frac{\Delta t}{\text{day}} = 45.6 - 7.2 = 38.4 \frac{\mu\text{sec}}{\text{day}}$$

But we must be aware that, even correcting the time at the clock in orbit through a time retardation of $38.4 \mu\text{sec/day}$ the clock is physically displaced of a $\Delta L = 0.177 \text{ m/day}$.

The above is a well documented value of advance at a clock that every day due to precession moves forward from the line of collimation of a $\Delta L = 0.177 \text{ m/day}$, and, with the succession of days since the precession is an effect that accumulates, the collimations become increasingly incorrect (see fig 2) and the inverse triangulations determining the position on Earth from a point of reception of a signal become increasingly unreliable, a fact that imposes a periodic re-synchronization of the system.

3) Hafele-Keating experiment

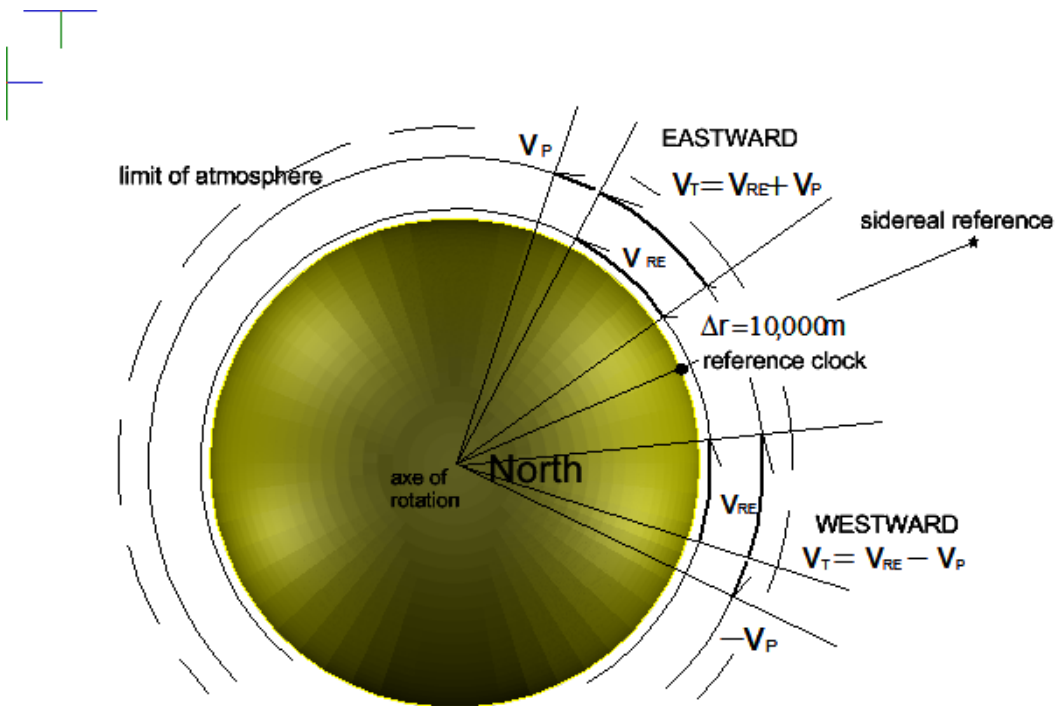
For Earth rotating eastwards and the airplane moving towards east $v_{RE}+v_P$ and then towards west $v_{RE}-v_P$:

The velocity of rotation of the Earth at Earth surface is $v_{RE} \sim 463$ m/sec and a stationary clock turning with the Earth at the level of the flying airplane $\Delta r=10000$ m is moving at :

$$v_{\Delta r RE} \sim 463.7266 \text{ m/sec}$$

the airplane is flying at average velocity $v_P = 220$ m/sec

Time of circumnavigation: ~ 50 hrs



Collimation at 50hrs Newton's time, when the plane flying in either direction has circumnavigated Earth and the temporal phenomenon affecting the clock on the plane must reflect the fact that the time on the clock on Earth is a local absolute (Newton's time) measured by a clock containing inertial m-e



Figure 3 (Hafele-Keating)

Inertial formula of time for the airplane flying eastwards and westwards:

$$\frac{\Delta t}{50\text{hrs}} = - \frac{(v_{\Delta r RE} \pm v_P)^2 - v_{RE}^2}{2c^2} \cdot 50 \cdot 3600 = \frac{-253\text{ns}}{50\text{hrs}} - \frac{155\text{ns}}{50\text{hrs}}$$

Note: we have a time delay in the first instance and a time advance in the second.

Note: the clock which measures the Newton time in seconds is loaded/unloaded at Δr height of flight, of inertial m-e M_{ESCE} with reference to the center of Earth as zero load.

Gravitational formula of time using the local values of gravitational depression of the ESF:

$$\text{At radius } R_P = R_E + \Delta \quad \text{for } \Delta r = 10,000 \text{ m}$$

The R_P is the radius of the flight altitude of the airplane to which corresponds a gravitational depression of the ESF v_{0P}^2/c^2 for $v_{0P} = 7906.93$ m/sec.

The R_E is the radius of the Earth at the surface to which corresponds a gravitational depression of the ESF v_{0E}^2/c^2 for $v_{0E} = 7913.13$ m/sec

The time gravitational formula gives a positive value since the time in the gravitational phenomenon retards with the increase of the gravitational depression:

$$\frac{\Delta t}{50\text{hrs}} = - \frac{v_{0P}^2 - v_{0E}^2}{c^2} \cdot 50 \cdot 3600 = 196 \frac{\text{nsec}}{50\text{hrs}}$$

For the airplane flying eastwards the clock will show time retardation:

$$\Delta t_{\text{EAST}} / 50\text{hrs} = -253 + 196 = -57 \text{ ns}/50\text{hrs}$$

For the airplane flying westwards the clock will show time advance:

$$\Delta t_{\text{WEST}} / 50\text{hrs} = 155 + 196 = 351 \text{ ns}/50\text{hrs}$$

Note: these formulations agree with the actual measurements though as can be understood there is a high element of error introduced, one of which is the physical confrontation of the two clocks (or of the clock of the airplane with a clock on the place of landing synchronized to Newton's time).

More on the Hafele-Keating experiment

One further character of the H-K experiment which was overlooked, is to be attributed to the fact that, whilst to make relativistic measurements of time, we take into account local absolute values of velocities and gravitational depression of the ESF, we have overlooked that the centrifugal Force developed by rotation has a physical effect opposing gravity in physical terms to which is associated a temporal effect also opposed to the one caused by gravity.

This on the airplane, considered in the experiment, flying at an altitude $\Delta = 10,000$ m will cause a time delay:

For the centrifugal effect due to Earth rotation $v_{CP} = 463.7266$ m/sec and $v_{CE} = 463$ m/sec

$$\frac{\Delta t_C}{50\text{hrs}} = - \frac{v_{CP}^2 - v_{CE}^2}{c^2} \cdot 50 \cdot 3600 = -1.346 \frac{\text{nsec}}{50\text{hrs}}$$

A small amount which in this particular exercise, results engulfed inside the range of the error, but related to an effect worthy to be investigated.

No precession is going to be present in the airplane flying inside the atmosphere of Earth, because the ESF is entrained and moves at the same velocity of rotation of Earth.

Note: the nature of the experiment is requiring synchronization of the clocks at take off and possibly to fly all the 50 hrs without stop, since if this is not done, each landing and take off is a possible source of errors of the order of few nanoseconds which in the whole is a feature of the H-K experiment difficult to overcome.

[Appendix I](#) Why in the GPS the geometric time precession expressed in time units and the gravitational phenomenon of time advance, give the same values? Explain.....

In the GPS above the gravitational formula:

$$\frac{\Delta t_G}{\text{day}} = - \frac{v_{0E}^2 - v_{0S}^2}{c^2} \cdot 86,163.55 = 45.55 \frac{\mu\text{sec}}{\text{day}}$$

And the geometric advance due to precession covered in time units at orbital velocity:

$$\frac{\Delta t_P}{\text{day}} = \frac{\Delta L_P}{v_0} = \pi \frac{v_{0S}^2}{c^2} \cdot 86,163.55 = 45.55 \frac{\mu\text{sec}}{\text{day}}$$

have the same value but not the same expression, and this constitutes a remarkable coincidence for the particular configuration used.

We have that the $\Delta r = 20,000,000$ m (elevation above sea level) $\approx \pi r_E$ and since:

for the satellite, $r_S = r_E + \Delta r = (1 + \pi) r_E$:

$$\pi v_{0S}^2 = \pi \frac{kM_E}{4\pi r_S} = \frac{kM_E}{4\pi r_E} \left(\frac{\pi}{(1+\pi)} \right)$$

Results equal to

$$v_{0E}^2 - v_{0S}^2 = \frac{kM_E}{4\pi} \cdot \left(\frac{1}{r_E} - \frac{1}{r_E \cdot (1+\pi)} \right) = \frac{kM_E}{4\pi r_E} \cdot \left(\frac{\pi}{(1+\pi)} \right)$$

Explaining the equal results for two different physical facets of the phenomenon observed.

Note: to my knowledge, at present the existence of precession in the orbits of the GPS satellites is a physical concept whose formulation was introduced for the first time in Ruggeri19 and further refined here.

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