Introduction

The present tractate has been conceived by the author to examine unusual aspects of macroscopic Physics with the purpose to test celebrated theories ability to withstand with the outcome of some famous experiments. By the way the overview includes also particular cosmic observations whose interpretation points to a new theoretical paradigm for macroscopic reality. This paradigm restores a modern Galilean age that seems to be absolutely compatible with Quantum Mechanics principia in which it founds its root in a harmonic fashion.

This journey starts in this same prologue with a new way to interpret Michelson Morley (MM) and other similar interferometer experimental results got in terrestrial labs that show invariance of two ways light speed in all directions of space up to a today detectable delay between orthogonal beams of 10^-17 s. This number is limited by the better observable resolution of dark fringes separation at the apparatus telescope, actually 1/100 of Na wavelength (Na wavelength is 589nm), and should allow detection of "ether" drifts higher than 5km/s as they are classically expected to be. Pointless to say they were never measured along all the history and progress of such interferometer technique.

Also the phenomena that cannot be coherently predicted by the Theory of Relativity (Sagnac platform based interferometer experiments) are consistently interpreted. This is deeply covered in chapter 4.

The experimentally tested retardation of moving clocks is taken into account.

All the above is achieved by proposing in chapter 1 a new transformation model named **Inertial – Galilean (IG)** together with the idea that almost separate "ether" systems exist in the proximity of every cosmic mass aggregation. More specifically in every point of the space a contribution to the "ether" property is received by the total universe mass (but the contribution is appropriately weighted by the distance to the considered point from each infinitesimal piece of the universe mass). This practically causes "ether" to assume local properties in space. Because almost entirely dependent by the nearest cosmic mass aggregation.

As consequence, in the particular case that a certain mass is sufficiently far away from all others masses of the universe in motion with respect this isolated one, then the same mass is the solely contributing to its local "ether" that in this case remains at rest with it. So light speed is isotropic as seen by an inertial frame at rest with a mass in this particular isolated condition, given the light is emitted by the same mass. If two distinct inertial frames (both in such isolated condition, so their respective rest masses being also far away from each others) exchange light beams, then each one sees the speed of light originated from the other's mass as given by the isotropic contribution that holds in its domain corrected by the relative motion of the emitting frame through a vector addition of the mentioned isotropic vector contribution with the emitting frame vector speed (as seen by the detecting frame).

This is the Galilean principle of the relative velocities vector addition among different inertial frames. The application of this principle also to speed of photons (again under the above restriction) is the postulate at the basis of this new theory that is presented in chapter 2.

If the above restrictions are not satisfied, as usually happen everywhere a mass concentration occurs in the universe (stars, planets..etc), an **“**adapted Galilean principle of relative velocities vector addition” must be used to sum up the isotropic vector contribution with the speed (again as seen by the detecting frame) of a suitable Third Frame (at rest with the center of mass mainly contributed by the local masses in the neighbors of the light emitting location) in place of the real emitting frame speed.

For the case of massive sub atomic particles emission the usual Galilean Principle of the relative velocities vector addition belonging to Classic Physics is considered as a limit to which tends (this works better the heavy are the emitted particle masses) the more general Adapted Galilean Principle of the relative velocities vector addition that seems to constitute the intimate principle ruling the natural laws in function of the emitted particle mass. By the way this principle, in present New Galilean paradigm tractate, does not apply only to photons but also to a broad range of sub atomic particles and may be it could be extended as well to macro molecules, see chapter 10).

As it is shown in chapter 3, a suitable H coefficient accounts for Adapted Galilean Principle of the relative velocities vector addition because it correctly weights the local masses in the neighbors of the light (or general sub atomic particle) emitting location. H value is in turn function of the emitted particle mass in order the lighter the emitted particle, the extended is the surrounding masses contribution to build its anisotropic vector speed component seen by the Detecting System. This council with quantum mechanics because wave function of light particles is much more extended than the one belonging to heavier particles.

The marvelous philosophical aspect of the H coefficient based model lies on the fact that it qualitatively applies to all the sub atomic particles without any qualitative distinction no matter other peculiar characteristics or quantum properties they can hold. The only distinction is quantitative and it is ported by the H value (it is higher the higher is the concerned emitted particle’s mass). So a very strong theoretical unification is ported by the New Galilean paradigm through Adapted Galilean Principle.

Until this point the Galilean or Adapted Galilean principles of relative velocities vector addition can be applied using the classic Galilean Transformations. No need to introduce any change in the related equations proposed by Galileo Galilei. By the way a sneaky ambiguity is already hidden behind Adapted Galilean principle applied in a classic Galilean context. It regards physical work provided or released by the surrounding masses to build the anisotropic velocity component of an emitted particle that, as will be pointed out at the end of chapter 10, remains a questionable subject because it changes with the selected inertial detecting system choice. IG model introduction will solve this ambiguity.

Inertial Galilean (IG) model introduction is necessary to take into account the well experimentally proved retardation of moving clocks avoiding to use Relativity Theory with all its known stuff of paradoxes linked to relativity of simultaneity concept. This is achieved by restoring the classic view of Absolute Simultaneity of two events if seen by any different observers in relative motion (simultaneity for one observer means simultaneity for all the others). IG model is also open to account for any kind of signal speeds higher than the light one without incur into imaginary solutions.

The IG model is based on the supposed existence of a natural Absolute Privileged Reference Frame. It will be briefly called Privileged System. It constitutes the intimate universe structure that is assembled without (known) boundaries. The density of such structure is negligible if compared with the one hold by known matter. Anyway its homogeneous (low) energy distribution defines the absolute rest status of the universe and marks the true cosmologic time in those space locations not influenced by surrounding mass gravitational fields. Also its point of view becomes the solely authorized to interpreter the non relativistic essence of a particle Energy (nevertheless it is the Compton or the kinetic one). Clocks at rest with Privileged System, and not disturbed by gravitational fields, advance with the same uniform peace that is the natural objective peace of the Privileged System. It is shown in chapter 9 that Privileged System can be eventually exchanged (moved to another actually not privileged inertial frame, becoming in turn itself the not privileged one) through physical manipulations that directly modify the natural peace of the clocks at rest on the two systems to be exchanged. This possibility (even if not realistically practicable due to the large amount of natural clocks present on both systems that should be appropriately manipulated including those embedded into mentioned intimate Privileged System structure..) is in favor of the correct description through IG model of such Privileged System whose (only hypothetical exchange with a not privileged one) cannot arise sneaky ambiguities in regards the new speed of the clocks on the two systems after the exchange of Privileges among them.

As previously anticipated the objective peace of clocks at rest with Privileged System is subjected to a disturbance caused by the gravitational field intensity present at every clock location. The fact that the far is a clock from a gravitational field source the quicker is its speed (with respect a clock closer to the source) is a physical phenomenon whose evidence is accepted by many theories including the New Galilean paradigm that is presently exposed. Consequently it is needed to select clocks at rest with Privileged System very far from disturbing masses (in order they could mark the absolute objective peace of the Privileged System). By this way the gravitational field at their locations is zero (within a given accepted precision). This choice has the merit to separate the absolute objective peace of Privileged System by any gravitational interference. It is straightforward that the same method must be applied to every not Privileged System whose clocks peace depends by Privileged System one through IG model inertial equation (this is analytically showed in chapter 1). Also in this case, these clocks must be sufficiently isolated by nearest masses to separate gravitational disturb from genuine IG model dependence law.

To reassume all the above points, the line of reasoning to land to this new model has been the following: Galilean Transformation (G) fails in prediction of classic "ether" idea because it cannot account for MM type interferometer experiments not ability to detect variance of two ways light speed in all directions of space causing more than today detectable delay between orthogonal beams of 10^-17 s. This condition supports detection of "ether" drifts higher than 5km/s, so the classic unique "ether" system hypothesis should be already experimentally confirmed (this is expected due to the fact that just terrestrial drift around Sun is close to 30km/s). But no light speed variance has been experimentally detected in spite such expectations. For this reason unique (universal) "ether" hypothesis should be abandoned.

Instead G model is not against the hypothesis of above mentioned almost separated "ether" systems. Because the presence of such local "ether" systems requires a variance of the two ways light speed that causes a delay between orthogonal beams more than two orders of magnitude smaller than today detectable value of 10^-17 s. Such negligible delay (beyond today MM technological capability) can be explained by terrestrial lab drift versus a local "ether" at rest with our planet center of mass not higher than 0.46km/s at equator worst case. This would require a detectable delay between orthogonal beams of less than 10^-19 s, as said just two magnitude orders beyond actual MM interferometer detection capability. Note that following this idea of local "ether", our planet center of mass becomes the famous "Third Frame" (mentioned above where **"**Adapted Galilean principle of relative velocities vector addition" is postulated) whose speed drift with respect terrestrial lab must be used to vector sum up with isotropic light component to compute the light speed detected by terrestrial lab apparatus if the beam is emitted by a "local" mass (belonging to our planet or floating in its nearby).

By the way G model can predict other interferometer experimental evidences like the one present into Sagnac rotating platform. Apparently surprising result of higher interferometer effect into Sagnac experiment (with respect MM type experiments) is justified using G model into chapter 4.

IG model, while keeping all the correct G model predictions of interferometer experiments, accounts for retardation of moving clocks as above said.

To achieve this, it was introduced into IG model a corrective coefficient in place of the simple Galilean transformation (identity) of the time. This factor, (the only difference between G and IG model) is (base e) exponential with the velocity module of the moving clock in order to "freeze" the moving time (moving with respect Privileged System) only for infinite velocity. In doing so, speed of light does not establish anymore a limit to other possible higher velocities. Speed of light in the Privileged System remains only the velocity of photons with respect Privileged system. No more of this. A particular “k” factor (inserted into the exponential coefficient) accounts to match Inertial – Galilean model to experimentally proved life elongation of muons circulating into accelerator ring. Its value is evaluated in chapter 5. Note that the exponential law that connects Privileged System time with a moving object proper time has been selected due to its suitable monotonic rate necessary to withstand with the Galilean concept that there is no limit to absolute velocity, any increment of absolute velocity must contribute in freezing the moving time no matter its current module value already is, and there is no reason to foresee some “privileged” absolute velocity milestone (like light velocity or others) that imposes an increase in time dilation rate when an object absolute velocity approximates to it. This last not acceptable case would introduce a flex disrupting the monotonic trend of time dilation in function of absolute velocity. For sure when further experiments, able to (directly and closely) monitor the relation between a generic particle velocity and its proper time dilation, will be performed then other interpolation points will be available. This could eventually invalidate actual use of the simple exponential law and a new relation will replace it. Even a not mathematically closed function. The author expects, whatever will be the eventual new relation able to fit all the future experimental data, the mentioned monotonic trend will be confirmed. This is due to the belief that New Galilean paradigm is the right one to rule the laws of macroscopic Physics and in this case the monotonic trend (from zero velocity to infinite velocity) is a necessity as above exposed. Moreover only a monotonic time dilation – absolute velocity relation is able to confirm the perfect interpretation of cosmological objects intrinsic red shift exponentially sequenced quantization in terms of a linear progression of quantized absolute velocities owned by the same objects. See chapter 6.

As just anticipated an interesting use of IG model to interpreter intrinsic cosmological red shift quantization evidence is presented into chapter 6. It leads to a paradigm of galactic bodies that are slowing down their velocity module (as seen by Privileged System) in a linear way with cosmological time. This is followed in chapter 7 by a digression concerning the galactic Doppler Effect computation from observed frequencies at light of present new Galilean paradigm. This is done with the purpose to eliminate this contribution from Quasars emissions focusing only on the intrinsic red shift component. An almost inappreciable difference on final localization of intrinsic red shift with respect the classic relativistic procedure is demonstrated as far as Quasars velocities are one magnitude order below the isotropic light speed. This result validates the already done use (in chapter 6) of the intrinsic red shift data retrieved from “Seeing Red” book because in “Seeing Red” context the Doppler Effect computation from perceived frequencies has been probably achieved through relativistic approach.

A paradoxical disconnection in classic treatment of Doppler Effect (even outside electromagnetism) is pointed out still in chapter 7. The wrong solution is explained as due to illegitimate omission of classic Galilean velocity vector addition principle.

It is shown since chapter 6 that the above mentioned cosmological paradigm of galaxies that are linearly approaching to a rest status with respect privileged System leads to further interesting considerations on the quantum mechanisms that are likely at the base of this behavior. The key idea is that mass itself depends by its proper time dilatation (as seen by Privileged System, because in motion with respect it as by IG model law). But proper time dilatation corresponds to atomic proper frequencies slowing down. This means in turn atomic energetic levels resizing. Lastly, through Maxwell famous law E=mc^2 obtained by the scientist in second half of XIX century by use of his homonymous electromagnetic equations to compute the wave pressure exercised on an absorbing body and getting in this way the transferred momentum from the wave, this implies a mass dependence by proper time. So mass becomes lighter the quicker is its speed with respect Privileged System. At this point, using the evidence of constant galaxies acceleration working to linearly reduce their speed with respect Privileged System, it is possible to argue that quantum interactions, between unknown substance building the inner skeleton of Privileged System and travelling mass within it, lead to a contrast on the moving particles that is lighter the quicker is the speed of them. This happens because the lighter (in term of mass) particles (this is due to their same quicker speed) are opposed with lower interaction energy. These light particles tend to propagate like ghosts with an extended quantum wave function leading them to interact with mentioned substance not only locally. Anyway the total contrast they are submitted to is lower due to their weak energy content. This behavior points, at the macroscopic level of extended atomic aggregations, to the confirmation of the 2^{nd} Newton law operating on a variable Mass through a variable Force to keep a constant acceleration (that ensures galaxies linear speed decrease with cosmological time). The expression of this variable Force is provided in chapter 8.

In the same chapter is presented a precise phenomenon that must be at the base of time dilatation of moving matter as described by IG model inertial equation. The same quantum interactions between Privileged System inner skeleton substance and moving particles regulate their inner electronic spins and frequencies. Both the kinematic process (ruled by above mentioned constant contrast acceleration) and the non kinematic one (regulating running frequencies) are intimately connected and depend by the quantum interactions between running matter and Privileged System. The non kinematic interaction is activated by a change of the matter speed that is started by the kinematic interaction. An enormous energetic disparity holds between the distinct energy fluxes provided by the two distinct processes (from travelling matter to Privileged System inner skeleton and vice versa for the non kinematic process that is the most relevant in term of energetic flux if compared to the kinematic process that transfers travelling matter kinetic energy to Privileged System inner skeleton). These fluxes are opposite during particles linear speed decrease but the one linked to non kinematic process is much more relevant. Moreover in case of active work done by an external force on a generic particle, this work leads to the release of a big portion of the initial Compton frequency dependent particle energy (when particle is at rest with Privileged System) to the Privileged System (9/10 of the initial energy if the particle travels at light speed).

Photons behave exactly like generic particles. They reduce their speed with cosmological time. In doing so, (like generic particles), they gradually reintegrate (from Privileged System) their initial rest Compton frequency dependent energy. Both above mentioned interaction processes happen because Privileged System owns the previously mentioned homogeneously distributed very low energy density that can be exchanged with traveling mass through the said kinematic and not kinematic processes.

In chapter 9 a benchmark between all the inertial systems transformation laws is presented. This includes the classic Galilean one, the Lorentz (involving pure space contraction) one, the Lorentz transformation at the basis of Special Relativity, the recently proposed Inertial Transformations by Selleri, to finish with actual IG model. Some topic phenomena are used to prove the solidity and weak points of each of these paradigms. It is showed that, at least in the non exhaustive current tractate examples casuistry, the IG model is the solely transformation to coherently predict those phenomena outcomes without incur in any paradox or sneaky ambiguity.

Finally a philosophical concept is raised in chapter 10. Mathematic is a wonderful discipline but its use cannot be abused. It means that it should remain at service of Physics. Nice attractive models due to their self parity and symmetrical mathematical aspect can be a mistaken interpretation of Physics. Together with this, a wrap up of the most intriguing ideas developed along all the previous chapters is done. New exciting Sagnac like experiments are proposed, especially aimed to exploit the different influence of surrounding masses extension as function of the same emitted particle mass value.

A nice unification of qualitative treatment of all the emitted particles holds. (That applies exactly in the same way from photons to macro molecules). The above mentioned suitable H coefficient pushes in the same universal model the needed quantification. This is another impressive behavior of the New Galilean paradigm here proposed.

All the remarkable scenario of bridges to Quantum Mechanics future interpretation of these ideas is emphasized point by point. In fact the author is convinced that the whole unusual macroscopic Physics paradigm here presented could give hopefully new impulse to the sub atomic particle discipline itself. These new bridges, pushed by the new Galilean paradigm to Quantum Mechanics, will hopefully enable to explain these new properties (coming from the level of macroscopic world and just wrapped in chapter 10). The historical incompatibility between theories pointing to very different dimension scale (macroscopic and sub atomic) is no more there. They are canceled by this new Galilean age able to explain reality no matter if mechanical or electromagnetic phenomena are concerned. This is achieved just adding to G model the exponential coefficient between different inertial systems time and by believing that Galilean principles have no barriers no matter what physical branch is pursued. The invariance of electromagnetism is Galilean wise locally embedded in all inertial systems provided that light is emitted by masses at rest with them and their detectors and there is no disturbance provided by other masses floating in the nearby. In the latter case an anisotropic light component disrupts mentioned electromagnetic invariance.

Classic Galilean relativism between different inertial systems still holds. But to make correctly work the new Galilean Theory is necessary to postulate the presence of the Absolute Privileged System whose role is to dictate the real absolute peace of time (when depurated by any gravitational disturbance) and to distribute it to all other inertial systems that are affected by a ruled (according to IG model inertial equation) freezing of their times as seen by Privileged System, whose point of view becomes the solely authorized to interpreter the non relativistic essence of Energy.

Chapter 1

The Inertial – Galilean Model is presented.

These are the equations of the Inertial – Galilean (IG) model
(system S' move with respect S along x direction. System S and S' respective Cartesian axis are parallel):

z'=z
y'=y
$x' = x - vt$ Galilean equations

$t' = e^{-kv/c}$ t Inertial equation (1.1)

Where :

v is velocity module of system S'(x',t') as seen by system S(x,t) that is Privileged (**Note 1**)
c is the S(x,t) isotropic light velocity module. Isotropic light velocity can be detected by system S(x,t) provided the photons are emitted by a mass at rest with S itself and sufficiently far away by other masses in motion with respect S. (see also **Note 2** here below).
For the inertial not privileged systems S' isotropic light velocity module will be c'. Isotropic light velocity can be detected by system S'(x,t) provided the photons are emitted by a mass at rest with S' itself and sufficiently far away by other masses in motion with respect S'. (see again **Note 2** here below).

It will be shown in chapter 2 that c and c' are in the ratio established by exponential coefficient into IG model inertial equation.

k is a parameter needed to allow inertial part of the model to predict life elongation of circulating muons generated by particles collision into accelerator ring (if ring is at rest with S(x,t)). See chapter 5 for its estimation.
(Note that if k=0 actual Inertial – Galilean model falls into pure Galilean model)

NOTE 1: The Privileged System constitutes the intimate universe structure that is assembled without (known) boundaries. The density of such structure is negligible if compared with the one hold by known matter. Anyway its homogeneous (low) energy distribution defines the absolute rest status of the universe and marks the true cosmologic time. Also its point of view becomes the solely authorized to interpreter the non relativistic essence of a particle Energy (nevertheless it is the Compton or the kinetic one).

NOTE 2: For the time being every mass at rest with a generic inertial system (nevertheless it is the Privileged one or any others) will be considered sufficiently far from any other mass aggregation in the universe in order the speed of light emitted by such generic inertial system is not conditioned by the motion of masses at rest with other inertial systems. That is any generic inertial system (whose rest masses are isolated by other moving masses) owns his private "ether" that is by definition at rest with it. This allows the generic inertial frame to detect isotropy of light speed module if the light is emitted by a mass at rest with itself. **(*)**

If two distinct inertial frames (both in such isolated condition, so their respective rest masses being also far away from each others) exchange light beams, then each one sees the speed of light originated from the other's mass as given by the isotropic value that holds in its domain corrected by the relative motion of the emitting frame through a vector addition of the mentioned isotropic contribution with the emitting frame speed (as seen by the detecting frame). **This is the Galilean principle of the relative velocities vector addition among different inertial frames).** It will be used as postulate for the arguments treated in chapter 2.

(*)

This restriction will be removed to treat Sagnac experiments and other common situation present in the universe. At that scope a Theory to account for influence of any infinitesimal cosmic mass to build the local "ether" drift as seen by a generic inertial frame in every point of the universe will be presented. The farther the infinitesimal masses from the considered local point, the lower their contribution. Anyway the results shown in Chapter 2 will keep their validity if a suitable "Third System" will be introduced to emit the light in place of Emitting System in the same location of the space. Again the module of the isotropic vector contribution that holds into Detecting System domain is unchanged, what is peculiar now is the total Galilean vector summation (seen by Detecting System) consisting by mentioned Detecting System isotropic vector contribution that sums up with Third System velocity (as well seen by Detecting System), this time in place of Emitting System velocity. The Third System being at rest with the center of mass of the local mass aggregation in the neighborhood of the location of light emission. **This is the Adapted Galilean principle of the relative velocities vector addition among different inertial frames.** It will be deeply exploited in Chapter 3.

Chapter 2

The Inertial – Galilean Model and its application to evaluate the light speed module as seen by the not privileged System (S') in motion with respect not privileged system (S'') if the light is emitted by not privileged system (S''). The reversed case is absolutely dual because of the Galilean principle of the relative velocities vector addition among different inertial frames. This principle is used as postulate of theory developed in current chapter.

The results presented in this chapter hold for any "k" choice selected into inertial equation of IG model. So they are really general and can be deduced also with selection of pure Galilean Model (k=0).

Moreover following results are really valid also if the systems couple is made by one of the two systems representing the Privileged System. Because Galilean principle of the relative velocities vector addition among different inertial frames can be applied to all the inertial systems.

Finally following results hold under Note 2 restrictions depicted in Chapter 1. When Sagnac experiment will be treated (chapter 4) these restrictions will be removed and an Adapted Galilean principle of the relative velocities vector addition among different inertial frames (it will be deeply afforded in chapter 3) will be invoked to explain the behavior of these more general situations of the couple S' S'' reference frames (also the term reference systems is used here after).

Given a system S' (moving with respect Privileged System S at **v'** as seen by S) and another system S'' (moving with respect Privileged System S at **v''** as seen by S), it is possible to use IG model to find out the relations between light beams exchanged by S' and S''. (Here is presented the special easy case of **v'** and **v''** lying on the same direction as seen by S and with the convenient Cartesian choice to have plane x'y' coincident with plane x''y'' and containing the light beam. These results hold anyway for any different orientations of S' and S'' velocities **v'** and **v''** as seen by Privileged System S).

These are the equations that hold between S and S'

z'=z
y'=y
$x' = x - v1 * t$ Galilean equations between S and S'

$t' = e^{-kv\prime/c} * t$ Inertial equation between S and S' (2.1)

These are the equations that hold between S and S''

z''=z
y''=y
$x'' = x - v'' * t$ Galilean equations between S and S''

$t'' = e^{-kv''/c} * t$ Inertial equation between S and S'' (2.2)

The S' and S'' composition results to be:

z''=z'
y''=y'
$x'' = x' + (v' - v'') * e^{kv'/c} * t'$ Galilean equation between S' and S''

$t'' = e^{-k(v''-v')/c} * t'$ Inertial equation between S' and S'' (2.3)

Let suppose for example that v'' is not equal v'. In order S' and S'' are distinct inertial systems.

In case a mass at rest with system S'' emits a light beam that S'' sees at ϑ'' angle with x'' axis, being c'' the light module isotropic value as seen by S'' because the emitting mass is at rest with S'', then its components along x'' and y'' axis are :

$$\frac{dx''}{dt''} = c'' * \cos\vartheta''$$

$$\frac{dy''}{dt''} = c'' * \sin\vartheta''$$

Let substitute these equations into above relation between S' and S" (2.3) but taken in differential form:

$$c'' * \cos\vartheta'' = \frac{dx'}{dt'} * e^{k(v''-v')/c} + (v' - v'') * e^{kv''/c}$$

$$c'' * \sin\vartheta'' = \frac{dy'}{dt'} * e^{k(v''-v')/c} \qquad (2.4)$$

Where
$\frac{dx'}{dt'} = c1x'$

that is the x' component of the light module seen by S' (being the beam launched by S'')

$\frac{dy'}{dt'} = c1y'$

that is the y' component of the light module seen by S' (being the beam launched by S'')

Let for the moment focus on the particular case ϑ''=0. Then by using (2.4):

$$\mathrm{c}'' = \mathrm{c1x}' * e^{k(v''-v')/c} + (v' - v'') * e^{kv''/c}$$

or

$$\mathrm{c1x}' = [\mathrm{c}'' - (v' - v'') * e^{\frac{kv''}{c}}] * e^{-k(v''-v')/c} \qquad (2.5)$$

But for this particular case (ϑ''=0) this expression must equate the isotropic component seen by S' (that is c') plus the additional Galilean term (velocity of S'' as seen by S')

It is to be remarked that this is the Galilean principle of the relative velocities vector addition among different inertial frames. The application of this principle also to speed of photons, again under the chapter 1 Note 2 restriction for both S' and S'' (their respective rest masses are also far away from each others), is the postulate at the basis of this new theory.

v1 (velocity of S'' as seen by S') can be got by relations between S' and S'' (2.3) but taken in differential form where:

$$\frac{dx''}{dt''} = 0 \quad \text{so}$$

$$\frac{dx'}{dt'} = \mathrm{v1} = (v'' - v') * e^{\frac{kv'}{c}} \qquad (2.6)$$

To respect the Galilean principle of relative velocities vector addition this equation holds:

$$\mathrm{c1x}' = \left[\mathrm{c}'' - (v' - v'') * e^{\frac{kv''}{c}}\right] * e^{-\frac{k(v''-v')}{c}} = \mathrm{c}' + (v'' - v') * e^{\frac{kv'}{c}}$$

This leads to conclude that the following general relation holds between S' and S'' not privileged systems respective isotropic light speeds modules:

$$\mathrm{c}' = \mathrm{c}'' * e^{-\frac{k(v''-v')}{c}} \qquad (2.7)$$

Coming back to the general case ϑ'' not equal to zero, it is possible to write the expression of the light module seen by S' if the photons are emitted by S'' (named c1). In fact rearranging (2.4):

$$\frac{dx'}{dt'} = \mathrm{c1x}' = [\mathrm{c}'' * \cos\vartheta'' - (v'' - v') * e^{\frac{kv''}{c}}] * e^{-\frac{k(v''-v')}{c}}$$

$$\frac{dy'}{dt'} = \mathrm{c1y}' = \mathrm{c}'' * \sin\vartheta'' * e^{-\frac{k(v''-v')}{c}}$$

After few simple passages and using (2.7) to express c'' in function of c', c1 becomes:

$$\mathrm{c1} = \sqrt{\mathrm{c1x}'^2 + \mathrm{c1y}'^2} = \sqrt{\mathrm{c}'^2 + (v' - v'')^2 * e^{2kv'/c} - 2(v' - v'') * \mathrm{c}' * \cos\vartheta'' * e^{kv'/c}} \quad (2.8)$$

This is the general relation (in function of ϑ'') that holds for c1.

The following particular cases for ϑ'' are commented. For easier note, relation (2.6) that is $\mathrm{v1}$ (velocity of S'' as seen by S') is here after re written.

$$\mathrm{v1} = (v'' - v') * e^{\frac{kv\prime}{c}} \qquad (2.9)$$

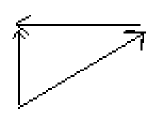
For ϑ''=0 $\mathrm{c1} = \mathrm{c}' + \mathrm{v1}$ according to the above mentioned Galilean addition of v1 to isotropic c'. (If v''>v' detecting system S' sees photons to move in same versus of emitting S'' system, if v''<v' detecting system S' sees photons to move in opposite versus of emitting S'' system).

For ϑ''=180 degrees $\mathrm{c1} = \mathrm{c}' - \mathrm{v1}$ according to Galilean subtraction of v1 to isotropic c'. (If v''>v' detecting system S' sees photons to move in opposite versus of emitting S'' system, if v''<v' detecting system S' sees photons to move in same versus of emitting S'' system).

For ϑ''=+/-90 degrees $\mathrm{c1} = \sqrt{c'^2 + v1^2}$ according to Galilean vector summation of v1 to c' isotropic. (Detecting system S' sees photons horizontal travelling component in the same direction/versus and with the same speed of emitting system S'' that in turn sees them launched at ϑ''=+/-90 degrees. This speed is v1. Also detecting system S' sees photons vertical travel component to be isotropic +/-c'. So the module of resulting vector composition between isotropic c' component and v1 is given for the case ϑ''=+/-90 degrees by Pitagora theorem application).

V1

c'



module of c1 is oblique and is given for the case ϑ''=+/-90 degrees by Pitagora theorem application

It is straightforward to compute the opposite prediction (photons emitted by S' and their velocity module c2 appreciated by S'' system). The above mathematical machinery can be reused. It is just enough to formally exchange S' with S'', v1 with v2, v' with v'', $\vartheta'$with ϑ'', c1 with c2, c' with c''.

So this is the general expression of c2 as function of ϑ' (the angle with x' seen by emitting system S' for the light beam):

$$\mathrm{c2} = \sqrt{c''^2 - 2\mathrm{c}''(v'' - v') * \cos\vartheta' * e^{kv\prime\prime/c} + (v'' - v')^2 * e^{2kv\prime\prime/c}} \qquad (2.10)$$

Also the particular cases for ϑ'=0, 180 and +/-90 degrees can be commented with dual argumentations.

Another interesting case is represented by collapse of system S' (or S'') to the Privileged one S. To get this it is sufficient to set v'=0 for the case of S' collapse to S. (Or v''=0 for the case of S'' collapse to S). For example if S' collapses to S, then the expressions for c1 and c2 become (note that in this case c'=c):

$$c1 = \sqrt{c^2 + (v'')^2 + 2 * v'' * c * \cos\vartheta''}$$

$$c2 = \sqrt{c''^2 - 2c'' * v'' * \cos\vartheta' * e^{kv''/c} + v''^2 * e^{2kv''/c}} \quad (2.11)$$

Conclusion:

Above cases of photons emitted by the Emitting System and detected by the Detector System (nevertheless one of them or nobody of them is the Privileged System), confirm the general rule that the Detector System sees the light speed module being composed by the vector addition of its isotropic contribution (if the light was emitted by himself) and the Galilean relative speed factor consisting into the speed of the Emitting System as seen by the Detector System. This is the classic Galilean principle of relative velocities vector addition able to correct the isotropic value of the Detector System pure domain with the velocity speed of the Emitting System (as seen by the Detector System).

As already remarked this property holds only if every mass at rest with a generic inertial system will be considered sufficiently far away from any other mass aggregation in the universe in motion with respect the mentioned rest masses.

Chapter 3

The Local Ether Theory

This theory has been developed by the author to properly account for actual interferometer results.

MM experiments are not able to detect lab drift with respect a privileged inertial frame hosting light speed isotropy. Note that actual interferometer technology should allow detection of such drift if “classic” ether idea was valid. In fact a terrestrial lab should move with respect a unique universal privileged frame (a unique privileged frame that is the only one able to see the light travel isotropic ally as by pre relativistic theories) at least at 30km/s (that is just the speed of our planet around Sun). As said in preface, the measurement of this drift would confirm two ways light speed anisotropy as seen by terrestrial lab and its detection is allowed by actual interferometer technology able to catch drifts > 5km/s.

But such drift was never detected.

Sagnac interferometer experimental results (in next chapter 4 this experiment will be deeply afforded) can only be justified with the hypothesis that light speed is “adapted” to an inertial frame that is not at rest with the rotating platform. This inertial frame should see the center of the rotating platform to travel at an almost constant speed during the transit time of the opposite beams carried out during the experiment. So the center of the rotating platform should be another inertial frame practically uniformly floating (during the circulation of the opposite beams) with respect the one which is honored to see the light speed isotropic.

Why terrestrial lab drift (with respect system which sees light propagate isotropic ally) is not detectable by MM interferometer experiments but it is detectable by a particular Sagnac type one?

This particular Sagnac interferometer experiment shows positive result with the platform not rotating as seen by the observer at rest with its center, given the platform radius is in the order of some hundred meters to allow interferometer detection. Let explain also this interesting result and use it in the following to make the hypothesis for expected local “ether” location and consequently use it to quantify the amount of the terrestrial lab drift with respect local “ether” to explain MM not ability to catch it.

The terrestrial lab could drift versus “ether” slowly than classically expected. So the drift could be hidden below actual MM detection ability (for this to happen it needs to be less than 5km/s). This could be the case if the drift is around our planet center of mass. This is a reasonable way in order to get a very small value for it (at equator worst case it would be 0.46km/s, still requiring for MM detection at least a two magnitude order progress in measurement of delay between orthogonal light beams. An improvement from actual 10^-

17s to better than 10^-19s should be required). The hypothesis that the isotropic frame is at rest with our planet center of mass is in agreement with another interferometer experiment. As just anticipated this is the Sagnac experiment. It shows positive result also if the platform is fixed to the laboratory (not rotating as seen by the observer at rest with the laboratory), given its radius is in the order of some hundred meters to allow interferometer detection. This means that it is the Focault component of the terrestrial rotation that rotates the platform with respect a frame at rest with our planet center of mass. The observer set on the ground at the center of the "fixed" platform is really on board of a rotating system! In conclusion the instantaneous rotation around the axis of an inertial system at rest with our planet center of mass (it is going to be showed that it hosts light speed isotropy) explains the positive Sagnac experiment carried out with a sufficiently large radius platform ("fixed" with terrestrial lab). Such inertial system at rest with our planet center of mass is the famous "Third System" mentioned in the prologue and in chapter 1 last note and by using the "**Adapted Galilean principle of the relative velocities vector addition among different inertial frames**" can be shown that a beam launched by an Emitter on board of the platform is seen by the Third System to travel isotropic. (Because the Third System is by definition at rest with the center of mass of all the nearby masses and consequently, if a Detector is installed on board of the Third System, it sees light isotropic contribution that vector sums up with (in this case) the null extra speed of the center of mass itself..). On the contrary a terrestrial lab Detector will need to vector sum up the isotropic contribution with the planet center of mass speed that in this case is not zero because drifts as seen by Lab Detector. This confirms the "ether" is not at rest with an unknown galactic frame but is represented by our local planet center of mass that drifts as seen by terrestrial lab with maximum 0.46km/s at equator worst case.

It is our local ether by the way. Also the other mass agglomerates in the universe define other local ethers each one at rest with the center of mass of its peculiar mass aggregation.

In next chapter 4 the apparently surprising result of higher interferometer effect into classic Sagnac experiment with small but rotating platform (with respect MM type interferometer experiments) will be justified using G or IG model. And also estimation of platform radius needed for large and fixed platform experiment will be provided.

Let now formulate the Local Ether Theory. It is needed to compute the center of mass (of the nearby masses of a given point of the universe) vector speed. Due to the fact that a contribution to the local property of ether must be expected by every mass of the universe, the following simple principle should hold:

Each infinitesimal mass contribution to the ether property of a certain universe location is appropriately weighted by the distance of the infinitesimal mass to the considered location.

This practically causes “ether” to assume local properties in space. Because almost entirely dependent by the nearest cosmic mass aggregation.

The proposed quantification of every infinitesimal mass contribution works in this way.

If “mi” is the “i” mass of the universe as seen by a certain inertial frame S (S being Privileged or not Privileged generic inertial frame), then if the local ether property is to be calculated in the point **r** (where the light beam is emitted by a mass floating there**,** note also the used bold notation being **r** a vector) the following pondered expression is evaluated in place of “mi”:

$$mpi = mi * e^{-H * |(\boldsymbol{r} - \boldsymbol{ri})|} \tag{3.1}$$

where $|(\boldsymbol{r} - \boldsymbol{ri})|$ is the distance from point **r** (where light is emitted) and point **r**i (position of the “i” mass). H is a coefficient to be experimentally evaluated.

Note that if such distance is null (“i” mass coincident with light emission location) or almost null (“i” mass in the immediate neighbors of light emission location) then mpi will practically coincide with original infinitesimal mass mi. Instead for long distances between light emission location and “i” mass, mpi will represent a negligible contribution from the original infinitesimal mass mi.

The vector speed of the center of mass of the pondered infinitesimal masses of the universe (pondered as above with the distance from light emission location) is seen by S to be:

$$\boldsymbol{vp} = \frac{\sum mpi * \boldsymbol{vi}}{\sum mpi} \tag{3.2}$$

where **vi** is the speed of the “i” infinitesimal mass as seen by the inertial frame S

By the use of the **“Adapted Galilean principle of the relative velocities vector addition among different inertial frames”, (this is taken as postulate at the basis of local ether theory),** this pondered center of mass velocity sums up in vector way with the isotropic speed of light in the location of light emission to build the actual light vector speed as perceived by S. So it defines the total vector Galilean contribution to the light speed detected by S if the beam is launched **by the considered emission location**. (The vector isotropic value is the light speed that would be seen by S for a beam started by a mass at rest with S in the same emission location but in case it would be sufficiently separated by other masses not at rest with S). In conclusion, through use of Adapted Galilean Principle, actual light speed perceived by S is anisotropic and is given in the generic direction by:

$$\boldsymbol{vanistropic} = \boldsymbol{c} + \boldsymbol{vp} \tag{3.3}$$

Where **c** is the mentioned isotropic light component and **vp** is the pondered center of mass speed (pondered with respect location of emission in order to premium the nearby masses to light emission location).

It is worthwhile to repeat that in case the Emitting system rest masses are not isolated (sufficiently far) from the rest of the universe masses, then **the Adapted Galilean principle** says that, in order to compute the Total Galilean vector light speed seen by Detecting System, (**1**) the Emitting System must be substituted by a suitable Third System introduced to vector sum Third System speed (as seen by Detector System in the location of the space where light is emitted) with the same vector module for the isotropic component of the beam seen by Detector system if the beam was launched there by a mass at rest with the Detector system and sufficiently separated by other floating masses.

This Third System must be at rest with the center of mass of the local mass aggregation in the neighborhood of the location of light emission.

At this point it is possible to propose a natural interpretation of the passage from **Galilean Principle** to **Adapted Galilean Principle**.

The first one is the merely application of the Galilean principle of the relative velocities vector addition also to photons. Nothing strange (if the relativistic dogmatism is avoided), photons are emitted by electron energetic transitions at a certain module velocity (with respect Emitting atom) that is a natural invariant along all spatial directions. This natural invariant is the famous isotropic constant. As for all the other cases of sub atomic emissions, this isotropic component must be vector composed with the emitting atom velocity as seen by a Detecting System (DS) to get the total Galilean contribution. That consists of the **sub atomic particle/photon velocity** seen by the Detecting System given by: (**atom velocity** seen by DS + **sub atomic particle/photon velocity** seen by the atom, the mentioned isotropic component).

Now this works correctly (for light) until Emitting Atom is sufficiently isolated by nearest atoms. These nearest ones, following Local Ether Theory, are able to add their contribution to the consolidation of the emitting system adapted speed in reason of their proximity to this emitting system. The emitting system adapted speed is not its cinematic velocity seen by the DS. The adapted speed is the particular one involved to "build" the Galilean contribution if other atoms are in the nearby. It is the medium velocity of the nearby masses (more exactly all the universe masses are concerned but their contribution weighted by their distance to emitting system through 3.1) the responsible to "build" such Galilean contribution. Of course medium velocity of the nearby masses collapses into emitting system cinematic velocity in the case the emitting atom is sufficiently far away from all other atoms of the universe. In this case the (3.1) shows the survived contribution is by the solely emitting atom. In other words Adapted Galilean Principle accounts for Galilean contribution from the all nearby masses (3.2) when their contribution is not negligible. This happens whenever emitting system is in the plenty of a mass aggregation (planets, stars).

An important question arises now. Why other atoms Galilean contribution does work for photons and it is almost negligible for more and more heavy sub atomic particles? It is possible to think that coefficient H into (3.1) is in turn dependent by the emitted particle mass. The greater is the emitted mass, the larger is H. So photons masses are almost negligible **(2)** and cause a relatively small value for H. Consequently (3.1) expression becomes negligible for masses placed at least at some considerable distance from the light emitting point. Reasonably some tenths of Earth diameter for our terrestrial case or even more, but it is not easy to quantify this amount given the fact until now experiments have been done not so far from our planet surface. At least Sagnac experiment done with large fixed platform (it is described into next chapter 4) confirms that Sun masses have no relevant influence at all on light emitted and received by terrestrial equipments.

Instead heavier sub atomic particles emission works in this way. H coefficient for most massive sub atomic emitted particles is able to bring (3.1) to zero for atomic masses lying even in the nearby of the specific emitting atom. Really it is only the punctual emitting atom that conserves its total original mass (for (3.2) computation purpose) after (3.1) weighting because it is the only one placed by definition at zero distance from himself. All the surrounding atoms contribution is neglected by big H. But if (3.2) collapse to **vp**=**v0,** where **v0** is the considered emitting atom velocity, then the Adapted Galilean Principle collapse to usual Galilean Principle for heaviest particles emission.

So usual Galilean Velocity Composition principle of Classic Physics is explained in term of a particular simplification (holding for sufficient large massive particles emission) of the more general Adapted Galilean Principle that seems to constitute the intimate principle ruling the natural laws in function of the emitted particle mass. This unifies photons behavior with more and more massive sub atomic particles one. Some of them, still with a negligible mass if compared to heaviest emission cases, could behave in intermediate way with respect photons and heaviest particles. As said, for lighter sub atomic particles emission, the only way to migrate from Adapted Galilean Principle to usual Galilean Principle is to be emitted by atoms sufficiently isolated (far away) from nearest atomic aggregations in order these aggregations are neglected by (3.1).

In chapter 10 a digression on how this property could be interpreted by Quantum Mechanics future developments will be afforded.

(1) Note that in case the Emitter rest masses are instead isolated by other masses floating with respect them the Total vector Galilean speed of light evaluated by the Detecting System is given by vector summation of isotropic contribution with Emitter speed as by classic **Galilean principle**

(2) It is possible to assume that photon rest mass is slightly different from zero if the relativistic paradigm is avoided (in chapter 10 its estimation is proposed). Because, out of this dogma, mass increase with velocity does not happen. It happen exactly the contrary, see chapter 8. Anyway photon rest mass is still a negligible value (again refer to chapter 10), so H assumes a finite (small) value in correspondence of an emitted photon and increases for increasing mass values of different emitted sub atomic particles.

Chapter 4.

Computation of Sagnac effect result through Local Ether Theory.

The Sagnac interferometer experiments are carried out through propagation of two light beams, separated by a common source on board the rotating platform through semi transparent mirror technique, and sent along the rotating platform border in opposite directions. The beams are reflected by mirrors mounted along the rotating platform border in order the beams perform a complete platform border circulation (one according to platform rotation, the other against it). They are reunited at the receiver again through semitransparent mirror technique and sent to a detecting telescope (also it mounted on board of the platform) that is able to resolve (with actual more advanced technology) dark fringes separated by 1/100 Na wavelength. This ensures detection till 2*10^-17s minimum delay between opposite beams arrival, caused by platform rotating speed, through evaluation till 1/100 Na wavelength fringe shift.

The relativistic theory is not able to justify the delay of arrival between the two beams if this delay is evaluated by the overall cooperation of the infinite number of inertial reference systems plugged instantaneously at rest with every point of the platform border. There is no chance. The two beams are seen to travel instantaneously in opposite directions and with the same module speed by any inertial system as by relativistic dogma. The path is the same for both beams (the platform circumference) so the total time to cover the path can be computed by a simple integration of each infinitesimal time provided by any of the generic inertial systems instantaneously at rest with the infinite platform border points at the time every beam reaches them. Each mentioned infinitesimal time is the one occurring to the beam to go through the corresponding generic inertial system infinitesimal linear path contribution. No delay can be predicted to exist between every opposite beam total circulation time because of the same instantaneous module speed seen for each beam by any inertial system. Including the ones before mentioned (displaced instantaneously at rest with each point of the platform border when they are reached by the beams) and used to build the total circulation time by mean of integration of their individual infinitesimal contribution.

Instead the Galilean theory is able to predict this delay independently by the selected reference. Nevertheless being it the quiet platform center or the overall cooperation of the infinite number of reference systems plugged instantaneously at rest with every point of the platform border.

In this chapter the prediction is done using IG model mathematics. As just said the result can be achieved also in the restricted condition "k=0" where IG model collapse into pure Galilean model.

Sagnac effect prediction got through IG model. (Achieved by use of S' and S'' not Privileged Systems).

As remarked in the prologue IG model is not relativistic because is based on the supposed existence of a natural Absolute Privileged Inertial Reference Frame that hosts the absolute time that is connected to the time of any generic not privileged inertial frame (uniformly floating with respect it) through the inertial equation of IG model:

$t' = e^{-kv/c}\,\mathrm{t}$

where t is the absolute time, t' is the not privileged time, k is a suitable coefficient, v is the velocity module of the not privileged frame as seen by the Privileged Frame, c is the isotropic value of light detected by Privileged Frame if it is emitted by a mass at rest with the Privileged Frame and sufficiently far from other masses floating with respect it.

Let figure out the following logic connections:

S (Privileged Frame, it sees the following 3 inertial systems instantaneously moving with respect him)

S'c (not privileged system at rest with our planet center of mass)

S'(not privileged system at rest with platform center located into terrestrial lab)

S''(not privileged system at rest with a generic point of the platform border).

S sees both S'c, S' and S'' almost uniformly floating (each one with a proper dynamic) with respect him during the short time of the beams circulation. (Respectively with module velocities v'c,v',v''). (2.3) equations for S' and S'' IG composition is here below rewritten considering S'' free to move in both x'' and y'' directions and it is noted that inertial equation is completely general because is valid for any distinct directions of S' and S'' vector velocities seen by S (here v' and v'' are their respective modules):

$z'' = z'$

$y'' = y'$

$x'' = x' + (v' - vx'') * e^{kv'/c} * t'$

$y'' = y' - e^{kv'/c} * vy'' * t'$ Galilean equations between S' and S''

$t'' = e^{-k(v''-v')/c} *\ \mathrm{t}'$ Inertial equation between S' and S'' (4.1)

Obviously $v'' = \sqrt{vx''^2 + vy''^2}$

The system S' (at rest with platform center) sees the platform border rotating with velocity **v1** whose direction is tangential to the border in any generic point of the border. The system S' also sees the opposite circulating light beams (sequentially received and re emitted by the several mirrors displaced along the platform border) resulting by the following (Adapted)

Galilean principle composition: **c1**=**c1isotropic**+**v1_S'c** where **C1isotropic** is the isotropic contribution and **v1_S'c** is the velocity of our planet center of mass (S'c) as seen by S'.

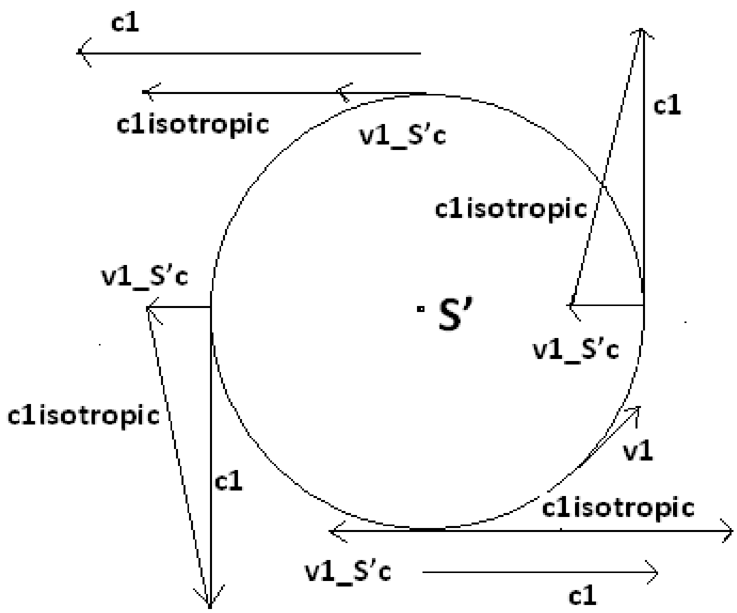


Fig.1

It is depicted the non uniform module of **c1** along the platform border for a beam circulating in agreement with platform rotation (see **v1** sense). It is straightforward to note that the condition allowing such circulation is module **c1isotropic** > module **v1_S'c**. The closest module **v1_S'c** approaches module **c1isotropic**, the larger is the time occurring to complete the entire circulation (the 360 degrees seen by S' fixed reference, not the complete circulation of the platform because the platform is moving in the mean time). By the way the very low (terrestrial) module of **v1_S'c** (with respect **c1isotropic** module) implies the time to complete this (fixed to S' reference) circulation is essentially due to **c1isotropic** almost unique contribution to build **c1**.

The opposite beam, the one that circulate opposite to **v1** sense, sees the same non uniform behavior for module of **c1**. In this case **v1_S'c** increases module **c1** in the south hemisphere against what does the other beam (it increases module **c1** in the north one) but the global trip (fixed to S' reference) time economy remains exactly the same for both beams. It is again remarked that the required time to complete the whole trip is increased as far as module **v1_S'c** approaches module **c1isotropic**.

So the delay of arrival of the opposite beams at the detector telescope can only be due to the concurrent platform rotation. This delay is firstly computed in the general case and secondly under the Physical appropriate hypothesis that module **c1isotropic** >> module **v1_S'c.**

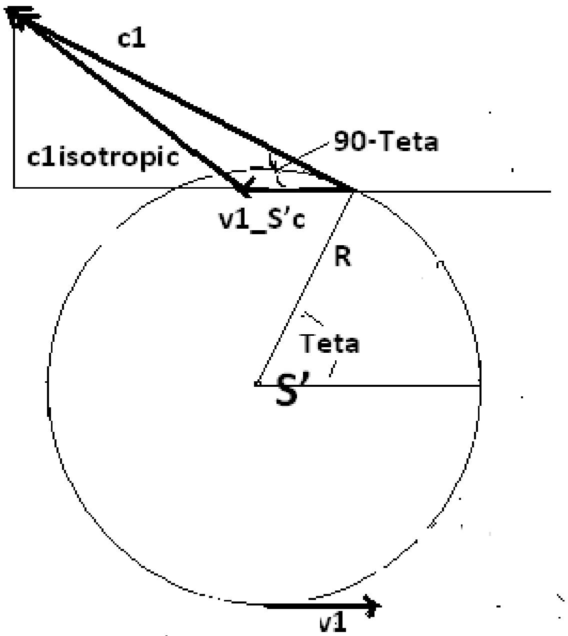


Fig.2

By simple trigonometric construction showed in above picture:

$$(c1 * \cos(90 - \vartheta) - v1\_S'c)^2 + (c1 * \sin(90 - \vartheta))^2 = c1isotropic^2$$

So the most general expression for **c1** module (beam according to ϑ increasing) is:

$$c1 = v1\_S'c * \sin(\vartheta) + \sqrt{v1\_S'c^2 * (\sin(\vartheta)^2 - 1) + c1isotropic^2} \qquad (4.2)$$

Let compute what is the time needed by the beam that run according to the platform rotation to go to the receiver:

$$R * \int_0^{2\pi} \left(\frac{1}{c1}\right) * d\vartheta + R * \int_0^{\vartheta 0} \left(\frac{1}{c1}\right) * d\vartheta$$

Where the first term accounts for the time taken to complete the circulation of the non rotating platform, the second term sums up the extra time taken to rejoin with the receiver (at ϑ0) because the receiver is on board of the platform rotating in agreement with the versus of the beam.

This overall contribution times the platform velocity module v1 equals the circular path piece done by the receiver in order the meeting angle being ϑ0. So:

$$\left(R * \int_0^{2\pi} \left(\frac{1}{c1}\right) * d\vartheta + R * \int_0^{\vartheta 0} \left(\frac{1}{c1}\right) * d\,\vartheta \right) * v1 = R * \vartheta 0 \qquad (4.3)$$

This expression can be numerically evaluated to get the ϑ0 value.(As the angle crossing point where the left hand side becomes < of the right end side). With this value the second integral contribution can be determined. Pointless to say these integrals have not a close mathematical solution due to c1 particular trigonometric dependence with ϑ.

A similar approach can be used to compute the time needed by the other beam (the one that runs opposite the platform rotation) to go to the receiver. The following is the expression that can be numerically solved to get it (**ϑ**1 is the angle crossing point where the left hand side becomes < of the right end side):

$$R * \left(\int_0^{2\pi-\vartheta1} \left(\frac{1}{c1}\right) * d\,\vartheta \right) * v1 = R * \vartheta1 \qquad (4.4)$$

Finally the delay of arrival of the opposite beams at the detector semitransparent mirrors is:

$$\Delta T' = R * \left(\int_0^{2\pi} \left(\frac{1}{c1}\right) * d\,\vartheta + \int_0^{\vartheta0} \left(\frac{1}{c1}\right) * d\vartheta - \int_0^{2\pi-\vartheta1} \left(\frac{1}{c1}\right) * d\,\vartheta \right) \qquad (4.5)$$

In Appendix A (placed at the end of the tractate) is presented a numerical program to calculate above value ΔT'. With following numerical inputs: R, v1_S'c, c1isotropic, v1.

The numeric approach demonstrates that ΔT' value is influenced by v1_S'c (velocity module of our planet center of mass S'c as seen by S'). But, being c1isotropic module 299792458m/s (within a claimed 10^-9 error), for any realistic rotation velocity module v1 of the platform border, the difference for ΔT' value (between the cases considered for study only of v1_S'c assumed to be zero and of v1_S'c assumed to be 100Km/s) is more than two decades below the detectable limit given by interferometer technology of 2*10^-17 s for ΔT' itself. ΔT' tends to very slightly increase with v1_S'c increase, but in a way always well below 2*10^-17 s detect ability (this is never reached until v1_S'c values of more than 100km/s).

This means ΔT' can be written with a closed mathematical formula for Physical purposes. (Because Physics is interested in v1_S'c values within 465m/s, and as above mentioned they can be ignored for ΔT' prediction. This means v1_S'c value can be directly assumed to be zero).

Under this assumption expression (4.2) collapses to c1=c1isotropic (without any dependence with **ϑ**). So the above ϑ0 and ϑ1 can be analytically solved after easy solution of the integrals into (4.3) and (4.4):

$$\vartheta0 = 2\pi * \frac{\mathrm{v1}}{c1isotropic - v1}$$

$$\vartheta1 = 2\pi * \frac{\mathrm{v1}}{c1isotropic + v1}$$

The (4.5) becomes:

$$\Delta T' = 4\pi * \mathrm{R} * \frac{\mathrm{v1}}{c1isotropic^2 - v1^2} \qquad (4.6)$$

Choosing for instance R=1 mt, the value that occurs to v1 to bring ΔT' to fringe shift detect limit of 2*10^-17 s is 0.15 mt/s that is really a very negligible quantity with respect isotropic speed of light!

“Ether” is not detectable with MM experiment because the two way beam pattern on board of each orthogonal arm almost self cancels the time unbalance that each beam accumulates (at the end of its two way path) with respect condition of not drift with “ether”. So “ether” drifts of the order of 465mt/s fall far then two decades below interferometer ability to detect them. Instead Sagnac experiment allows its opposite beams to sum up their time unbalance with respect stationary platform null rotation case along the path from the source to the receiver (without any self cancelation). This great efficiency permits detection of local platform border drift of only some decimeters per second!

But here “ether” movement with respect S’ seems to remain undetectable (ΔT’ does not appreciably vary with v1_S’c). So far it seems Sagnac interferometer outcome is completely not involved with our planet center of mass drift as detected by S’ (at least due to interferometer detection limitation, so Sagnac experiment is not better than classic MM one under this profile). By the way the only implicit drift considered till now was the uniform translation….

There is a surprise now that regards **rotation of S’ as seen this time by our planet center of mass..!** Sagnac experiment **gives positive result also if performed with a platform stationary with terrestrial lab** because (as already mentioned in chapter 3) a stationary platform (as seen by the lab) still instantaneously rotates with respect one fixed axis (passing by the platform center) of an inertial system at rest with our planet center of mass. (Also the platform center instantaneously drifts with respect our planet center of mass within 0.46km/s at equatorial worst latitude. But it has been just remarked this drift is not a detectable fact for Sagnac experiment).

Let evaluate what should be the radius of the stationary platform in order to allow detectable interferometer beams delay:

Rearranging (4.6) with ΔT’=2*10^-17, c1=299792458, ω1=5.14*10^-5 (this is the angular frequency of the terrestrial rotation component at Milan latitude as seen by a system at rest with our planet center of mass):

$$\mathrm{R} = \mathrm{c1isotropic} * \sqrt{\Delta T'/(\Delta T' * \omega 1^2 + 4\pi * \omega 1)} \qquad (4.7)$$

by substituting above values:

R = 53mt. This should be the minimum radius to get positive Sagnac detection with non rotating platform (fixed to terrestrial lab) at medium latitudes.

In 1925 Michelson and Gale performed this experiment with a medium value for R even higher (around 300mt). For exact technological implementation of this particular experiment and related interference formula please refer to note **1** of chapter 10. This results (keeping the mathematical solution of a big 300mt radius circular platform for actual discussion) in ΔT'=6.5*10^-16 by the way in the plenty detectable interferometer range. So Sagnac type detection caused by terrestrial rotation component was achieved and in expected agreement with the terrestrial rotational component at the latitude where the experiment was performed!

Definitively above stationary platform Sagnac experiment outcome is the signature that the rotation of our terrestrial lab, at concerned latitude around a fixed axis of a reference frame at rest with our planet center of mass, is the phenomena that can quantitatively explain the interferometer effect according to the hypothesis our planet center of mass is the example of Third System mentioned in the prologue (that means it hosts light speed isotropy as seen by any Detector at rest with it).

Please note, (even being our planet center of mass drift with respect S' platform contained within 0.46km/s at equatorial worst latitude a negligible fact for Sagnac experiment because out of any possible interferometer detection of ΔT' variations with v1_S'c), one can anyway question for pure curiosity why above numerical approach shows this slight increase of ΔT' following our planet center of mass drift progress from zero (at poles) to equator maximum. It is simple to answer considering again expression (4.6). That explains how ΔT' increases with v1 (platform board rotation seen by S'). Increase of v1_S'c equally slows down the circulation time of both the opposite beams (see again Fig.1), this resulting in a "medium c1" decrease. But this can be accounted in (4.6) where the "medium c1" value can be substituted to the c1 constant isotropic value for v1_S'c=0.

This brilliantly shows ΔT' increase with "medium c1" decrease (that in turn depends by v1_S'c) for any fixed value of v1. This is only a way to smell the phenomena through (4.6) still in a qualitative way because the relation between v1_S'c and "medium c1" cannot be expressed in a closed analytical form.

Now let move to examine all the above phenomena as seen by a system at rest with the rotating platform border. In above logic connections (in beginning of this chapter) this system was named S''. The goal is to show plenty agreement to the results got by S' point of view with the ones seen by S''.

Pointless to say Special Relativity is not able to council S' and S'' points of view by mathematical construction. Because S'' is built in Lorentz Transformations with the same symmetrical privileges of S' so every distinct S'' frame (each one sees S' instantaneously move with respect him at the same uniform speed) distributed at any border platform points need to see the opposite light beams to travel with the same speed module as by SR dogma. The interferometer outcome at the receiver (due to the integration in both opposite directions of the respective identical delta travel times seen by each of the infinite S'' displaced along the platform border and at rest with it at the instant the beam transits in that point) cannot be different than zero by construction…

Coming back to IG model evaluation of Sagnac effect by mean of the overall cooperation of the infinite number of inertial reference systems plugged instantaneously at rest with every point of the rotating platform border, let consider again the vector construction (note the use of the suffix “2” here because is the system S’’ now the considered reference) of the beams velocity **c2**= **c2isotropic**+**v2_S’c**. Here v2_S’c is the module of the planet center of mass speed as seen by S’’. The adapted Galilean principle of vector velocities addition is applied as well. In following Fig.3 it is showed the system S’’ at rest with the rotating platform border. This is an instantaneous flash only because after a delta t’’ the system S’’ will fly away from the platform border being inertial and for this reason moving in rectilinear way. The dot line reminds this concept.

What is important from S’’ point of view is that **v2_S’c**=**v2**+**v1_S’c** that is the planet center of mass speed seen by S’’ is given by vector summation of the same velocity (but seen by S’ reference at rest with platform center) plus the velocity of S’ itself this time as seen by S’’. By the way this is the usual Galilean velocity composition. **(1)**

At this point **v2_S’c** (function of angle ϑ between **v1_S’c** and **v2**) vector sum up with **c2isotropic** in two distinct ways to build **c2**. In both cases the same direction of **v2** is kept. The equal or the opposite versus with respect **v2** one makes the difference.

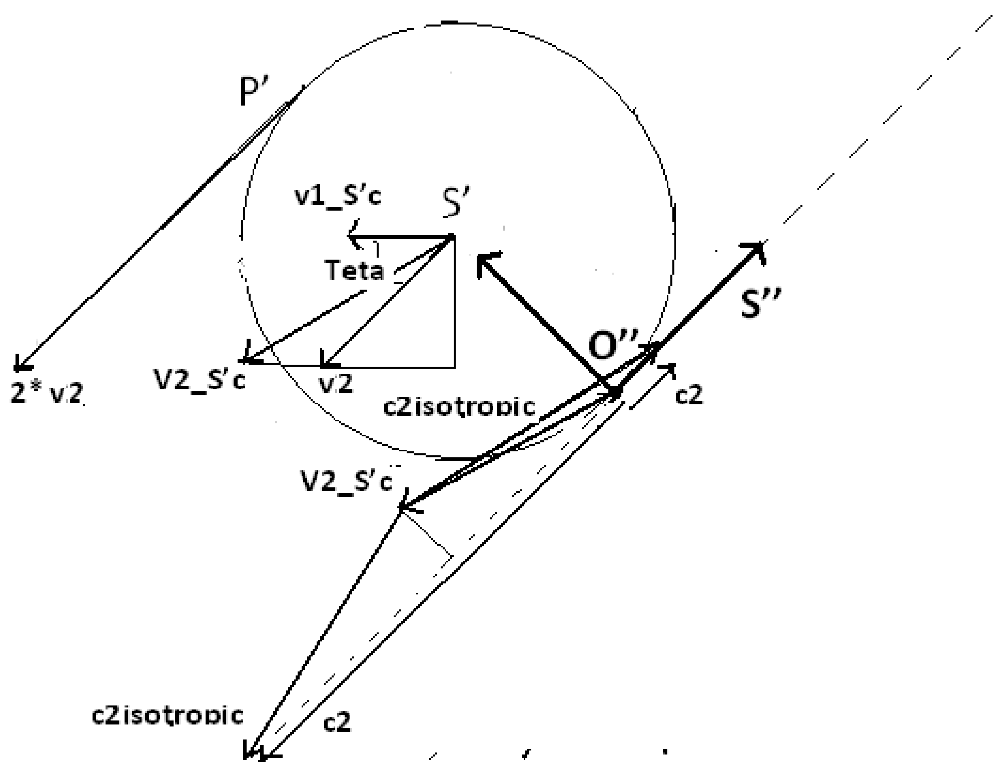


Fig.3

The two expressions of **c2** module (c2+,c2-) are dependent in a very complicated way by the angle ϑ. What is needed is still to integrate over the whole (0-2π) interval both expressions for the two distinct **c2** modules c2+ and c2- in this way to get $\Delta T''$ between the arrivals of the opposite beams at the receiver. As previously remarked each piece of this integration is provided by a different inertial system S'' placed ad hoc at rest with the next adjacent border location at the time the given beam reaches this further location):

$$\Delta T'' = R * \left(\int_0^{2\pi} \left(\frac{1}{(c2+)}\right) * d\vartheta - \int_0^{2\pi} \left(\frac{1}{(c2-)}\right) * d\vartheta \right) \quad (4.8)$$

This integration is correct because every infinitesimal $\left(\frac{1}{(c2+)}\right) * d\vartheta$ and $\left(\frac{1}{(c2-)}\right) * d\vartheta$) are built through the use of an infinite series of S'' systems distributed along the platform perimeter at the time they are reached by the considered beam. It is needed also for the general case of the beams seen by S'' systems cooperation a numerical method to calculate $\Delta T''$ given following numerical inputs: R, v1_S'c, c2isotropic, v2. This is due to c2+ and c2- dependence with ϑ.

The numerical method is escaped in order to directly jump to the usual approximation (v1_S'c assumes physical values from 0 to 465mt/s so it can be considered practically zero in front of c2isotropic). This makes **v2_S'c**=**v2**.

Looking again to Fig.3 this immediately leads to:

$$(c2+) = c2isotropic - v2$$

$$(c2-) = c2isotropic + v2 \quad (4.9)$$

Note that neither $c2isotropic$ nor $v2$ are constant around the platform border in spite of just done approximation. This can be easily seen by following considerations. From chapter 2 it is already known the relation between isotropic speed modules of two different not privileged systems (2.7) and here proposed again:

$$\text{c1isotropic} = \text{c2isotropic} * e^{-\frac{k(v''-v')}{c}} \quad (4.10)$$

Also the relation between the velocity modules of S' (seen moving by S'', that is v2) and of S'' (seen moving by S', that is v1) can be found. In fact by (2.6):

$$v1 = |(v'' - v')| * e^{\frac{kv'}{c}}$$

By symmetric speculation:

$$v2 = |(v' - v'')| * e^{\frac{kv''}{c}}$$

So the relation between v1 and v2 is:

$$v1 = v2 * e^{-\frac{k(v''-v')}{c}} \quad (4.11)$$

Let first use (4.10) making c1isotropic1 collapse to c (Privileged System isotropic light velocity). This leads to:

$$\mathrm{c} = \mathrm{c2isotropic} * e^{-\frac{kv''}{c}}$$

From the above relation it is evident that c2isotropic depends upon v'' so it cannot be constant around the platform border trip due to v'' in turn not constancy. This will immediately be shown. Before to do that let consider also, by use of (4.11), $v2$ is not constant along the platform border due to the same v'' dependency. Note instead that v' can be considered constant during the brief opposite beams circulation. And $v1$ is constant by definition of considered platform uniform rotation as observed by S'.

The v'' components along x'' and y'' can be retrieved by differentiating (4.1) and by respectively imposing $\frac{dx''}{dt''} = 0$, $\frac{dx'}{dt'} = v1x = v * cos\boldsymbol{\vartheta}$ and $\frac{dy''}{dt''} = 0$, $\frac{dx'}{dt'} = v1y = -v * sin\boldsymbol{\vartheta}$. This results in:

$$v\mathrm{x}'' = v1 * \cos\vartheta * e^{-\frac{kv'}{c}} + v' \qquad (4.12)$$

$$v\mathrm{y}'' = v1 * \sin\vartheta * e^{-\frac{kv'}{c}} \qquad (4.13)$$

So it is pretty evident the dependency of v'' by $\boldsymbol{\vartheta}$ (that is by platform border position)

And the consequent $\boldsymbol{\vartheta}$ dependence of $c2isotropic$ and $v2$:

$$\mathrm{c2isotropic} = \mathrm{c} * e^{\frac{kv''}{c}}$$

$$v2 = v1 * e^{\frac{k(v''-v')}{c}}$$

It comes from $v'' = \sqrt{vx''^2 + vy''^2} = \sqrt{v1^2 * e^{-\frac{2kv'}{c}} + v'^2 + 2v1 * v' * \cos\vartheta * e^{-\frac{kv'}{c}}}$

It is possible to numerically compute (4.8) otherwise the $\boldsymbol{\vartheta}$ dependency through v'' can be synthesized by evaluating its mean value along the platform border. Let exactly evaluate it:

$$vmean'' = \frac{1}{2\pi}\int_0^{2\pi} \sqrt{v1^2 * e^{-\frac{2kv'}{c}} + v'^2 + 2v1 * v' * \cos\vartheta * e^{-\frac{kv'}{c}}} * d\vartheta \qquad (4.14)$$

The solution is still numeric but the same mean value is approximated (due to cosine 2π periodicity) by:

$$vmean'' \simeq \sqrt{v1^2 * e^{-\frac{2kv'}{c}} + v'^2}$$

By use of above (4.14) $vmean''$ value it is possible to use the following analytical expression for $\Delta T''$ because in this way c2+ and c2- have definitively missed their dependence with $\boldsymbol{\vartheta}$ into (4.8). So it does hold the following (4.15) expression:

$$\Delta T'' = 2\pi R * \left[\left(\frac{1}{(c2isotropicmean - v2mean)}\right) - \left(\frac{1}{(c2isotropicmean + v2mean)}\right)\right] = 4\pi * R * \frac{v2mean}{c2isotropicmean^2 - v2mean^2}$$

(4.15)

With, by use of (4.14) pulled into (4.10) and (4.11):

$$c2isotropicmean = c1isotropic * e^{\frac{k(vmean'' - v')}{c}}$$

$$v2mean = v1 * e^{\frac{k(vmean'' - v')}{c}}$$

So (4.15) expression can be further simplified to relate it to (4.6).

$$\Delta T'' = 4\pi * R * \frac{v1 * e^{\frac{k(v_{mean''} - v')}{c}}}{c1isotropic^2 * e^{\frac{2k(v_{mean''} - v')}{c}} - v1^2 * e^{\frac{2k(v_{mean''} - v')}{c}}} \tag{4.16}$$

But this is related with $\Delta T'$ from (4.6):

$$\Delta T'' = 4\pi * R * \frac{v1}{c1isotropic^2 - v1^2} * e^{-\frac{k(v_{mean''} - v')}{c}} = \Delta T' * e^{-\frac{k(v_{mean''} - v')}{c}} \tag{4.17}$$

That is the expected result because of following again reported IG model inertial equation (4.1) that links S' and S'' proper times as function of the different instantaneous S' and S'' velocity modules that are seen by Privileged System S (that has the unique privilege to host the universal absolute time):

$$t'' = e^{-k(v'' - v')/c} * t'$$

The only difference between above instantaneous relation and (4.17) is that (4.17) reflects the contribution (summed over the platform border) of all S'' instantaneous systems through $vmean''$ in place of v'' that indeed is not constant around it.

In conclusion by using IG model, the prediction of S'' systems cooperation is in perfect agreement with S' point of view concerning valorization of opposite beams delay at the receiver.

Note also that this coherent prediction is achievable also in case "k=0" that is by use of pure Galilean Transformations.

Last interesting point is that the "fixed to lab" platform (rotating at concerned latitude around a fixed axis of a reference frame at rest with our planet center of mass) can be also studied by S'' inertial systems (at rest instantaneously with the rotating "but fixed to lab" platform border). Their conclusion on $\Delta T''$ is linked to the already showed result $\Delta T'$ (got previously in this chapter by using a reference system at rest with our planet center of mass) through (4.17) itself. It is really another physical way to interpreter the same mathematic machinery contained into (4.6) by adopting a cooperation of different inertial reference frames. Each one is instantaneously at rest with the appropriate platform border location when one light beam reaches such location.

(1)

To be formally correct in the general framework of IG transformation the expression **v2_S'c**=**v2**+**v1_S'c** should be substituted by: $\mathbf{v2\_}\boldsymbol{S}'\mathbf{c} = \mathbf{v2} + \mathbf{v1\_}\boldsymbol{S}'\mathbf{c} * e^{\frac{k(v''-v')}{c}}$

This correction is achieved by differentiating (4.1) and writing $\frac{dx''}{dt''}$ in function of $\frac{dx'}{dt'}$. So in the one dimensional simplest case (**v2_S'c** is oriented as **v2)**:

$\frac{dx''}{dt''} = \frac{dx'}{dt'} * e^{\frac{k(v''-v')}{c}} + (v' - v'') * e^{\frac{kv''}{c}}$ where $|\frac{dx''}{dt''}| = \text{v2\_}S'\text{c}$ and $|\frac{dx'}{dt'}| = \text{v1\_}S'\text{c}$

So using also $\text{v2} = |(v' - v'')| * e^{\frac{kv''}{c}}$ as already done in this chapter to get (4.11), the right expression is got (through generalization from scalar mono dimension to vector context):

$\mathbf{v2\_}\boldsymbol{S}'\mathbf{c} = \mathbf{v2} + \mathbf{v1\_}\boldsymbol{S}'\mathbf{c} * e^{\frac{k(v''-v')}{c}}$. For k=0 (pure Galilean model) then **v2_S'c**=**v2**+**v1_S'c.**

Chapter 5

IG model K coefficient estimation

The k coefficient contained into IG model inertial equation accounts for experimentally proved retardation of moving clocks. This is the reason the exponential coefficient $e^{-\frac{kv}{c}}$ (it contains k) has been introduced in place of the simple unit identity of pure Galilean Transformations where t'=t (in Galilean framework the same peace holds for clocks in relative motion because k=0). **(1)**

Pointless to repeat that exponential factor has been selected to avoid any forbidden barrier to the velocity of the not privileged system S' with respect the Privileged System S (that is honored to mark the absolute time of the universe). The other inertial system times are derived by it through this coefficient application, everyone customized by its specific velocity as seen by the Privileged System.

In this chapter an estimation of the k coefficient contained in turn into mentioned exponential coefficient is attempted. Basing on the results got by an experiment performed in 1977 into CERN muon storage ring. The time elongation of the circulating muon life resulted to be 28.87 times its laboratory rest life time. This was measured in presence of a tangential muon velocity into the ring in turn detected to be 0.9994 times the velocity of light.

The huge centripetal acceleration applied by magnetic field to keep charged muon circulating at this extraordinary speed is not matter of further impact on its life elongation. This can be understood because it acts on the muon causing every "dt" a slight change of the instantaneous inertial system at rest with it. But the velocity module of any of such infinite inertial systems that alternates at rest with it when laboratory time goes on does not change with time itself. So there is no reason to foresee an independent contribution to life elongation given by acceleration on top of the one caused by speed itself. Acceleration can never directly impact time elongation. When (in different experimental contexts) it changes the velocity module of a particle it indirectly influences time elongation but is only the velocity module that is instantaneously determining the particle time elongation. **(2)**

The k coefficient of IG model is evaluated in function of the ϑ' angle between x' axis of S' system and the muon instantaneous linear trajectory as seen by S'. The laboratory system S' is the instantaneous (as in turn seen by Privileged System S) terrestrial inertial system that performs muon based experiments, including CERN storage ring ones. In the following will be shown that k coefficient estimated expression contains also c' parameter. Being c' the isotropic light speed as seen by S'. The value of 299792458 m/s with 1 part over 10^-9 error is adopted for it. The anisotropic disturbance of our planet center of mass drift and rotation about the terrestrial lab on its measure is already included into the mentioned error. The other variable affecting k estimation is v’ (Privileged System speed as seen by S’). Unfortunately there is not actually a way to foresee such value. Some reasonable assumptions are made (v’ ranging from 0 to 1000km/s). Considering Milky Way Galaxy is an “old” one and the idea of a slow (some hundred km/s or less) speed residual with respect the IG model Privileged System is followed (see chapter 6 for the extensive discussion on this paradigm developed through IG theory).

The Privileged System S sees S’ system (the terrestrial lab) travelling instantaneously at v module speed (their x and x’ axis do coincide, y/y’ and z/z’ are parallel as usual). So the IG relations linking S and S’ are:

$z' = z$

$y' = y$

$x' = x - vt$ Galilean equations

$t' = e^{-kv/c}$ t Inertial equation (5.1)

The Privileged System sees the muon moving at v_m module speed. Where muon trajectory is instantaneously linear and lies on xy plane (that coincides with x’y’ plane) because an appropriate choice of y/y’ and z/z’ axis has been made to host in this way such trajectory. At a certain time (and for a dt) muon speed and direction are constant so an inertial system S’’ can be instantaneously selected at rest with the muon, moreover muon is positioned into O’’ axis origin of S’’. (x/x’’ ,y/y’’ ,z/z’’ axis are parallel). IG relations linking S and S’’ are:

$z'' = z$

$y'' = y - v_{my} * t$

$x'' = x - v_{mx} * t$ Galilean equations

$t'' = e^{-kv_m/c}$ t Inertial equation (5.2)

It is straightforward that $v_m^2 = v_{mx}^2 + v_{my}^2$

Combining (5.1) and (5.2) relation sets it is possible to write the relation linking S’ and S’’ systems:

$z'' = z'$

$x'' = x' + e^{kv/c} * (v - v_{mx}) * t'$

$y'' = y' - e^{kv/c} * v_{my} * t'$

$t'' = e^{k(v-v_m)/c}$ t’ (5.3)

By differentiating (5.3) it is possible to write muon x'' and y'' speeds seen by S''. They are respectively $v''_{mx''} = \frac{dx''}{dt''}$, and $''_{my''} = \frac{dy''}{dt''}$. They must be equated to zero. (The muon is at rest with S'', then its x'' and y'' speeds are zero). The muon x' and y' speeds seen by S' ($v'_{mx'} = \frac{dx'}{dt'}$, $v'_{my'} = \frac{dy'}{dt'}$) enter into such expressions equated to zero:

$$0 = e^{-k(v-v_m)/c} * v'_{mx'} + e^{kv_m/c} * (v - v_{mx})$$

$$0 = e^{-k(v-v_m)/c} * v'_{my'} - e^{kv_m/c} * v_{my} \quad (5.4)$$

Now the S' terrestrial lab is the place where the muon is seen travel at v'_m =0.9994*c' (c' is remarked to be the isotropic light speed module seen by S').

Where $v'^2_m = v'^2_{mx'} + v'^2_{my'}$ and

$$t'/t'' = e^{k(v_m-v)/c} = \mathrm{f}(\vartheta') \quad (5.5)$$

The time elongation factor t'/t'' of the muon travelling at v'_m =0.9994*c' (as seen by S') is function of **ϑ'** (angle between x' and the muon instantaneous vector speed as seen by S') because v_m depends by **ϑ'** as it will be clear by coming (5.6) expression **(3)**.

From first and second of (5.4) it derives respectively:

$$v'_{mx'} = (v_{mx} - v) * e^{kv/c}$$

$$v'_{my'} \quad = v_{my} * e^{kv/c}$$

so being

$$v'^2_m \quad = v'^2_{mx'} + v'^2_{my'}$$

$$v'^2_m = v_m^2 * e^{2kv/c} + v^2 * e^{2kv/c} - 2v * v_{mx} * e^{2kv/c} \quad (5.6)$$

Now using $\frac{v1}{v2} = \frac{c1isotropic}{c2isotropic}$, thanks to (4.10) and (4.11) relations concerning two systems S' and S'' instantaneously floating with respect Privileged System S, by making collapse S' with S itself and renaming S'' with S' (here S' is the laboratory reference system), then:

$$\frac{v}{v'} = \frac{c}{c'}$$

Where v is the speed module S sees to move S' laboratory reference system and v' is the speed module S' sees to move S. Then c is S isotropic light speed, c' is S' isotropic light speed.

Now using v'_m =0.9994*c' and $v_{mx} = v'_{mx'} * e^{-kv/c} + v$, then expression (5.6) becomes:

$$0.9994^2 * c'^2 = v_m^2 * e^{2kv'/c'} + v^2 * e^{2kv'/c'} - 2v * (v'_{mx'} * e^{-\frac{kv'}{c'}} + v) * e^{2kv'/c'} \quad (5.7)$$

Coming back to (5.5), again using $\frac{v}{v\prime} = \frac{c}{c\prime}$ and retrieving by (4.10) again with actual redirection of S' / S'' to S / S':

$$\mathrm{c} = \mathrm{c}' * e^{-\frac{kv}{c}}$$

(5.5) can be developed in:

$\ln[f(\vartheta')] = k/c * (v_m - v) = k/c' * e^{\frac{kv'}{c'}} * v_m - kv'/c'$ so:

$$v_m = \frac{c'}{k} * \ln[f(\vartheta')] * e^{-\frac{kv'}{c'}} + v' * e^{-\frac{kv'}{c'}} \qquad (5.8)$$

Porting (5.8) into (5.7) and using $v'_{mx'} = v'_m * \cos(\vartheta')$ and v'_m =0.9994*c' and $v' = v * e^{\frac{kv'}{c'}}$(this last one deduced by 4.11 with actual redirection of S' / S'' to S / S') leads:

$$0.9994^2 * c'^2 = (\frac{c'}{k})^2 ln^2[f(\vartheta')] \quad + v'^2 + \frac{2v'c'}{k} * \ln[f(\vartheta')] + v'^2 - 2v'^2 - 2v'c' * 0.9994\cos(\vartheta')$$

The following 2nd order equation into k is got after rearranging above terms:

$$[0.9994^2 c' + 2v' * 0.9994 * \cos(\vartheta')] * \mathrm{k}^2 - 2v' * \ln[f(\vartheta')] * k - c' * ln^2[f(\vartheta')] \quad = 0 \qquad (5.9)$$

Equation (5.9) gives the following solution for k (note the minus value in front of the radical is physically forbidden being k a positive number):

$$k = \frac{\ln[f(\vartheta\prime)]*[v\prime + \sqrt{v\prime^2 + 0.9994^2 * c\prime^2 + 2v'c' * 0.9994 * \cos(\vartheta\prime)}]}{0.9994^2 c' + 2v' * 0.9994 * \cos(\vartheta\prime)} \qquad (5.10)$$

The muon, circulating at 0.9994c' module speed into CERN muon storage ring as seen by S' terrestrial lab, elongates his life with respect the laboratory rest life time of the factor 28.87.

This is the result of the experiment performed in 1977 in CERN muon storage ring.

But (5.5) tells that instantaneous life elongation of muon circulating into storage ring depends by **ϑ**' angle of muon instantaneous speed direction with respect common x/x' axis direction of S and S'.**ϑ**' can always be seen lying on the xy S plane (it coincides with x'y' S' plane) or in a plane parallel to it because of the freedom in the xy / x'y' plane choice. So following extremes cases for muon storage ring plane orientation with respect x/x' axis direction can be studied:

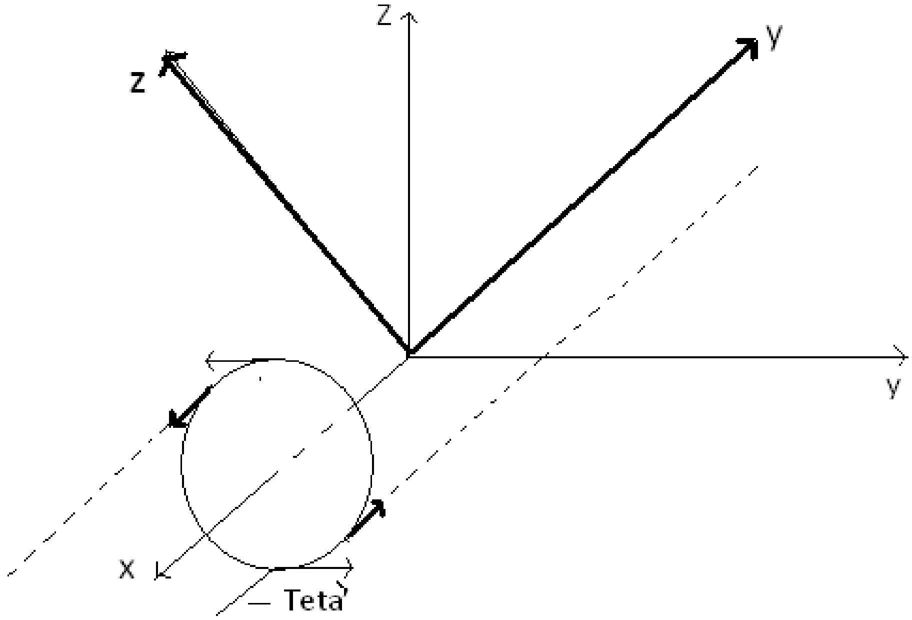


Fig.1

Case A: muon storage ring plane is orthogonal to x/x' direction. This means every instantaneous muon vector speed can be seen lying parallel to an appropriately selected xy (x'y') plane with a ϑ' angle with respect x/x' direction of 90 constant degrees. Non bold / bold yz axis corresponds to non bold / bold muon instantaneous vector velocity. (yz axis choice rotates with muon instantaneous position).

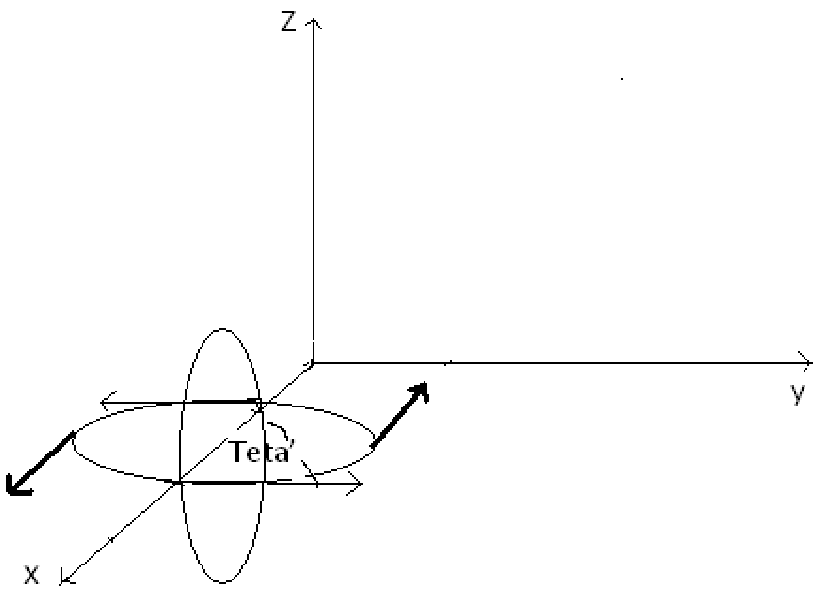


Fig.2

Case B: muon storage ring plane contains x/x' direction. This means every instantaneous muon vector speed is separated by a ϑ' angle with respect x/x' direction that is not constant. ϑ' goes from 0 to 360 degrees when the muon vector speed completes its circulation. Note this condition is symmetrical for any position of storage ring plane (always containing x/x' direction). The whole 360 degrees positions (around same x/x' direction) are identical.

Actually lack of knowledge about position of muon storage ring during CERN experiment, with respect x/x' direction (or with respect **v'** vector speed direction of Privileged System S as seen by S' terrestrial lab), leads to consider k estimation in function of the two extreme cases **A** and **B.** Pointless to say that the mentioned cases determine the extremes of the variable range of k estimation. Moreover such range estimation is realized for various v' speed module hypothesis about S.

In Appendix B is presented a numerical program to calculate (in function of above extreme position cases **A** & **B** possibly assumed by muon storage ring during CERN experiment), the k value in function of v' speed module values. Case **A** procedure is the simplest due to ϑ'=90 degrees for any point of the storage ring. It simply consists in substituting ϑ'=90 degrees into (5.10) and using the constancy of the angular time elongation factor (5.5) in any point of the ring (for any point ϑ' is always constant). Then (5.5), present into (5.10), is set equal to 28.87 that is the experimentally measured value for circulating muon life elongation.

Case **B** procedure is a bit more complicated because (5.5) is no more constant (ϑ' goes from 0 to 360 degrees as the muon travels through all the storage ring points). Now it is convenient to get from (5.10) the following general expression for (5.5) in function of k coefficient:

$$f(Teta') = e^{\mathrm{k} * \frac{0.9994^2 c' + 2v' * 0.9994 * \cos(\vartheta')}{v' + \sqrt{v'^2 + 0.9994^2 * c'^2 + 2v'c' * 0.9994 * \cos\vartheta'}}} \qquad (5.11)$$

By numerical program presented into Appendix B it is found for (5.11) the medium value along all ϑ' range (0-360 degrees) in function of v' and of increasing k values from k=3.3648219 that is common for both cases **A** & **B** if v'=0 (that is its absolute minimum got when terrestrial lab coincides with Privileged System). See (5.12) expression for medium value of (5.11) along all ϑ' range (0-360 degrees) to be numerically computed for each k:

$$\frac{1}{2\pi}\int_0^{2\pi} f(\vartheta') * d\vartheta' = \frac{1}{2\pi}\int_0^{2\pi} e^{\mathrm{k} * \frac{0.9994^2 c' + 2v' * 0.9994 * \cos(\vartheta')}{[v' + \sqrt{v'^2 + 0.9994^2 * c'^2 + 2v'c' * 0.9994 * \cos\vartheta'}]}} * d\vartheta' \qquad (5.12)$$

Once (5.12) is found to reach famous 28.87 experimentally measured value for circulating muon life elongation, the program stops its reiteration of (5.12) calculations for increasing k and the right k value is extracted for the considered v'. This approach makes sense because the CERN muon storage ring is 14mt diameter. Much more than 200 circulations are done by the accelerated muon before its life expires. So (5.11) medium value calculus can be approximated considering integer circulations only through (5.12) formula. The residual not completed circulation weights less than 1/200 with its unbalanced contribution to the complete “building” of the right 28.87 number for life elongation.

Fig.3 shows the results got for k with v’ speed module values ranging from 0 to 1000 km/s. Note the almost linear trends for both **A** & **B** cases in mentioned v’ speed module range.

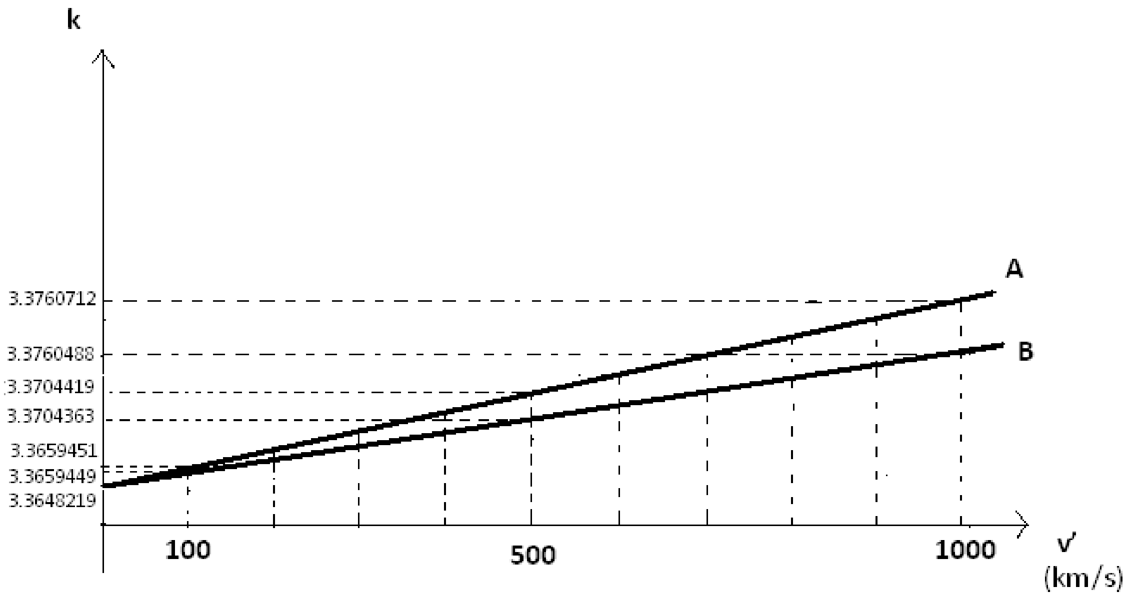


Fig.3

It is straightforward to note that undetermined k range between **A** and **B** curves increases with v’. But for v’ module hypothesis of 500km/s the difference between all the possible orientations of CERN storage ring with respect **v’** vector at the time the experiment was performed leads to an error for k of less than 10^-5 with respect the right one (that still is not known). By the way the not known allocation of v’ module value in the range (0-500km/s) causes an error much more greater but in any case contained into less than 1% of the right unknown one. (The A case for v’=500km/s minus common case for v’=0 km/s that is k=3.3648219 leads to less of 1% error with respect the possible right value located in between this v’ range).

It makes sense to think of a probable range of (0-500km/s) for v’ module by following the idea of a slow (some hundred km/s or less) speed residual of Milky Way Galaxy center with respect a fixed universal framework (now it could be the Privileged System according to IG model theory).

Definitively the best approximation achievable for k coefficient is:

k= [3.3648219 - 3.3648219+1%]. (5.13)

It surely works for module v’ values ranging from 0 (terrestrial lab is at rest with Privileged System) to several hundred km/s that is the mentioned reasonable range where our planet should stay.

It is hard challenge to test the paradigm exposed here above by future experiments using a storage ring whose plane can be displaced in all directions of space for consecutive experiments oriented to detect minimal changes into accelerating muon life time elongation. This can be understood supposing 28.87 was found by chance in the extreme case **A** and for the reasonable module value of v’=500km/s. By use of k=3.3704419 (see fig.3), and by numerically computing (5.12) for this value, the life elongation expected for a measure done for the other extreme case **B** is got. It is 28.8701 and the resolution needed to detect such slight difference with respect 28.87 is 10^-4. Unfortunately it likes to be two magnitude orders beyond actual safe capability. Even in the less probable case of v’=1000km/s the life elongation expected for case **B** is still 28.8706. Consequently no significant detection improvement can be expected for such less probable value for v’ module.

In conclusion, even if actual technological limitations impacting muon speed control and position fine detection during its circulation are most likely preventing to resolve such expected 10^-4 fluctuations of the muon life elongation, from a pure theory cal point of view it is possible to state that case **A** is the storage ring position where such life elongation find its minimum (with same experimental conditions). So the plane of the muon storage ring producing this minimum life elongation is exactly orthogonal to **v’** direction that could be in a next future hopefully evaluated with respect a fixed reference at rest with our galaxy center **(4)**. This should require compensating our planet self and around sun rotation and in the mean time exploring all the possible spatial displacements of the muon storage ring plane (with a sophisticated storage ring rotating apparatus about the three spatial axis) while repeating the same life elongation experiment with a technology able to resolve such fine life fluctuations.

But as far as module v’ value eventually approaches 0 (terrestrial lab instantaneous inertial system tends to collapse with Privileged System), the muon life elongation fluctuations with muon storage ring spatial displacement become more and more negligible until they completely disappear for the limit v’=0. So, if this is the case for v’ (module of Privileged System speed as seen by instantaneous terrestrial lab inertial system), that is its value is really much close to 0 then to 500km/s, then any chance to detect such life fluctuation will never realize in spite of the best expected technological progresses.

(1)

Note that the exponential law that connects Privileged System time with a moving object proper time has been selected due to its suitable monotonic rate necessary to withstand with the Galilean concept that there is no limit to absolute velocity, any increment of absolute velocity must contribute in freezing the moving time no matter its current module value already is, and there is no reason to foresee some “privileged” absolute velocity milestone (like light velocity or others) that imposes an increase in time dilation rate when an object absolute velocity approximates to it. This last not acceptable case would introduce a flex disrupting the monotonic trend of time dilation in function of absolute velocity. For sure when further experiments, able to (directly and closely) monitor the relation between a generic particle velocity and its proper time dilation, will be performed then other interpolation points will be available. This could eventually invalidate actual use of the simple exponential law and a new relation will replace it. Even a not mathematically closed function. The author expects, whatever will be the eventual new relation able to fit all the future experimental data, the mentioned monotonic trend will be confirmed. This is due to the belief that New Galilean paradigm is the right one to rule the laws of macroscopic Physics and in this case the monotonic trend (from zero velocity to infinite velocity) is a necessity as above exposed. Moreover only a monotonic time dilation – absolute velocity relation is able to confirm the perfect interpretation of cosmological objects intrinsic red shift exponentially sequenced quantization in terms of a linear progression of quantized absolute velocities owned by the same objects. See chapter 6.

(2)

A completely different situation holds for gravity. It can directly impact time elongation.

The claimed relativistic plenty equivalence between gravity and acceleration is therefore rejected because acceleration cannot impact time elongation. Only cinematic equivalence can be meaningfully maintained (concerning equivalence of trajectories of masses subjected to external forces equivalently caused by inertial or gravitational effects).

In addition to this, the positivistic idea that different inertial systems point of view can “invent” gravity presence in place of acceleration for one inertial system S’’ and only acceleration presence for its homologue S’ (equipped with equal rights) can no longer be sustained. Inertial acceleration is one physical phenomena kind. Gravity is another one. The paradoxical merge of these two souls (it happens if one inertial system selects one of them to justify a change of the velocity of an observed object and another inertial system does the other choice to justify the same velocity change this time as observed by it) has been already highlighted by clever notes of F.Selleri. Again Equivalence Principle connecting acceleration and gravity is accepted by the author only from Galilean point of view. That is equivalence between acceleration and gravity surely holds to justify cinematic trajectories seen by a generic inertial system if its observer is prevented, for any reason, by evaluating an eventual impact on the peace of clocks submitted to the unknown gravitational or inertial forces (if the observer is instead able to do this evaluation than can easily determine the nature of the unknown force). Anyway once a certain equivalence hypothesis (either acceleration or gravity) is selected by one observer, the same hypothesis must hold for any other inertial system observer to keep consistency in explaining the same cinematic phenomenon. Definitively positivistic permission of different physical realities (acceleration versus gravity) function of the purely change of inertial system point of view is unacceptable. (See also the discussion regarding twins experiment into chapter 9). **Reality is unique for definition, and is independent from the selected point of view.**

(3)

Let see why vm (velocity module of the muon as seen by Privileged System S) depends by $\boldsymbol{\vartheta}'$ (angle between x' and the muon trajectory as seen by S'). Considering (5.6):

$$v'_m{}^2 = v_m{}^2 * e^{2kv/c} + v^2 * e^{2kv/c} - 2v * v_{mx} * e^{2kv/c}$$

v'_m (muon velocity module into CERN ring storage as seen by S' terrestrial lab), k (coefficient contained into IG inertial equation exponential factor), v (velocity module of S' terrestrial lab as seen by S Privileged System), c (isotropic velocity module of light as seen by Privileged System S under Note 2 restrictions of chapter 1) are values not dependent by $\boldsymbol{\vartheta}'$.
Instead:

$v_{mx} = v'_{mx'} * e^{-kv/c} + v$ as it is derived by first equation of (5.4)

is dependent by $\boldsymbol{\vartheta}'$ through

$$v'_{mx'} = v'_m * \cos(\vartheta')$$

Definitively the above relation demonstrates why v_m (velocity module of the muon as seen by Privileged System S) depends by $\boldsymbol{\vartheta}'$ (angle between x' and the muon trajectory as seen by S'). This happens through v_m dependence by v_{mx} that in turn depends by $v'_{mx'}$ that finally depends by $\boldsymbol{\vartheta}'$.

(4)

It is possible that even Milky Way rotates as seen by Privileged System on top of the self rotation that is commonly appreciated because of the visible relative motion of its galactic bodies. This is difficult to be confirmed because the muon storage ring plane orientation, (the one that produces the minimum muon life elongation being orthogonal to **v’** direction), could change due to the above supposed phenomenon, with respect a fixed reference at rest with Milky Way center, in a not appreciable way even if experiments are redone after years. This could be caused by the slowness of Milky Way rotational drift about a Privileged System fixed axis. In conclusion not detection of such drift could not be a proof that it does not exist.

Chapter 6

IG model paradigm ability to interpreter cosmological red shift quantization

H. Arp book “Seeing Red” lists a wide number of documented evidences of high speed matter expulsion processes from “mother galaxies”. Many times the relatively young matter that is expelled by them concentrates into Quasars couples at opposite side of each originating galaxy and still runs far away from it at considerable speed really comparable with the light one. The mysterious Quasars spectrum red shift (with respect the spectrum observed through same terrestrial elements analysis) still constitutes a debated interrogative. In the same book other intriguing evidences are presented. Several cases of quantized red shift in certain firmamental horizon areas are documented. They involve Quasars (affected by wide and not uniform red shift quantization effects) and young galaxies (these ones affected by very narrow and uniform 37.5km/s or 72km/s quantization in the low end of red shift window).

H. Arp suggests a possible theoretical framework, involving Mach interactions ruling universal particles mass evolution (increase), to explain such observations. Inertial mass non local (quantum) “communication” effects could be at the base of a progressive particles mass increase with the same particles age. The periodic creation of young mass through expulsion processes from older mother galaxies could be a serious candidate to explain red shift quantization.

The following is the rational. Being atomic energetic steps (between the various electrons energy levels) in turn proportional to emitted photon frequencies, total atomic mass increase (given by Mach interactions) will also cause those emitted photon frequencies increase through total atomic energy levels scale increase **(1)**. Red shifts are (following this paradigm) the signature of a still relatively young (not heavy) mass light emission.

Here it is presented a new possible explanation to justify red shift emission that goes through the same chain mass / energy / frequency but from its opposite side (the frequency one). At the end the emitted mass should be lighter then terrestrial one but this time its lighter behavior is not due to its younger status (again in H. Arp view it should be the reason of not yet sufficient Machian “communication” with the other far cosmological mass). This time its lighter behavior should be only ascribed to its speed with respect Privileged System whose existence is assumed by IG model theory. Note the Inertial Equation of IG model shows that the higher is the speed (as seen by Privileged System) of a particle, the lower are its observed natural inner electronic frequencies (and photon emitted frequencies), so the higher the transmitted red shift. These frequencies slow down with the particle speed immediately reflects on the particle mass lowering through same quantum resizing effect on its atomic energy levels scale (that is through the above mentioned opposite path).

In the following text the intrinsic (not caused by Doppler phenomena given by cosmic recession with respect our galaxy) quantized red shift of selected Quasars and Galaxies will be interpreted as caused by the absolute velocity module of such bodies with respect Privileged System. It will be reasonably assumed that our old Milky Way practically is almost at rest with this Privileged System. This is the consequence of the idea that the galactic velocity module linearly slows down from a time zero high speed matter expulsion status to an almost rest status with Privileged System (this convergence happens at cosmological Privileged System time scale). In conclusion our Milky Way is an old galaxy because it had time to almost minimize its absolute speed with respect Privileged System. This is its important difference with respect a lot of other younger galaxies or Quasars.

The reason of velocity module decrease (with respect Privileged System) of the galaxies (after their high speed expulsion from older progeny galaxies and during all their life evolution) could be ascribed to non local quantum interactions with other "old" already at rest masses and / or with some unknown elementary substance building the innermost skeleton of the Privileged System. The same interactions should rule the galaxies proper time dilatation as active function of their velocity module (with respect Privileged System). Note that this reminds in some first macroscopic approximation way to the classic ether idea whose presence mechanically slow down the peace of the clocks moving within it or, more appropriately, regulates the running matter frequencies as function of its speed as seen by ether. At the end this is the slight difference with respect H. Arp proposed Machian theory. Mach interactions directly increase the young mass of the matter that gradually receives machions from other more and more far masses. As said this leads to red shift reduction with ageing etc..Instead the approach contained in current chapter is in favor of a gradual mass increase that is consequence (not cause) of a progressive atomic proper time dilatation decrease in turn to be ascribed to mentioned quantum interactions that, beside actively regulating the matter velocity module impact on its time as observed by Privileged System (and consequently electronic spin frequencies, emitted photon frequencies and related atomic energy levels differentials), are as well ruling the natural (cosmological) linear slow down in time of the same velocity module seen by Privileged System.

The red shift (z) is defined as:

$$z = \frac{\Delta\lambda}{\lambda} \tag{6.1}$$

Where λ is one emitting (or absorbing) light wavelength from a known reference element located into terrestrial lab. **Δ**λ is the wavelength variation as measured when the same element is on board of a far galactic body.

The red shift is positive and can be expressed in function of the received lower frequency f1 through the following relation:

$$z = \frac{\Delta\lambda}{\lambda} = \frac{\lambda 1 - \lambda}{\lambda} = \frac{c/f1 - c/f}{c/f} = \frac{f - f1}{f1} \quad (6.2)$$

Where f is the frequency of the considered wavelength if it is emitted by a known reference element located into terrestrial lab, f1 is the frequency of the corresponding wavelength if it is emitted by the same reference element located on board a galactic body, and c is the light speed isotropic component module seen by the observer (it is to be remarked that total light speed is in general anisotropic vector quantity unless detecting system is at rest with the center of mass of the mass agglomerate in the nearby of the emitting system. It follows from Adapted Galilean Principle applied to photons. See chapter 3).

In the "Seeing Red" chapter 8 devoted to red shift quantization evidence, H. Arp shows the following experimentally detected sequence of multiple Quasar red shifts (these Quasars class are linked in turn to low red shift mother galaxies agglomerates): 0.061 - 0.3 - 0.6 - 0.91 -1.41 - 1.96.

So there is evidence of a first slight and afterward exponential increase of quantization steps and the need to find a law explaining this trend with respect some variable.

Given general IG model inertial equation (2.3) between not privileged systems, it is possible to find the terrestrial and galactic body proper times general relation as function of the velocity modules of the emitted galactic body and of the terrestrial lab (both as seen by Privileged System) **(2)**. But under the approximations presented into just referred note (2), the relation between the galactic body and terrestrial lab proper times simplifies into:

$$t' = e^{-kv/c} * \mathrm{t} \quad (6.4)$$

Where t' is the proper time of galactic body, t the proper time of the Privileged System that is assumed to coincide with terrestrial lab. This approximation is included into +1% error accounted for coefficient k=3.3648219 (this error has been estimated in chapter 5 and is due to unknown Privileged System velocity module as seen by terrestrial lab, anyway supposed below 500km/s). Then c=299792.458km/s is the isotropic light speed module and v is the galactic body speed module. Both as are seen by terrestrial lab that coincides with Privileged System for galactic bodies running at high speeds (from few thousand km/s onward). This relation allows computing the galactic body red shift in function of the galactic body speed **module** v seen by terrestrial lab. Let see why.

Relation (6.4) implies that if t (proper time of the Privileged System) contains n wave cycles, then t' (proper time of the galactic body) contains only $e^{-kv/c} * \mathrm{n}$ wave cycles.

But Privileged System (coincident with terrestrial lab as far this is included into coefficient k error) sees these reduced cycles coming by galactic body to occupy its whole window t. So the perceived frequency "f1" coming from the galactic body will be $e^{-kv/c}$ times lower than the perceived frequency "f" from the same chemical element present into terrestrial lab where it produces n wave cycles into t window.

So:

$f1 = e^{-kv/c} * \mathrm{f}$ (6.5)

Substituting (6.5) into (6.2):

$\mathrm{z} = \frac{\mathrm{f} - e^{-kv/c} * \mathrm{f}}{e^{-kv/c} * \mathrm{f}} = \frac{1 - e^{-kv/c}}{e^{-kv/c}} = e^{kv/c} - 1$ (6.6)

This is the basic relation connecting red shift with velocity module v of the galactic body

The inverse (v/c in function of the red shift is the following):

$v/c = \left(\frac{1}{k}\right) * \ln(\mathrm{z} + 1)$ (6.7)

In figure 1 it is presented the plot of (6.7) in the z range of the above mentioned multiple Quasar red shifts exponentially increasing quantization: 0.061 - 0.3 - 0.6 - 0.91 - 1.41 - 1.96.

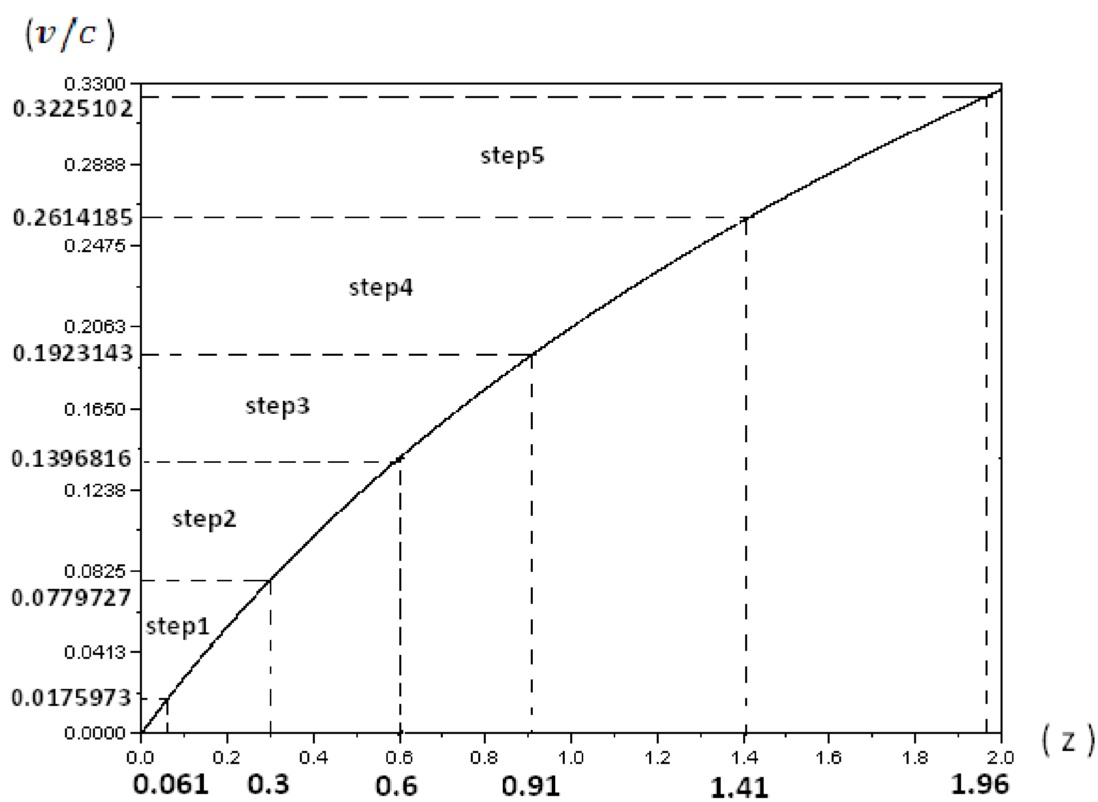


Fig.1

On the x axis are aligned in bold the experimentally detected values for z. On the y axis are aligned in bold the corresponding v/c normalized values.

Upfront horizontal increasing values (after 0.91 this is particularly evident), the vertical values tend to keep the same stepping size. In order to quantify the phenomena the vertical steps (they are represented into Fig.1) are reported here after:

Step1: 0.0603754

Step2: 0.0617089

Step3: 0.0526327

Step4: 0.0691043

Step5: 0.0610916

Fig.2

It is very interesting to note that error between Step1 (taken as reference), Step2 and Step5 are contained within 2%. Instead Step3 and Step4 suffer (again with respect Step1) of an error around 14%. This is due to horizontal value 0.91. If it was 0.96 also Step3 and Step4 were exactly balanced as Step1, Step2 and Step5.

It is possible to extrapolate the following possible explanation. A part the local anomaly **(3)** of Step3 and Step4 that could even be caused by some unknown factor that affects computation of horizontal value 0.91, a more general trend appears: also the upper horizontal values (that after 0.91 are separated by a clear exponential increase) are exactly compensated by logarithmic (6.7) formula that turns them into linear stepping increase into vertical axis. Please note also that 0.91 anomaly is replaced by the expected 0.96 value for another sequence of Quasar quantization steps (presented by H. Arp from another cosmic agglomerate), where 0.061 - 0.3 - 0.6 - 0.96 sequence is detected.

The general success of (6.7) in turning the exponential increase of z quantized values of Quasar red shifts into corresponding linear evolution of v/c steps, seems to point to a cosmological situation of Quasars groups each one marked with a specific v/c quantized value.

The simplest way to figure out this situation is to think that, at some specific Privileged System cosmological time intervals, an almost simultaneous young matter high speed expulsion (its speed comparable or even higher than actual known light one) from a single or various progeny galaxies happens. When this matter condenses, it originates Quasar couples that are running in opposite directions with high speed not far from the expulsion value. This speed, according to (6.6) law, corresponds to the higher quantized red shift. This is due to quantum interactions (between running matter, older matter almost at rest with Privileged System and most probably some unknown elementary substance building the innermost skeleton of the Privileged System) ruling the galactic bodies (here Quasars) proper time dilatation as active function of their velocity module (with respect Privileged

System). The same interactions are responsible in turn of the Quasar progressive velocity module decreasing with cosmological time. If by hypothesis this trend is linear with time as well as those matter expulsions happen at equal time intervals, it can be explained the presence of such v/c quantized and constant steps figured out in Fig.1. These quantized v/c values will drift versus zero with cosmological time keeping the same quantized Step separation. Below Step1 lower level no other v/c levels are present. It means those (previously at that level) red shift Quasars are already (almost) at rest with Privileged System because they have been transformed into low red shift Galaxies and have been disappeared by such Quasars quantization group. The fact that above upper level of Step5 there is no experimental evidence of higher red shifts could mean that, at least for that particular class of objects, there are no expulsions at v/c speed higher than 0.3225102+0.0610916 (The first term of the addition is the v/c value corresponding to the higher detected quantized red shift, the second term is the constant v/c steps amplitude, please refer also to Fig.1 and Fig.2). Following this line of thoughts, with cosmological time evolution some new Quasars of this class will be expelled in the speed range between 0.3225102 and 0.3225102+0.0610916. As said this will happen after the same time (passing from one expulsion to the following) will be expired from the last one. To be remarked that these v/c values range refers to the specific Quasars class in turn linked to low red shift mother galaxies agglomerates specifically presented by H. Arp in "Seeing Red" chapter devoted to red shift quantization phenomena. Other object classes are present with even higher red shifts. They need to belong to objects running at higher speed. But it is likely that the same qualitative Fig.1 paradigm applies also to them when specific data will be available for their extensive analysis.

Also another interesting red shift quantization phenomena presented by H. Arp can be deduced through the same paradigm by presence of equally spaced v/c steps. In a certain cosmic area some sequences of galactic red shifts quantized by z=37.5/c (being c the terrestrial light speed measured in km/s) have been found. The upper and lower levels vary from one sequence to the other but are generally confined in the red shift window 0 to 2500/c.

Each red shift sequence quantized at constant 37.5/c can be explained in term of an equally spaced burst of adequate v/c steps because total red shift window (0-2500/c) is confined in the very lower end of Fig.1. Where (6.7) can be approximated by the following linear relation in z:

$$v/c = \left(\frac{1}{k}\right) * z \tag{6.8}$$

This explains why equally spaced v/c steps practically turns into equally spaced 37.5/c red shift steps. Again the red shift quantization can be ascribed to the corresponding quantization of the galactic speeds. If the paradigm ruling Quasar linear speed decreasing with Privileged System cosmological time turns into a similar paradigm (that starts when

Quasars arrive in the low end of Fig.1 x axis and eventually transform into low red shift galaxies), then it could be possible that such new born galaxies proceed with a linear speed decrease this time very much slower than it was for Quasars. Hence this could explain the narrow 37.5/c quantization steps.

In next chapter a digression is presented to evaluate Doppler phenomena on received light frequency in the context of IG model Theory. It is anticipated that the formula that will be retrieved leads to not so different quantitative estimation with respect the actually general accepted relativistic one (at least for matter running well below c, because as remarked in chapter 2 actual IG model Galilean Theory allows extension of matter speed beyond the isotropic light speed). So it will be showed that the intrinsic (depurated by Doppler disturbance) red shift computation difference in between using each of the two paradigms is not high even for matter running within a value already comparable to light speed module. Hence H. Arp conclusions in regards intrinsic red shift quantized values computation need only a slight correction (only for worst case hypothesis of big Doppler Effect involved) or just practically no correction at all. It will be shown either possibility do not change at all the exposed paradigm of Quasar couples absolute velocity equally spaced quantization.

(1)

Mass is strictly connected with energy by relation E=mc^2. This relation was deduced by Maxwell in the second half of XIX century starting from another result achieved by use of his homonymous electromagnetic equations: the computation of the electromagnetic wave pressure exercised on an absorbing body. The related transferred light Momentum knowledge leaded Maxwell to deduce the famous relation between mass and energy.

Using this fundamental equivalence firstly discovered by Maxwell between mass and energy, total atomic mass is equivalent to a certain energy amount. With a very schematic representation, part of it is confined in atomic nucleus, the rest into different energetic quantized levels owned by atomic electrons. So if atomic mass increases the consequence is also a proportional increase of electronic energy levels. This leads in turn to a consequent increase of the differential energetic steps between the various electronic energy levels.

(2)

In general emitting body proper time is related to terrestrial proper time by (2.3):

$$t'' = e^{-k(v''-v')/c} * t' \qquad (6.3)$$

Where t'' belongs to emitted galactic body, t' to terrestrial lab. (v'' and v' are the emitted galactic body and terrestrial lab velocity modules as seen by Privileged System). And k=3.3648219 is the IG inertial coefficient value evaluated with an approximation contained in no more than +1%. (See 5.13 for its computation).

Due to the fact that such approximation take into account the indetermination of the terrestrial lab velocity module as seen by Privileged System (reasonably few hundred km/s or even less), it is possible to collapse the terrestrial lab with the Privileged System when the observed galactic body moves at speed not negligible if compared with the magnitude order of light.

Through (2.7) where v' collapses to 0 and v'' transforms into v_{lab} that is lab velocity module seen by Privileged System:

$$c = c_{lab} * e^{-\frac{kv_{lab}}{c}}$$

It is evident, because $v_{lab} << c$, that isotropic value of c (seen by Privileged System) is almost coincident with isotropic c_{lab} that is in turn almost coincident with measured 299792.458km/s because the anisotropic content of this measured value is today undetectable (it is anisotropic in principle because suffers of terrestrial lab drift of less than 1km/s with respect our planet center of mass during the 2 way light speed measurement). At the end for actual purposes (6.3) transforms into canonic IG model inertial equation:

$$t' = e^{-kv/c} * t \qquad (6.4)$$

Where t' is the proper time of galactic body, t the proper time of the Privileged System that is assumed to coincide with terrestrial lab due the +1% error accounted for coefficient k=3.3648219 in the supposed range of velocity of the lab as seen by Privileged System. Then c=299792.458km/s (due to above $c \simeq c_{lab}$ statement) and v is the galactic body module speed seen by terrestrial lab.

(3)

This local anomaly affecting Step3 and Step4 due to 0.91 red shift value (in place of expected 0.96) is unknown. But the interesting thing is that the general trend can be extrapolated simply by estimating the upper level of Step5 starting from the lower level of Step1 and repeating the not anomalous Step1 value 5 times. That is (please refer also to Fig.1 and Fig.2):

Estimated upper level of Step5 = 0.0175973+0.0603754*5 = 0.3194743

Being real upper level of Step5=0.3225102, then its estimated value differs from real value by only 0.9% error. This is a clear signature of the need to use EQUAL separation of v/c steps (deduced through 6.7 by use of experimental values of z excluding z=0.91) in order to correctly foresee each of v/c levels of the whole speed scale a part the slight anomalous one caused by z=0.91. Please note also that **0.91 anomaly does not exist**s for another sequence of Quasar quantization steps (presented by H. Arp from another cosmic agglomerate), where 0.061 - 0.3 - 0.6 - 0.96 sequence is detected.

Chapter 7

Doppler phenomena on received frequency in the context of IG model Theory. This Galilean approach is universal: it applies to light as well to general non electromagnetic waves. A paradoxical disconnection in classic treatment of Doppler Effect (even outside electromagnetism) is pointed out. The wrong solution is explained as due to illegitimate omission of classic Galilean velocity vector addition principle. The Quasars intrinsic red shift computation difference in between using Galilean or relativistic paradigm (to depurate the observed data by Doppler disturbance) demands a slight correction of the intrinsic data showed in chapter 6 because most likely got through the relativistic approach. The correction is due only for worst case hypothesis of big Doppler Effect involved otherwise it is practically not needed at all. It will be shown either possibility totally reconfirm the chapter 6 depicted paradigm of Quasar couples absolute velocity equally spaced quantization.

The frequency of an incoming wave, measured by a receiver at rest with a selected (for the computation purpose) inertial frame, can increase (or decrease) if the inertial frame at rest with the emitter approaches to (or recedes from) the receiver one when the wave is delivered by the emitter.

In the framework of actual Galilean theory this phenomenon can be estimated as well (and with total agreement) if the inertial frame selected for computation purposes is moved to the inertial frame at rest with the emitter.

This is an expected result because Reality cannot change with a change of the system selected for observation. Let see this for both cases:

A receiver inertial frame selected for Doppler estimation

B emitter inertial frame selected for Doppler estimation

It will be shown that case **A** needs the delivered wave speed is assumed to be given by Galilean vector velocity addition of following contributions:

- wave speed (in case the emitter does not approaches or recedes from the receiver)
- Emitter approaching or receding speed as evaluated by the receiver when the wave starts.

A paradoxical disconnection in case **A** Classic treatment of Doppler Effect (even outside electromagnetism and sustained even in some classic physics formulations!) leads to a wrong solution due to illegitimate omission of such Galilean velocity addition principle. This erroneous procedure uses (for all generic waveforms) the relativistic arrogation stipulating that wave speed is not dependent by the motion status of the emitting system with respect the detecting one. It will be remarked beside the following right case **A** approach.

This is case **A** development:

RC_ _ _ _ _ _ _ _ _ _ <--TR(t0' RC time)

RC_ _ _ _ _ _ <--TR(t1' RC time)

If the transmitter TR is approaching the receiver RC, the t0'=0 (for a clock at rest with the receiver) and t0=0 (for a clock at rest with the transmitter) is the instant TR is exactly at a certain distance s' apart from RC. So the instant the signal sent at t0'=0 is joining RC is for the receiver clock:

$$\mathrm{t1}' = \frac{s\prime}{(c\prime + v\prime)} \qquad (7.1)$$

Being c' and v' respectively the isotropic wave speed (in case the emitter TR was at rest with the receiver RC) and the emitter TR approaching speed as evaluated by the receiver RC.

Note that classic wrong solution considers v'=0.

At t1' TR has moved a little bit forward versus RC. TR proper time t1 is linked to RC t1' proper time by (6.3) because of previously assumed t0=t0'=0:

$$t1' = e^{-k(v\prime - v)/ci} * \mathrm{t1} \qquad (7.2)$$

Where v' is RC module speed as seen by the Privileged System and v is the TR module speed as seen by Privileged System. ci is the isotropic light speed module of Privileged System. In general $e^{-k(v\prime - v)/ci}$ value can be either greater or lower than unity. It depends upon what are v and v' during the wave delivery.

If t1=T, (being T the TR signal fundamental period) when the first wave front joins RC, still at t1 the second wave front starts from TR to join RC at RC time:

$$\mathrm{t2}' = \frac{s' - v\prime * t1'}{(c\prime + v\prime)} + \mathrm{t1}' \qquad (7.3)$$

Let express the difference t2'-t1'= T' (period between fronts perceived by RC) in function of t1':

$$\mathrm{T}' = \frac{s' - v\prime * t1'}{(c\prime + v\prime)} \qquad (7.4)$$

Passing to the perceived RC proper wavelength by using:

$$c' + v' = \frac{\lambda\prime}{T'}$$

And also considering that s'= λ (TR reference wavelength but measured by RC) because it is really the distance done by the wave front in one proper period T of TR (but evaluated by the inertial system at rest with RC) then:

$$\frac{\lambda'}{(c'+v')} = \frac{\lambda - v' * \mathrm{t1}'}{(c'+v')}$$

Expressing t1' through (7.1):

$$\lambda' = \lambda - v' * \frac{\lambda}{(c'+v')}$$

Passing to RC detected red shift, being λ the reference wavelength for z' computing, (it obviously coincides with TR evaluated λ wavelength and is the wavelength seen by RC in case RC is at rest with TR):

$$\mathrm{z}' = \frac{\lambda'-\lambda}{\lambda} = -\frac{v'}{(c'+v')} \qquad (7.5)$$

This is case **A** correct solution. Please note that if wrong (v'=0) assumption was used in building the RC perceived wavelength speed, then the wrong result (wrong but claimed by some physicists!) was achieved because v' would be canceled by (7.4) denominator:

$$\mathrm{z}' = \frac{-v'}{\mathrm{c}'} \text{ WRONG !} \qquad (7.6)$$

Coming back to correct solution, it is to be noted z'--> -0.5 if v'-->c'. It means λ variation (towards blue shift) equals one half of λ. It is intuitive because the reference wavelength measured by RC is really the distance done by the first wave front in one proper period T of TR. It is t1'*c' if v'=0 and is t1'*2c' if v'=c'. In the first case the second wave front sees the same distance (whole reference wavelength) because TR is at rest with RC. In the second case the second wave front sees half the distance (half reference waveform) to join RC because when that wave front starts the emitting TR is already at half the distance from RC it had when the first wave front started. Another interesting case is given by z'--> ∞ if v'-->-c'. It is really the limit value allowing RC to receive the wave emitted by TR in case of TR recession. It is the maximum red shift condition.

Pointless to say that above treatment can be naturally applied to photons because Galilean Principle holds also for electromagnetic waves. So light Doppler phenomenon related red shift is expressed by (7.5) as well.

This is case **B** development:

RC(t0)-->_ _ _ _ _ _ _TR

RC(t1)-->_ _ _ _ _TR

If the receiver RC is approaching the emitter TR, the t0=0 (measured by a clock at rest with the transmitter) is the instant RC is exactly at a certain distance s apart from TR. So the instant the signal sent at t0=0 is joining RC is:

$$\mathrm{t1} = \frac{s - v * t1}{c}$$

$$\mathrm{t1} = \frac{s}{(c+v)} \tag{7.7}$$

Being c and v respectively the isotropic wave speed (sent by TR) and the receiver RC approaching speed as evaluated by the emitter TR.

If t1=T, (being T the TR signal fundamental period) when the first wave front joins RC, still at t1=T the second wave front starts from TR to join RC at t2.

At t1 RC and TR are divided by $s - v * t1$ so:

$$t2 - t1 = \frac{s - v * t1}{(\mathrm{c+v})} \tag{7.8}$$

Using (7.7) to eliminate s by (7.8) then:

$$t2 - t1 = \frac{c * t1}{(\mathrm{c+v})}$$

Let express the difference t2-t1= T’ (period between both fronts arrival to RC as seen by TR) in function of t1=T:

$$T' = \frac{c * T}{(\mathrm{c+v})} \tag{7.9}$$

Considering the RC perceived wavelength and TR reference wavelength (both calculated by TR inertial system):

$c = \frac{\lambda\prime}{T'}$ for RC and $c = \frac{\lambda}{T}$ for TR

Then:

$$\lambda' = \frac{c * \lambda}{(\mathrm{c+v})}$$

Passing to RC detected red shift, being λ the reference wavelength for z’ computing:

$$\mathrm{z}' = \frac{\lambda' - \lambda}{\lambda} = -\frac{v}{(c+v)} \tag{7.10}$$

This is case **B** solution.

It is possible to demonstrate that case **A** and case **B** solutions are exactly the same using (4.10) and (4.11) (see chapter 4) to transform (7.10) back to (7.5):

$$c = c' * e^{-\frac{k(v\prime - v)}{ci}} \qquad (4.10)$$

This is the general relation between two generic inertial systems isotropic light speed modules.

$$v = v' * e^{-\frac{k(v\prime - v)}{ci}} \qquad (4.11)$$

This is the general relation between two generic inertial systems reciprocal speed module evaluation.

So:

$$z' = \frac{\lambda' - \lambda}{\lambda} = -\frac{v}{(c+v)} = -\frac{v\prime}{(c\prime + v\prime)} \qquad (7.11)$$

This result is in line with what must be expected by a theory. **Reality is unique by definition and its behavior (here it is Doppler phenomenon) cannot change whatever is the inertial system used to evaluate it.**

The following is the procedure to extrapolate the intrinsic red shift from a Quasars couple slightly different z values. It means that Doppler phenomenon is taken out by the two measured red shift values to get the Quasars intrinsic common red shift level. The procedure will be applied in both the Galilean context and in the relativistic one. An inappreciable difference on final localization of intrinsic red shift will be pointed out.

This is the development of Galilean context.

The Quasars couple different measured red shift values are: z1 and z2. This is the way the measured value is contributed by intrinsic and Doppler Effect:

$z = \frac{\lambda' - \lambda}{\lambda}$ where $\lambda' = \lambda + \Delta\lambda i + \Delta\lambda d$
$\Delta\lambda i$ is the intrinsic contribution and $\Delta\lambda d$ is the Doppler contribution. By dividing the above expression with λ reference wavelength:

$$z = zi + zd \qquad (7.12)$$

It is important to consider that (at a certain Privileged System cosmological time) zi is common between the two Quasars by definition of intrinsic contribution and being the Quasars speeds modules with respect Privileged System as described here below.

Regardingzd, by putting into (7.11) opposite values for Quasars radial velocities seen by terrestrial lab because both velocities of the Quasars are radial oriented and opposite with respect emitting galaxy rest status and (within estimation error included into IG model inertial equation k parameter) the same terrestrial lab at rest with Privileged System (obviously provided terrestrial lab view sight is almost parallel to Quasars velocities):

$$\mathrm{z1[d]} = -\frac{v}{(c+v)} \tag{7.13}$$

Quasar1 pure Doppler Effect (perceived by terrestrial lab) is blue shift being v into (7.13) positive (radial module velocity of Quasar1 oriented toward terrestrial lab and parallel to its view sight). c is isotropic light speed of terrestrial lab.

$$\mathrm{z2[d]} = \frac{v}{(c-v)} \tag{7.14}$$

Quasar2 pure Doppler Effect (perceived by terrestrial lab) is red shift being v into (7.14) positive (radial module velocity of Quasar2 oriented this time opposite to terrestrial lab and again parallel to its view sight).

The expression (7.12) can be customized for z1 and z2 Quasars couple measured red shifts:

$$z1 = zi + z1[d] \tag{7.15}$$

$$z2 = zi + z2[d] \tag{7.16}$$

Subtracting (7.15) from (7.16) and using (7.13) and (7.14):

$$\Delta z = z2 - z1 = z2[d] - z1[d] = \frac{v}{(c-v)} + \frac{v}{(c+v)} = \frac{2cv}{(c+v)(c-v)} \tag{7.17}$$

From (7.17) the following 2nd order equation in v holds:

$$v^2 + \frac{2c}{\Delta z} * \ v - c^2 = 0 \tag{7.18}$$

The following result holds for v in function of Δz (being v a speed module it is positive):

$$v = c * \left(\sqrt{1 + \frac{1}{\Delta z^2}} - \frac{1}{\Delta z}\right) \tag{7.19}$$

Clearly Δz -->0 means v-->0 and Δz --> ∞ means v-->c.

Let explicit z1 [d] in function of Δz through (7.19):

$$\mathrm{z1[d]} = -\frac{\left(\sqrt{1+\frac{1}{\Delta z^2}} - \frac{1}{\Delta z}\right)}{1+\left(\sqrt{1+\frac{1}{\Delta z^2}} - \frac{1}{\Delta z}\right)} \tag{7.20}$$

Finally through (7.15) and (7.20) the intrinsic red shift contribution is isolated as function of z1 and Δz measured values.

$$zi = z1 - z1[d] = z1 + \frac{(\sqrt{1+\frac{1}{\Delta z^2}}-\frac{1}{\Delta z})}{1+(\sqrt{1+\frac{1}{\Delta z^2}}-\frac{1}{\Delta z})} \qquad (7.21)$$

It is clear that if Δz -->0 then zi-->z1=z2 and if Δz --> ∞ then zi-->z1+0.5. To be noted also that for v<<c expressions (7.13) and (7.14) for z1[d] and z2[d] turn out to be equal and opposite hence for this particular approximation zi≃z1+(z2-z1)/2=z1+Δz/2.

This is the development adopting Relativistic paradigm.

The Quasars couple different measured red shift values are again named: z1 and z2. The following is the relativistic formula:

$$\mathrm{z1[d]} = \frac{\sqrt{1-v/c}}{\sqrt{1+v/c}} - 1 \qquad (7.22)$$

Quasar1 pure Doppler relativistic Effect (perceived by terrestrial lab) is blue shift being v into (7.22) positive (radial module speed of Quasar1 oriented toward terrestrial lab and parallel to its view sight). c is isotropic light speed of terrestrial lab.

$$\mathrm{z2[d]} = \frac{\sqrt{1+v/c}}{\sqrt{1-v/c}} - 1 \qquad (7.23)$$

Quasar2 pure Doppler relativistic Effect (perceived by terrestrial lab) is red shift being v into (7.23) positive (radial module speed of Quasar2 oriented this time opposite to terrestrial lab and again parallel to its view sight).

Also for relativistic context expression (7.12) is customized for z1 and z2 Quasars couple measured red shifts:

$$z1 = zi + z1[d] \qquad (7.24)$$

$$z2 = zi + z2[d] \qquad (7.25)$$

Subtracting (7.24) from (7.25) and using (7.22) and (7.23):

$$\Delta z = z2 - z1 = z2[d] - z1[d] = \frac{\sqrt{1+v/c}}{\sqrt{1-v/c}} - \frac{\sqrt{1-v/c}}{\sqrt{1+v/c}} = \frac{2v/c}{\sqrt{\left(1+\frac{v}{c}\right)(1-\frac{v}{c})}} \qquad (7.26)$$

From (7.26) the following v value is found as Δz function:

$$v = \Delta z * \frac{c}{\sqrt{4+\Delta z^2}} \qquad (7.27)$$

Clearly Δz -->0 means v-->0 and Δz --> ∞ means v-->c. (Same result found as for Galilean context).

Let explicit z1 [d] in function of Δz through (7.27):

$$\mathrm{z1[d]} = \frac{\sqrt{1-\frac{\Delta z}{\sqrt{4+\Delta z^2}}}}{\sqrt{1+\frac{\Delta z}{\sqrt{4+\Delta z^2}}}} - 1 \tag{7.28}$$

Finally through (7.24) and (7.28) the intrinsic red shift contribution is isolated as function of z1 and Δz measured values.

$$zi = z1 - z1[d] = z1 + 1 - \frac{\sqrt{1-\frac{\Delta z}{\sqrt{4+\Delta z^2}}}}{\sqrt{1+\frac{\Delta z}{\sqrt{4+\Delta z^2}}}} \tag{7.29}$$

It is clear that if Δz -->0 then zi-->z1=z2 and if Δz --> ∞ then zi-->z1+1. To be noted also that for v<<c expressions (7.22) and (7.23) for z1[d] and z2[d] turn out to be equal and opposite (using $\sqrt{1+v/c} \simeq 1 + v/2c$ and $\sqrt{1-v/c} \simeq 1 - v/2c$) hence for this particular approximation zi≃z1+(z2-z1)/2=z1+Δz/2.

It is possible to show that if the intrinsic zi value is extracted by the measured $z1$ and $z2$ through relativistic formula (7.29) then the intrinsic homologue extracted by the same measured values through Galilean formula (7.21) is smaller the more is the difference between $z1$ and $z2$. Instead if $z1 = z2$ (no Doppler Effect at all), then (7.21) and (7.29) collapses to provide the same $zi = z1$ estimation **(1)**. Anyway by comparing of (7.21) and (7.29) Galilean and relativistic expressions leads to the conclusion that they are still equivalent for practical purposes as far as Quasar velocity component parallel to observing laboratory view sight v<<c. This limited Doppler Effect condition makes $\Delta z \simeq 2v/c$ as can be seen by (7.17) and (7.26) for both Galilean and relativistic approach so $zi \simeq z1 + \Delta z/2$ for both cases as previously highlighted. Looking back to chapter 6 Fig.1, the first three Quasar intrinsic red shift steps of the famous quantized sequence (documented in “Seeing Red”: 0.061 - 0.3 - 0.6 - 0.91 - 1.41 - 1.96), corresponds to a maximum total module normalized speed of 0.14 that is contained in mentioned v<<c approximation also considering the worst case condition that the Quasar couple is running almost parallel to observing laboratory view sight so the total 0.14*c velocity is causing the Doppler Effect. (Looking to chapter 6 Fig.1, 0.14 normalized speed corresponds to 0.6 red shift position). Let show the overall expected negligible impact on the on v/c vertical axis equal spaced galactic quantization presented in previous chapter 6 and starting by such 0.6 red shift Quasar case.

Before to insert v=0.14*c into (7.17) it is needed a meditation on the meaning of chapter 6 use of (6.7) to retrieve all the v/c values from corresponding intrinsic red shift data. These ones (got by “Seeing Red” so probably obtained after a relativistic approach to separate Doppler Effect by original observed data) must now be properly considered as an over estimation of the right intrinsic red shift values that can be retrieved after a Galilean approach to separate Doppler Effect from observed data. Over estimation because in **(1)** has been showed that relativistic estimation is always higher then Galilean one working on the nude $z1$ and $z2$ observed values. Also it is remarked again that inserting the (in turn over estimated through (6.7) conversion of intrinsic red shift value) v=0.14*c into (7.17) implies considering the case the total vector velocities of the Quasar couple are almost completely aligned with the direction made by terrestrial observing system and the same Quasars. This case is the worst in term of super imposing Doppler Effect on top of intrinsic value given by 0.14*c (it implies the higher possible Doppler Effect). This further over estimated condition leads to a resulting over estimated Δz=0.285.

Let put such Δz value into (7.30) expression of note **(1)** to evaluate this time an under estimated intrinsic Galilean red shift (because obtained by subtracting from relativistic red shift intrinsic value the overestimated Δz value). In this way it is possible, by mean of a simple recursive procedure (it is reported in Appendix C) that goes through the previous (6.7) and (7.17) chain, to converge to a final estimated value for intrinsic Galilean red shift. Of course it is less than relativistic intrinsic red shift as by note **(1)** considerations and its difference from true intrinsic relativistic data remains affected by worst case hypothesis that considered the whole v/c module value of Quasars couple belonging to vector velocities almost parallel to the observer view sight and consequently arising the maximum Doppler Effect that in turn points to a worst case minimum Galilean intrinsic red shift. Applying such recursive approach to 0.6 relativistic intrinsic red shift value of chapter 6 Fig.1, it leads to a final intrinsic Galilean value of 0.59 (this worst case minimum value caused by $\Delta z = z2 - z1 = 0.28$). This minimum value points through (6.7) to v/c =0.1379. Let recalculate Step2 in the hypothesis that upper Step1 v/c value is still 0.0772797 because that Quasar couple observation was not by chance affected by any Doppler effect (its$z2 = z1 = zi = 0.3$). The new Step2 results to be 0.06 still in plenty agreement with equal spaced steps calculated with intrinsic red shift values taken by “Seeing Red” and showed in chapter 6 Fig.2. At the end this was expected because (7.21)≃(7.29) if v<<c.

Concerning higher quantized sequence values the difference in v/c that arises by using Galilean approach is impacting the magic equal Steps trend from a certain grade of alignment to the direction made by terrestrial observing system and the Quasars couple. Taking the higher sequence value 1.96 (because it corresponds to the higher total module normalized speed of 0.3225102, see chapter 6 Fig.1), the recursive procedure leads to the new Galilean value of 1.91 (this worst case minimum value caused by $\Delta z = z2 - z1 = 0.7$). This minimum value points through (6.7) to v/c =0.3172908. Let recalculate Step5 in the hypothesis that upper Step4 v/c value is still 0.2614185 because that Quasar couple observation was not by chance affected by any Doppler effect (its$z2 = z1 = zi = 1.41$). The new Step5 results to be 0.056 very different from 0.06. To go back to the magic equal steps trend it is needed either the previous Quasar couple (with observed intrinsic red shift 1.41) is affected as well by a certain amount of Doppler Effect leading to diminish in turn its 1.41 value with Galilean intrinsic calculation, and / or the higher red shift Quasar couple is travelling with vector velocities not completely parallel to the observer view sight. Both these independent things could easily recover the Step5 calculation to 0.06. For instance if the observer view sight was separated by at least 45 Degrees from the Quasars couple running direction then this would be enough to recover the expected equally spaced v/c steps of 0.06 even by use of Galilean approach to separate the Doppler Effect disturbance that leads to the new intrinsic red shift value retrieved through (7.30) by the relativistic one.

So the considerations done in this chapter only slightly correct the already done (in chapter 6 by Galilean IG model theory) use of intrinsic red shift data (retrieved from “Seeing Red” book). This is due because in “Seeing Red” context the intrinsic red shift data has been most likely calculated from measured wavelengths through relativistic approach to discard Doppler Effect disturb on the genuine intrinsic value. It is remarked that the slight correction is done only under the hypothesis that observed $\Delta z = z2 - z1$ (unfortunately this data is not known by the author) was by chance the higher being caused by Quasar absolute velocity completely aligned with observing laboratory sight view and leading to a maximum Doppler Effect. If this worst case hypothesis was not happened then the original intrinsic red shift data, retrieved through relativistic approach to separate Doppler Effect by observed data, tend already to coincide with the intrinsic values that are retrieved following the Galilean approach due to (7.21)≃(7.29) if Quasar velocity component parallel to observing laboratory view sight v<<c. Anyway whatever it was the Δz amount at the time the astronomic observations were done, leading in turn to slightly correct through the mentioned recursive numerical approach (presented in Appendix C) or just reconfirm the intrinsic red shift data extracted by “Seeing Red” for the famous Quasar couples, present chapter digression showed that the paradigm of equally spaced Quasar couples absolute velocity quantization is totally reconfirmed.

(1)

The intrinsic red shift expression is for Galilean case by using (7.21):

$$zi\_gal = z1 - z1[d] = z1 + \frac{(\sqrt{1+\frac{1}{\Delta z^2}} - \frac{1}{\Delta z})}{1+(\sqrt{1+\frac{1}{\Delta z^2}} - \frac{1}{\Delta z})}$$

The intrinsic red shift expression is for relativistic case by using (7.29):

$$zi\_rel = z1 - z1[d] = z1 + 1 - \frac{\sqrt{1-\frac{\Delta z}{\sqrt{4+\Delta z^2}}}}{\sqrt{1+\frac{\Delta z}{\sqrt{4+\Delta z^2}}}}$$

Then by combining (7.21) and (7.29):

$$zi\_gal = zi\_rel - 1 + \frac{\sqrt{1-\frac{\Delta z}{\sqrt{4+\Delta z^2}}}}{\sqrt{1+\frac{\Delta z}{\sqrt{4+\Delta z^2}}}} + \frac{(\sqrt{1+\frac{1}{\Delta z^2}}-\frac{1}{\Delta z})}{1+(\sqrt{1+\frac{1}{\Delta z^2}}-\frac{1}{\Delta z})} \tag{7.30}$$

The right side equal zi_rel for Δz =0 and tends to (zi_rel – 0.5) for $\Delta z \rightarrow \infty$. Hence $\_gal \lesssim zi\_rel$. It tends asymptotically to be less of a 0.5 offset for big Doppler Effect.

Chapter 8

The cosmological contrast acceleration opposes to matter speed with respect Privileged System. It originates a velocity dependent contrast force to absolute matter motion. IG model paradigm deduces that work done by an external force to increase the speed of a generic particle leads to the release of a big portion of the initial Compton frequency dependent particle energy (when particle is at rest with Privileged System) to the Privileged System (9/10 of the initial Compton energy if the particle finally travels at light speed). Photons behave exactly like generic particles. They reduce their speed with cosmological time. In doing so, (like generic particles), they gradually reintegrate (from Privileged System) their initial rest Compton energy.

In chapter 6 it has been developed an approach in favor of a gradual (with cosmological absolute time of Privileged System) mass increase of the matter (in the mean time slowing down its speed as seen by Privileged System) that is consequence (not cause) of a progressive atomic proper time dilatation decrease. This phenomenon must be ascribed to quantum interactions of the running matter with the Privileged System inner substance that, beside actively regulating the matter velocity module (seen by Privileged System) influence on its atomic time observed by Privileged System (and consequently electronic spin frequencies, emitted photon frequencies and related atomic energy levels differentials), are as well ruling the natural (cosmological) linear slow down in time of the same matter velocity module again as seen by Privileged System. This immediately leads to mentioned matter observed time dilatation decrease in parallel with absolute matter speed slow down. That is travelling matter observed frequencies gradually converge to the values that are observed (by Privileged System) when matter is at rest with Privileged System itself (Privileged System owns absolute time peace).

Let briefly go through the chain frequency / energy / mass to show the mass dependence upon matter speed module as seen by Privileged System. After that a macroscopic Newtonian model of the contrast force to mentioned speed will be proposed through the experimentally detected evidence (see chapter 6) of a constant acceleration that opposes to absolute matter speed.

The Compton frequency γ of a general rest particle (with Privileged System) is linked to the particle intrinsic energy content by the quantum mechanics relation:

$$E = h\gamma \tag{8.1}$$

Where h is the Planck constant. By use of $E = mc^2$(see chapter 6 note 1 for historical attribution of the first discovery of such fundamental law), the relation between a general particle rest mass (with respect Privileged System) and its rest (or intrinsic) Compton frequency is given by:

$$m = \frac{h\gamma}{c^2} \tag{8.2}$$

c is the light isotropic value that holds for Privileged System that is also assumed to practically coincide with terrestrial lab one due to the +1% error accounted for coefficient k=3.3648219 into IG model inertial equation that includes the supposed very limited speed of terrestrial lab as seen by Privileged System . This means that c value is well approximated by the terrestrial measured two ways light speed.

Using IG inertial equation it is possible to retrieve the relation between the perceived frequency "$\gamma 1$" coming from the same particle if it does move with respect Privileged System and the perceived frequency"γ" when the particle is at rest with Privileged System. The first will be $e^{-kv/c}$times lower than the one perceived from the particle at rest due to the same argument pointed out in chapter 6 to retrieve equation (6.5) that is here after replicated:

So:

$$\gamma 1 = e^{-kv/c} * \gamma \tag{8.3}$$

Note that v is the particle speed as seen by Privileged System.

Finally putting together (8.2) and (8.3), the mass of a particle travelling at v (as seen by Privileged System) results to be:

$$m(v) = e^{-\frac{kv}{c}} * \frac{h\gamma}{c^2} = e^{-\frac{kv}{c}} * m \tag{8.4}$$

The particle mass depends by IG inertial equation exponential term and by its rest value m with Privileged System. It tends to zero for v -->∞.

In chapter 6 it was presented the hypothesis that the equally distributed quantized velocity values of Quasars (calculated through chapter 6 Fig.1 logarithmic conversion law from Quasars quantized intrinsic red shifts) were in turn caused by equally spaced (in cosmological time) new Quasar couples expulsions (by old mother galaxies) and by their supposed constant speed decrease versus Privileged System rest status.

Now this paradigm is generalized to the behavior of a generic particle travelling at v as seen by Privileged System. It is not known if the constant speed decrease is the same of the Quasar couples (in this case it should be a universal constant). Most likely it is not because in chapter 6 another signature of a constant acceleration that opposes to velocity of galaxies (in this case with narrow quantized 37.5/c red shift steps) has been presented. The phenomenon is qualitatively analogous to the Quasar one but, in order to work correctly, the constant acceleration must be more reduced for the galaxies case (their quantized absolute velocity values lie in a very lower velocity window as seen by Privileged System). It is surely not surprising if contrast acceleration tend to decrease to zero (with contrasted matter speed approaching zero as seen by Privileged System). But with a law that can locally (at least for a certain velocity window) be approximated with a constant contrast acceleration$a$).

So let consider an unknown constant (both in respect to time and to velocity) contrast acceleration value for a generic particle in motion with respect Privileged System and without any other interference or interactions working on this particle. The contrast constant acceleration is named “a”. It must be very low (if compared for example with gravity acceleration) because it acts against speed v of the particle with an effect detectable at cosmological time scale only. This explains why experimental physic never detected it. By Newton second law it is straightforward to macroscopically model the contrast force (due to the running particle quantum interactions with Privileged System unknown substance) acting on the particle itself:

$$F(v) = a * m(v) \tag{8.5}$$

The contrast force depends by velocity v in the same way that mass does because a=constant. It means that the contrast force tends to zero for v-->∞. This must be explained (at quantum mechanical level) with the fact that at higher velocity the particle mass (energy) tends to zero and this fact limits the interactions with Privileged System unknown substance (even if interactions are more and more spatially extended due to the most extended function wave of the lighter particle). In conclusion at higher velocity the particle collapses to a ghost whose interactions are becoming negligible but anyhow able to preserve the famous a=constant because the mass itself is becoming negligible as well.

It is interesting to calculate the physical work executed on a particle (initially at rest with Privileged System that also coincides with detecting inertial system to make things simplest) by an external force that acts on it and is opposed only by this famous contrast force in presence of no other interactions.

First at all let write the net acceleration of the particle subjected to the external and to the contrasting force:

$$F - F(v) = \frac{\mathrm{d}v}{\mathrm{dt}} * m(v) \tag{8.6}$$

F is the external force, $F(v)$ is the contrast force, $m(v)$ the particle mass and $\frac{\mathrm{d}v}{\mathrm{dt}}$ is the net acceleration.

The mentioned work executed by F is using (8.6):

$$\mathcal{L} = \int_0^l F ds = \int_0^l F(v) ds + \int_0^l m(v) * \frac{\mathrm{d}v}{\mathrm{dt}} ds \qquad (8.7)$$

Where 0 is the place where the external force starts to act and l is the final application place. Now, $\frac{\mathrm{d}s}{\mathrm{dt}} = v$and using (8.4) and (8.5):

$$\mathcal{L} = \int_0^l F ds = \int_0^{t1} a * m * e^{-\frac{kv}{c}} * v\, dt + \int_0^{v1} m * e^{-\frac{kv}{c}} * v * dv \qquad (8.8)$$

The integral in dt must be calculated through numerical approach by summing up at each t + dt the expression contained in it (every time updated with the right new value of v). Also v values in function of dt steps must be found by numerical integration of (8.6). The integral in dv can be instead calculated through integration by parts as it will be immediately done for the photon case.

Now the above paradigm is applied to photons, later on it will be extended to generic particles.

Quantum mechanics principle says that a photon is emitted due to an atomic electron transition from a high level energy excited status to a low level energy status. The differential energy gap is exactly the energy content of the emitted photon.

This principle is interpreted at light of Galilean paradigm that is not conditioned by the need that photon rest mass should be null. (It is merely the relativistic paradigm need that demands a photon owns a null rest mass to avoid an infinite mass/energy photon travelling content).

New Galilean paradigm says that photon rest mass/energy exists and is related to its rest (as seen by Privileged System) Compton frequency by (8.1) and (8.2) as it works for any generic particle. The Compton frequency (or energy) of the rest photon can be directly deduced by the atom electron energetic transition because it accounts for both photon Compton rest energy building (it creates the rest photon) plus the additional work transformed into photon kinetic energy done to launch the photon at isotropic light speed. The final photon light speed can remain isotropic or not, depending if the detecting system is at rest with the center of mass of nearby floating masses (with respect emitting atom) as by Adapted Galilean principle, see chapter 2 and chapter 3) or it is not.

So a photon (with Compton rest frequency γ) can be launched by an atom electronic transition only if the transition energy loss is equal to the same photon Compton rest energy (it is needed to materialize the rest photon with that particular frequency γ) plus the work needed to launch it at isotropic light speed. Using (8.1) and (8.8) and calling the atom electronic transition energy Et and again supposing the emitting atom and detecting inertial system are at rest with Privileged System to make computation simplest:

$$Et = h\gamma + \mathcal{L} = h\gamma + \int_0^l Fds = h\gamma + \int_0^{t1} a * m * e^{-\frac{kv}{c}} * v\, dt + \int_0^c m * e^{-\frac{kv}{c}} * v * dv \qquad (8.9)$$

l is the infinitesimal length occurring by the impulsive (for the emitted photon case) extraordinary atomic force F to locally (inside atom orbital) spend the needed work to launch it at c isotropic light speed component. This isotropic component as detected by an observer at rest with the emitting atom. An additional work must be provided or released by the surrounding atoms cooperation on the photon already launched at isotropic speed to add the anisotropic speed component detected by the same observer. This additional work needs a time actually difficult to be modeled being dependent by the modality surrounding atoms interact with the photon once it leaves the emitting atom. This is really a very challenging open point. In chapter 10 mentioned anisotropic work will be properly discussed including its fictitious nature unless it is detected by a system at rest with Privileged System. By the way the same ambiguity would concern also the isotropic work spent by the emitting atom unless it is again detected by an inertial system at rest with Privileged System. Coming back to actual isotropic velocity component building as properly evaluated by an inertial system at rest with Privileged System and also with emitting atom (this last condition to make things simplest), t1 is the infinitesimal time occurring to emitting atom to complete the task.

Due to the fact that t1 is infinitesimal and that a is a very little constant (as above depicted its impact is meaningful only at cosmological time scale), the expression (8.9) for photon emission can be approximated by:

$$Et = h\gamma + \mathcal{L} = h\gamma + \int_0^l Fds \simeq h\gamma + \int_0^c m * e^{-\frac{kv}{c}} * v * dv \qquad (8.10)$$

The following procedure holds to solve integral in dv by parts:

$$\int_0^c m * e^{-\frac{kv}{c}} * v * dv = \left[m * e^{-\frac{kv}{c}} * \left(-\frac{c}{k}\right) * v\right]_0^c + \left(\frac{c}{k}\right)\int_0^c m * e^{-\frac{kv}{c}} * dv$$

$$= -m * e^{-k} * \left(\frac{c^2}{k}\right) - \left[\left(\frac{c^2}{k^2}\right) * m * e^{-\frac{kv}{c}}\right]_0^c$$

$$= -m * e^{-k} * \left(\frac{c^2}{k}\right) - \left(\frac{c^2}{k^2}\right) * m * e^{-k} + \left(\frac{c^2}{k^2}\right) * m$$

$$= -m * \left[\left(\frac{c^2}{k}\right) * e^{-k}(1 + \frac{1}{k}) - \left(\frac{c^2}{k^2}\right)\right]$$

$$= m * \left[\left(\frac{c^2}{k^2}\right) * \left(1 - e^{-k}\right) - \left(\frac{c^2}{k}\right) * e^{-k}\right] \qquad (8.11)$$

Putting (8.11) back into (8.10) and using (8.2) to express the photon rest mass m in function of its rest Compton frequencyγ, the following expression for Et holds:

$$Et = h\gamma + \mathcal{L} = h\gamma + \int_0^l F ds \simeq \mathrm{h}\gamma * [1 + \left(\frac{1}{k^2}\right) * \left(1 - e^{-k}\right) - \left(\frac{1}{k}\right) * e^{-k}] \tag{8.12}$$

The atom electronic transition energy Et is transformed into photon rest energy $h\gamma$ plus the work needed to launch the same photon to c. (The additional work against a is omitted because negligible for practical purposes).

By calculating the square bracket value with usual k=3.3648219 value the photon rest Compton frequency results to be:

$$\gamma = \frac{\mathrm{Et}}{1.075 * \mathrm{h}} \tag{8.13}$$

It is interesting to note that travelling Compton frequency dependency by v (speed of the photon as seen by Privileged System) diminishes the work needed to launch the photon at c with respect the one occurring with a constant Compton frequency through all the v range. This second case would lead value of (8.12) square bracket to increase from 1.075 to 1.5 as can be checked by using k=0 because this cancels into (8.10) the mass/Compton frequency dependence upon v. (To clarify this it is needed to pull into square bracket a Taylor series expansion of e^{-k} until the 2^{nd} power of k in the neighbor of k=0). Looking to (8.12) if k=0 then the work to launch the photon at c:

$$\mathcal{L} = \left(\frac{1}{2}\right) * \mathrm{h}\gamma = \left(\frac{1}{2}\right) * \mathrm{m}c^2$$

This is due to constant photon Compton frequency and related mass (their rest values transported through all the v range from zero to c as it should be expected to be predicted by pure Galilean model. Instead the correct value for the work to launch the photon at c is:

$$\mathcal{L} = 0.075 * \mathrm{h}\gamma = 0.075 * \mathrm{m}c^2 \tag{8.14}$$

The (8.14) shows the correct work in function of the photon rest Compton frequency / mass because they diminish with the photon speed increase (as seen by Privileged System). Their final values are calculated from (8.3) and (8.4) with v=c:

$$\mathrm{m(c)} = \mathrm{m} * e^{-k} = \mathrm{m} * 0.0345682 \tag{8.15}$$

$$\gamma(\mathrm{c}) = \gamma * e^{-k} = \gamma * 0.0345682 \tag{8.16}$$

Coming back to (8.13) it is clear the difference introduced by IG model in evaluating the emitted photon energetic content with respect the generally accepted view that is conditioned by the need that photon can only travel at c speed and with an hypothetical null rest mass (by the way these are limits pulled in by the relativistic theory).

Generally shared view says that, upfront an electronic transition energy Et, emitted photon acquires exactly this energy. So its relation between proper energy Et (entirely acquired from electronic transition) and proper (fixed) Compton frequency results to be:

$$Et = h\gamma \qquad (8.17)$$

By the way IG model theory estimates through (8.13) the following relation linking electronic transition energy Et and photon proper (rest) Compton frequency:

$$\mathrm{Et} = 1.075 * \mathrm{h}\gamma \qquad (8.18)$$

But it is not all. The electronic transition energy Et is transformed not only in a photon at rest with Privileged System (whose energy is $\mathrm{h}\gamma$), but as previously already remarked, also in work to bring such rest photon to isotropic light speed c**.** This work is easily retrieved by (8.18) subtracting$\mathrm{h}\gamma$ and arriving to (8.14) expression for it.

At the end the emitted photon energy is given by two contributions. The first is (8.16) (multiplied by Planck constant of course) to take into account its travelling Compton frequency. It is connected to photon residual mass because it travels at speed v=c as seen by Privileged System. The second contributor is its kinetic content that is given by (8.14) because it is by definition represented by the amount of work spent to bring it at v=c. (Surely it is not ½ $\mathrm{h}\gamma$ =½mc^2 because its mass/energy changed during its speed change until v=c).

So the process started with a release of energy Et (provided by the atom electronic transition). Finally the remaining energy is given by the above mentioned two contributors. This means that there is the following net difference:

$$\mathrm{Eint} = \mathrm{Et} - (\mathrm{h} * \gamma(\mathrm{c}) + \mathcal{L}) \qquad (8.19)$$

By use of (8.14),(8.16), and (8.18):

$$\mathrm{Eint} = \mathrm{Et} - (0.0345682\mathrm{h}\gamma + 0.075 * \mathrm{h}\gamma)$$

$$\mathrm{Eint} = 1.075\mathrm{h}\gamma - (0.0345682 + 0.075)\mathrm{h}\gamma$$

$$\mathrm{Eint} = 0.96543\mathrm{h}\gamma \qquad (8.20)$$

The Eint net difference is the “interaction” energy released by the photon to the Privileged System inner skeleton due to the quantum contrast interactions that act between the travelling photon and the Privileged System inner skeleton. As already remarked they are responsible of two intimate connected processes. From one side they tend to regulate the internal frequencies of travelling matter (with a non kinematic process) according to the variation of its speed in the way described by IG inertial equation. So a non kinematical work is gradually spent by the photon against such contrast interactions at each delta photon speed increase, when a certain amount of Compton travelling energy is released to the

Privileged System. Eint is the total "interaction" energy released by the photon at the end of the process (when its v=c) whose result is a lowering of its final travelling Compton frequency and related energy. From the other side the quantum contrast interactions tend to oppose to the travelling matter speed itself according to a constant contrast acceleration (note this is the kinematic process correctly included into motion equation (8.9), but as already commented it can be ignored for the infinitesimal time needed to launch the photon at v=c).

It is very impressive to see that Eint is 89.8% of the whole Et disposed by the electronic energy transition. It means that 9/10 of this energy is released to Privileged System due to the travelling Compton frequency / energy reduction.

Note that this result (got for photon case) can be extended (thanks to New Galilean paradigm) to any massive particle. It is worth to observe that for the generic particle the rest Compton energy is $\mathrm{h}\gamma$ and its travelling Compton energy is$\gamma(v) = \gamma * e^{-\frac{kv}{c}}$. If a given work $\mathcal{L}$ is applied to launch the particle at v, the following energetic equation must hold:

$$\mathrm{h}\gamma + \mathcal{L} = h\gamma(v) + \mathcal{L} + Eint \qquad (8.21)$$

Eint is the balance interaction energy that is needed to take into account the loss of total travelling particle energy ($\mathcal{L}$ kinetic plus travelling particle Compton energy) with respect initial energy (particle rest Compton energy plus work $\mathcal{L}$ that will be transformed into kinetic energy). So:

$$Eint = \mathrm{h}\gamma - h\gamma(v) = \mathrm{h}\gamma(1 - e^{-\frac{kv}{c}}) \qquad (8.22)$$

If the speed v=c then

$$\mathrm{Eint} = 0.96543\mathrm{h}\gamma \qquad (8.23)$$

Note that (8.23) equals (8.20). This confirms the bold general comment.

The New Galilean paradigm fundamental concept pointing to the photon case as a common massive particle case implies that photons are subjected to the famous constant acceleration a that opposes to matter absolute speed. (This kinematic effect was already considered into (8.9)). So if a photon travels for an important portion of cosmological time **(1)** then this opposition a makes detectable signature. Photon speed is reduced from c to a given value v. During the slowing process the contrast force varies (increases) like the travelling mass (8.4) and the related travelling Compton frequency (8.3). At each photon speed (as seen by Privileged System) decreasing interval, the increase of the available travelling Compton frequency energy is linked to a decrease of the Eint interaction released energy (it means Privileged System sends back such energy to the photon). Their summation is constant and equals to the rest Compton energy as by (8.21). At the end whole Eint

disappears because the photon has gained again its rest status with Privileged System and with it all the interaction energy Eint (previously released to the Privileged System) has been reintegrated by non kinematic interactions with Privileged System that regulate the internal frequencies of travelling matter. The important fact is that the total work acted by the photon against the contrast force until the photon is halted corresponds again to the entire amount $\mathcal{L}$ that occurred to launch the photon at c. This time the kinetic energy $\mathcal{L}$ is released by the photon to the inner skeleton of the Privileged System through the kinematic process regulated by constant contrast acceleration$a$. At the end the quantum interactions are responsible of two opposite energy fluxes intimately connected. The non kinematic one is an energy reintegration to the photon from the Privileged System .From (8.14) is:

$$\mathrm{Eint} = 0.96543\mathrm{h}\gamma \tag{8.24}$$

The kinematic one is a (kinetic) energy releasing from the photon to the Privileged System. It is from (8.20):

$$\mathcal{L} = 0.075 * \mathrm{h}\gamma \tag{8.25}$$

Note the enormous disparity: upfront a negligible kinematic energy expenses (its kinetic energy) the photon recovers the very much bigger (12.8 times bigger) Compton energy missing. Both mentioned interaction processes happen because Privileged System owns the previously mentioned homogeneously distributed very low energy density that can be exchanged with traveling mass through the said kinematic and not kinematic processes.

It is worthwhile to observe that in most of practical cases the photons cannot alter their speed **(2)**. Due to the fact they are emitted and absorbed in almost instantaneous times. Instead the photon messengers from space can arrive at terrestrial detectors with an important lost of their total kinetic energy$\mathcal{L}$. So the residual work $\mathcal{L}'$ they can release to the absorbing atom together their rest Compton energy builds an amount Et' that is less than original Et (released by the atom when the photon was emitted). This avoids the absorption of the right energy Et. A reduced (red shifted) detection happens if the absorbing atom is able to make reduced electronic upper energetic transitions. Eventually a new photon is scattered to balance a transition that does not entirely fits. Otherwise no absorption occurs at all.

(1)

The (8.8) is the motion equation for a general particle that is launched to a certain speed v1 starting from its rest condition with Privileged System. Obviously in the very general case such motion equation cannot be simplified by omitting the integral of the contrast acceleration. This is true the more is the time occurring to launch the particle to a given speed. By the way previous mentioned Quasars quantized red shift observations still show that contrast constant acceleration a is so low that acts in a visible way only through cosmological times scale. So it can still be ignored for terrestrial experiments.

(2)

The constant (as seen by Privileged System) contrast acceleration a shows up its effect on galactic bodies only at cosmological time scale. Its value is not known (and probably it tends to reduce with galactic bodies progressive slow down) but let try to establish at least a maximum limit for it. Looking to chapter 6, Fig.2 the quantized Quasar couples velocity steps are about 0.06 (in v/c units). The constant time occurring between matter expulsions (from progeny galaxies), that is also the time taken by Quasars to go through the whole 0.06 step, is not known (if it was known, a could be precisely calculated by simply dividing 0.06*c with this time). But due to the fact that such Quasars red shift observations appear absolutely stacked by tenth of years, it is roughly (pointing to a maximum a over estimation) assumed that a 0.001 variation occurs every 50 years. (This is just assumed to stay within the 2% calculation error between the various steps showed in chapter 6). This leads to:

$$a = \frac{0.001 * 299792458}{3600 * 24 * 365 * 50} = 190 \text{ umt}/s^2$$

In spite of the monstrous over estimation method adopted, this value is still very much low than another undetectable (by terrestrial sensors technology) acceleration: the gravity acceleration exercised by the Sun on our planet. That is roughly 7000 umt/s^2.

So there is no way to detect a signature by experiments done inside our solar system. At least let use the a over estimated value to establish the minimum estimation limit for the time elapsing between matter expulsions from progeny galaxies. It is:

$$\Delta\text{tmin} = \frac{0.06 * 299792458}{0.00019 * 3600 * 24 * 365} \simeq 3000 \text{ years}$$

This means that such explosive events are separated by not less than 3000 years. Anyhow, this worst case sounds too much out of good sense because the contrast acceleration phenomenon works on large cosmological time scale. So it is not surprising that the real value of such separation could lie in the range of millions or even tenth of millions years.

Chapter 9

An interesting benchmark is made among a selected number of Transformation Models that, starting from end of XIX century till recent years, were proposed by several scientists aimed to generalize the Galilean Transformations and to enhance the Physics of macroscopic systems. The comparison is not claimed to be exhaustive, being focused on a limited number of experimental results whose interpretation has always been difficult (Sagnac effect, muon life elongation, Michelson experiment), and is also extended to another class of experiments not yet achievable at light of current technologies. Here the purpose is simply to point out logic disconnections or paradoxes that illegitimate the fundamentals of even popular theories. IG model seems to be the solely able to withstand the challenge moved by the above mentioned experimental classes (even if they are for sure still limited in terms of examined phenomenon's number).

The following five transformations models are considered (system S' move with respect S along x direction. System S and S' respective Cartesian axes are parallel, y=y' and z=z'). v is the speed module S sees S' to translate along x/x' direction, c is isotropic light speed module that holds in S and

$$\mathrm{R} = \sqrt{1 - \frac{v^2}{c^2}}$$

(Galilean Model "G")

$$x' = x - vt \qquad (9.1)$$

$$\mathrm{t}' = \mathrm{t} \qquad (9.2)$$

(Lorentz Length Contraction Model "LC")

$$Rx' = x - vt \qquad (9.3)$$

$$\mathrm{t}' = \mathrm{t}$$

(Lorentz Model adopted by Einstein for Special Relativity "SR")

$$Rx' = x - vt \qquad (9.4)$$

$$Rx = x' + vt' \qquad (9.5)$$

(Selleri Model "IT")

$$Rx' = x - vt$$

$$\mathrm{t}' = \mathrm{R}\,\mathrm{t} \tag{9.6}$$

(Inertial Galilean Model “IG”. k=3.3648219)

$$x' = x - vt \tag{9.7}$$

$$t' = e^{-kv/c}\,\mathrm{t} \tag{9.8}$$

Michelson Morley Experiment

It shows invariance of two ways light speed in all directions of space up to a today detectable delay between MM apparatus orthogonal beams of 10^-17 s. This number is limited by the better observable resolution of dark fringes shift at the apparatus telescope, actually 1/100 of Na wavelength (Na wavelength is 589nm), and should allow detection of “ether” drifts higher than 5km/s.

Classic Galilean (G) and Inertial Galilean (IG) models predict an interferometer effect that is function of the laboratory drift with respect Local Ether (our planet center of mass). Please refer to chapter 3 Local Ether Theory. The conclusion is that the positive effect prediction is still beyond MM apparatus orthogonal beams delay detection ability. (10^-17s versus 10^-19s needed to reveal the drift versus our planet center of mass that is 0.46km/s at equator worst case).

Instead all the other models predict zero interference by definition.

SR mathematical symmetry (9.4) and (9.5) converts isotropic light speed detection of reference frame S to S’ and vice versa. This implies, whatever S or S’ is selected to be at rest with MM apparatus, the light speed is always isotropic (as it must be by SR axiom) hence zero interference happens.

IT Theory is based on the assignment of isotropic privileges to a pragmatically selected Privileged inertial Reference Frame S. The physical assignment of S is speculative so it can be changed according to the effective estimation of a certain phenomenon. No trace, at least in present author understanding, of S as player of a “fixed” universal arbitration. By the way even if a not privileged reference inertial frame S’ is fixed at rest with MM apparatus, the two way light speed module remains constant and equal to the value that reigns in isotropic S. This by mathematical construction as can be easily seen using (9.4) and (9.6) and starting by c isotropic assumption in S.

The Lorentz Length Contraction LC model is based too on the supposed existence of a Privileged Reference Frame S that hosts full light speed isotropy. But, through an opportune length contraction of an S’ rod (as seen by S) in the direction of the translation between S and S’, it adjusts by mathematical construction using (9.2) and (9.3) the two way light speed module, evaluated by the frame S’ at rest with MM apparatus, to be constant and equal to the isotropic value that reigns in S.

In conclusion all the five models here considered seem to win their challenge with MM experiment outcome (for the different ways to interpreter it!) The author is in favor of G and IG estimations of very low positive MM interferometer effect, still hidden by actual interferometer technology limit, due to MM apparatus drift with our planet center of mass. This is in line with chapter 3 Local Ether Theory. Other models prediction of a priori negative MM outcome, due to their common conclusion (or assumption for SR model case) that two ways light speed is always isotropic, should be wrong.

Muon Life Elongation

This experiment was performed in 1977 into CERN muon storage ring. It shows (see chapter 5) an elongation of the circulating muon life to 28.87 times its laboratory rest life time (this happens when its circulating velocity is 0.9994 times the light one). This outcome confirms the observed life elongation of muons created by cosmic rays at stratospheric height. As it is known this phenomenon allows these muons to reach the terrestrial detectors before expiration of their observed life time.

G model is not able to predict muon life elongation because its time transformation (9.2) points to a universal unique time.

The Lorentz Length Contraction LC model is not able to predict muon life elongation because its time transformation (9.2) is the same of G model and points to a universal unique time.

IG model is able to account for this phenomenon (please refer to chapter 5 for the deeply digression). But very shortly it can be stated that exponential term into time transformation (9.8) accounts for it after a proper selection of k parameter (k=3.3648219). Moreover IG model needs to refer to a Privileged System S that is marking the universal absolute time, when no surrounding masses gravitational influence exerts on same Privileged System absolute clock peace. A selected not privileged system S’ is fixed at rest with the running muon in order to express its observed (by the Privileged System) time elongation through (9.8). It is remarked again that a 1% error over the mentioned k value accounts for the terrestrial lab unknown instantaneous velocity with respect Privileged System or, in other words, accounts to assimilate terrestrial lab (that hosts muon circulating ring) with Privileged System.

The SR model is able to account for this phenomenon because a terrestrial lab observer at rest with S (or S' due to the mathematical symmetry that allows any swap between two generic equally privileged inertial systems S and S' as by Special Relativity postulate) observes the following relation between its delta time S (measured between t1 and t2 at the different S places where S sees the muon to translate) and the muon delta time S' (evaluated by S' between correspondent t1' and t2' in the same S' place where the muon is at rest):

$$\Delta t' = R\Delta t = \sqrt{1 - \frac{v^2}{c^2}} * \Delta t \qquad (9.9)$$

This expression, retrieved by (9.4) and (9.5) under the above condition (S' measures are done in the same S' place), accounts for muon (observed by S) time dilatation at the following ratio of muon speed with respect light:

$$\frac{v}{c} = 0.9994$$

In spite of the nice prediction of the experimental measurement, a sneaky ambiguity arises from an only hypothetical experiment. What would happen if S' (the system at rest with the muon) performs its time measurements in the different S' places where in turn (reciprocally) S' sees the S terrestrial observer to translate? In this case S' is interested to compare these new own time measurements with the ones performed by S in the same S place where the observer is fixed. Now, quite magically from physical stand point but to be expected due to SR model symmetry, (9.9) formula changes because (delta t') and (delta t) exchange their positions inside it. At the end what is the right selection among these two possible choices?

The fact that travelling muon time dilates with respect the terrestrial lab observer time (from terrestrial lab point of view) or terrestrial lab observer time dilates with respect the travelling muon time (from muon point of view) cannot be physically sustained anymore. Reality is unique and cannot depend by the particular stipulation of a point of view. In this case the muon life elongation phenomenon is concerned, but this remark more generally applies to the identification of the reciprocal position of two reciprocally moving clocks lancets that, whatever it is, represents the only possible outcome of an experiment hence cannot depend from a particular point of view. Terrestrial lab sees circulating muon life that increase, a realistic theory pretends that also the muon rest observer agrees on this phenomenon. SRM symmetry cannot permit this so it cannot avoid the enormous paradox that has been historically accepted by positivistic dogmatism.

IT model, like IG model, does not incur into SR model paradox because in both model cases, in spite of the different coefficient (both are function of S' speed module as seen by S), S and S' times are linked by a proportional relation through mentioned coefficient. The geometrical mixing with space is avoided and both models recover the concept of absolute simultaneity (that is simultaneity between two events as seen by certain observer means simultaneity between them also if seen by any other observer in uniform motion with respect the first selected one). Definitively IT model through (9.6) is able to achieve the differential relation (9.9) that fits experimentally observed muon life time elongation and is not affected by S and S' point of view divergences.

Sagnac Effect.

IG model is able to predict Sagnac effect. This has been demonstrated in chapter 4. The conclusion is a coherent prediction of the Sagnac phenomenon by both the system that is at rest with the center of the rotating platform and by the overall cooperation of the infinite inertial systems that succeed each others in being at rest with all the border points of the rotating platform that are sequentially joined by each of the opposite light beams. This coherence is expressed for IG model by (4.17) formula. It shows that the ratio between the opposite beams delay for first case (evaluation by the system at rest with platform center) and for the second case (evaluation by above mentioned overall cooperation) is exactly equal to IG model inertial equation exponential (medium) coefficient between two not privileged systems S' and S''. Provided S'' is in this case no more a single inertial system but represents the contribution of the infinite inertial systems displacement about the platform border that own (as they are globally seen by Privileged System) a medium velocity that can be entered into IG model inertial equation exponential coefficient between two not privileged systems in place of the generic S'' instantaneous velocity in order the exponential coefficient expresses the right time dilation between opposite beams delay time observed by overall systems (S'' type) cooperation and the delay time observed by S'.

G model is able to predict Sagnac effect too being a simple sub case of IG model (k=0). This causes above ratio to be unitary due to absence of mentioned time dilatation.

LC model is able to coherently predict Sagnac effect too (keeping agreement between prediction of system at rest with rotating platform center and the prediction by the overall cooperation of the infinite inertial systems that succeed each others in being, at increasing instants, at rest with all the border points of the rotating platform). It follows the brief demonstration.

The system S (at rest with platform center) sees the platform border to rotate with tangential speed module v. Due to (9.2) and (9.3) equations a rod with rest length s is seen by S with moving length R*s with again:

$$\mathrm{R} = \sqrt{1 - \frac{v^2}{c^2}}$$

So the platform moving border circumference is seen by S to measure R*L where L is its rest measure (when the platform does not rotate). The beam that travels in agreement with platform rotation is seen by S to join the receiver (following a complete platform border circulation) after the time Ta where it must be:

$$\mathrm{c} * \mathrm{Ta} = \mathrm{R} * \mathrm{L} + v * Ta$$

This immediately leads to:

$$\mathrm{Ta} = \frac{\mathrm{R}*\mathrm{L}}{\mathrm{c}-v} \qquad (9.10)$$

It is straightforward to realize that the beam travelling opposite to platform rotation joins the receiver at:

$$\mathrm{To} = \frac{\mathrm{R}*\mathrm{L}}{\mathrm{c}+v} \qquad (9.11)$$

The delay between beams as seen by S is:

$$\Delta\mathrm{T} = \mathrm{Ta} - \mathrm{To} = \frac{2vLR}{c^2 - v^2} \qquad (9.12)$$

The generic system S' is instantaneously at rest with the rotating platform border. Taking the differentials of (9.2) and (9.3) and using |dx/dt|=c, then S' sees the following different light speed modules for the beam travelling according to platform rotation and the one travelling opposite to it:

$$\mathrm{c'a} = \frac{\mathrm{c}-v}{\mathrm{R}} \qquad (9.13)$$

$$\mathrm{c'o} = \frac{\mathrm{c}+v}{\mathrm{R}} \qquad (9.14)$$

This leads to the following prediction (for the opposite beams circulation times) by the overall cooperation of the infinite inertial systems that succeed each others in being, at increasing instants, at rest with all the border points of the rotating platform:

$$\mathrm{Ta'} = \frac{\mathrm{R}*\mathrm{L}}{\mathrm{c}-v} \qquad (9.15)$$

$$\mathrm{To'} = \frac{\mathrm{R}*\mathrm{L}}{\mathrm{c}+v} \qquad (9.16)$$

It is worthwhile to remark that each generic inertial system S' sees (in the precise instant it remains at rest with a selected point of the rotating platform border) the platform to be at rest, hence it sees the platform circumference measure to be simply L. This justifies expressions (9.15) and (9.16) retrieved by dividing L respectively with (9.13) and (9.14).

This lead to the following expression for the delay between beams as seen by mentioned overall cooperation:

$$\Delta T' = Ta' - To' = \frac{2vLR}{c^2 - v^2} \tag{9.17}$$

But (9.17) is equal to (9.12) so LC model predicts coherent results (exact identity) for the delay between beams as seen by S or by mentioned overall cooperation.

It is interesting to note the slight difference between G model prediction and LC model one. It is constituted by relativistic R factor present into LC prediction. Also IG model prediction is at net of R if it is done by S (system at rest with platform center) as by (4.6). Instead if it is done by the overall cooperation it includes the famous exponential term but this is coherent with IG inertial equation that accounts for the time dilatation of the platform border instantaneous rest systems as seen by the one at rest with the platform center. Coming back to R term difference, the R term into opposite beams delay prediction is present everywhere the selected model shows by its mathematical construction the R term added to the pure Galilean equation terms. This can be seen into (9.3) for LC model, into (9.4) and (9.5) for SR model, (9.4) for IT model. By the way SR model contains the R term only into prediction done by system at rest with center of rotating platform, IT model contains R term in both predictions even if in the one done by overall cooperation contains R^2.

SR prediction done by system S at rest with rotating platform center is equal to LC one case. It is given by (9.12) because of the same mathematic of (9.3) and (9.4). But SR model is not able to council S prediction and prediction by overall cooperation of the infinite inertial systems that succeed each others in being, at increasing instants, at rest with all the border points of the rotating platform. Because these inertial systems are built in Lorentz Transformations (9.4) and (9.5) with the same symmetrical privileges of S, so every distinct S' frame (each one sees S instantaneously move with respect him at the same uniform speed) distributed at any border platform point needs to see the opposite light beams to instantaneously travel around its platform border with the same speed as by SR dogma and by consequent symmetric mathematic contained into (9.4) and (9.5). The interferometer outcome at the receiver due to the overall cooperation of the different S' systems cannot be different than zero by construction… This is the second enormous paradox linked to SR model after the one remarked when muon elongation time experiment was discussed.

As just anticipated IT model, concerning prediction done by system S at rest with rotating platform center, behaves exactly like SR and LC. This is due to same (9.4) mathematic that leads to (9.12). Instead it differs by LC for the inertial term R present into time transformation (9.6). This leads to the following expression for the delay between beams as seen by overall cooperation of the infinite inertial systems that succeed each others in being, at increasing instants, at rest with all the border points of the rotating platform:

$$\Delta \mathrm{T}' = \mathrm{Ta}' - \mathrm{To}' = \frac{2vLR^2}{c^2 - v^2} \tag{9.18}$$

This is easily retrieved adopting the same procedure executed to exploit overall cooperation with LC model. This time there is R^2 in place of R because of the inertial term R present into time transformation (9.6). But coherence of IT model predictions (from S and overall cooperation points of view) is preserved because IT inertial equation (9.6) accounts for the time dilatation of the platform border instantaneous rest systems as seen by S at rest with the platform center. This R time dilatation reflects exactly in (9.18) with respect (9.12).

The above prediction analysis using the various models for the three considered experiments is summarized in the following table:

Feasible experiments	**Michelson Morley**	**Muon Elongation Time**	**Sagnac Effect**
Galilean Model	Fits the positive outcome (due to the interferometer technology limitation the positive outcome is not detected)	Cannot predict it because it does not account for S' time dilatation (as seen by S)	Predict it
Inertial Galilean Model	Fits the positive outcome (due to the interferometer technology limitation the positive outcome is not detected)	Predict it	Predict it
Lorentz Contraction Model	Fits by mathematical construction the negative outcome	Cannot predict it because it does not account for S' time dilatation (as seen by S)	Predict it
Lorentz Special Relativity Model	Fits by mathematical construction the negative outcome	Predict it. But a sneaky paradox on the reciprocal prediction of S' (that is in opposition to S one) is present. The justification of supremacy of terrestrial lab observer prediction cannot be found into SR model	It fails prediction if it is attempted through the overall contribution of the infinite inertial systems instantaneously at rest with rotating platform border
Inertial Transformations Model	Fits by mathematical construction the negative outcome	`Predict it	Predict it

Fig.1

Let move now to the other class of experiments (the one not practically feasible even if logically admissible). A couple of interesting examples will be used to test the various models axiomatic fundamentals to point out any disconnections between different point of view predictions.

S and S' systems exchange experiment.

This exchange of the behavior S sees S' and vice versa is generally achieved through interventions on the rods reference length of S and S' (limited to those rods oriented along the S and S' line of translation) and through interventions on the totality of the inner particle frequencies (or phases for IT model case) following some precise rules to act on such particles no matter if they are at rest with S and/or S'. As it will be shown for IT model case a sneaky ambiguity arises if some frequencies (namely clocks) are not submitted to the change.

G model is a pure relativistic model. It is needed no intervention at all on frequencies of matter at rest with S and S' to exchange S and S' role. Also rods reference length on S and S' remains unchanged. It is only needed to reverse versus of x and x' axis to get (9.1) and (9.2) reversed into S and S' notations. That is all to make S behave like S' and vice versa.

IG model allows S and S' systems exchanging themselves by reversing their x and x' axis versus and by opportune rescaling of their rest particles inner frequencies (namely clocks) peace. This is done by mean of the exponential factor E=$e^{-kv/c}$, dividing t'/E for intervention on S' and multiplying E*t for intervention on S. Note that this easily follows by (9.7) and (9.8). At the end the same equations are retrieved with simple S and S' notation exchange. The Privileged System S is miraculously passed to S' and vice versa! (Unfortunately this is not practically feasible…). The agreement of the IG model fundamentals with physical good sense is proven by the following consideration. If some clocks, at rest with S (S') before S and S' exchange, are left untouched, the just exchanged systems see the peace of these untouched clocks to run at a changed value with respect the totality of other rest particles clocks, lying on S' (S) too, that instead were submitted to above mentioned intervention. But this is quite normal. At the end these untouched clocks speed results altered (as seen by each exchanged system) in perfect agreement with the E factor amount (divided or multiplied) that acted on both systems rest particles clocks.

LC model allows S and S' systems exchanging themselves by reversing their x and x' axis versus. This in addition to x and x' axis reference rods rescaling. (By mean of the R relativistic factor, dividing x/R for intervention on S and multiplying Rx' for intervention on S'). This easily follows fro (9.2) and (9.3). The system S is passed to S' and vice versa. Here again there is no hint that can compromise physical good sense of LC fundamentals. In case a reference rod is left unchanged, it is pretty normal the changed ones measure it having different length with respect them in reason of R factor.

SR model is a pure relativistic model like G. So it is needed no intervention at all on frequencies (namely clocks) of particles at rest with S and S' to exchange S and S' role. Also rod reference lengths along x and x' remain unchanged, it is only needed to reverse versus of x and x' axis. That is all to make S behave like S' and vice versa.

IT model allows S and S' systems exchanging themselves by reversing their x and x' axis versus and by opportune re synchronization of their rest particles frequencies. That is by a simple phase change of particles inner clocks. This follows from (9.4) and (9.6). This is not just trivial as above simple example (see IG model) of peace change through a constant E factor multiplying or dividing. So these are the few analytical steps:

$$Rx' = x - vt \tag{9.4}$$

$$\mathrm{t}' = \mathrm{R\,t} \tag{9.6}$$

Taking (9.4) and (9.6) and isolating at first member R*x:

$$Rx = R^2x' + vt' \tag{9.19}$$

The above second member must be equalized to:

$$R^2x' + vt' = x' - vtn'$$

Where tn' is the new (after manipulation) S' clock time. This ensures the new expression (9.19) transforms into the same form of (9.4) but into reversed S and S' notations. So tn' expression is:

$$tn' = \frac{(1-R^2)}{v}x' - t'$$

Using R relativistic factor expression, tn' is:

$$tn' = \frac{v}{c^2}x' - t' \tag{9.20}$$

At the end tn' is retrieved adding to -t' an expression linear into x'

Also expression (9.6) must be transformed into its same form but with reversed S and S' notations. So:

$$\mathrm{tn} = \mathrm{R\,tn}'$$

This leads to the following tn expression:

$$tn = R\frac{v}{c^2}x' - Rt'$$

Using (9.4) and (9.6) this results in:

$$tn = \frac{v}{c^2}(x - v\mathrm{t}) - R^2\mathrm{t}$$

$$tn = \frac{v}{c^2}x - \mathrm{t} \quad (9.21)$$

At the end tn is retrieved adding to -t an expression linear into x

By mean of (9.20) and (9.21) synchronizations the (9.4) and (9.6) are restored with reversed S and S’ notations. This proofs the above mentioned statement. Note also that, after (9.20) and (9.21) synchronizations, the peace relation (9.6) holding between S’ and S clocks:

$$\mathrm{t}' = \mathrm{R\,t} \quad (9.22)$$

Is reverted into:

$$\mathrm{tn} = \mathrm{R\,tn}' \quad (9.23)$$

This shows that, as by IT model (9.4) and (9.6), before synchronization the S’ clocks peace was slower than the S one. Instead after resynchronization, (9.22) and (9.23) show S’ clocks peace is faster than S one (The Privileged System has been moved to S’ from S).

In conclusion the same (9.4) and (9.6) equations are retrieved with simple S and S’ notation exchange. The IT model Privileged System S is miraculously passed to S’ and vice versa! (Even if unfortunately this is not practically feasible…).

But the agreement of the IT model fundamentals with physical good sense faces a big problem. That is a sneaky ambiguity arises after S and S' exchange because, as above demonstrated, this operation is performed only through S and S' respective particles clocks resynchronization. But this means just move back or forth the clock lancets. This cannot alter their relative peace for sure! While the claimed result of S and S’ exchange leads to the mathematical conclusion that clocks on system that just moved from S to S’ are now slower (through R factor) than those on board of system just moved to S privileged, (before the exchange the relative peace was instead reversed), physical good sense is against this picture. Because a simple re synchronization of clocks (moving back or forth their lancets) cannot alter their peace!

This is additionally proved by the following consideration. If some particles clocks, at rest with S (S’) before their exchange, are left untouched, the just exchanged systems see these untouched clocks to run at a changed value with respect the totality of other rest particles clocks, lying on S’ (S) too, that instead were submitted to above mentioned re synchronization intervention. This is because these untouched clocks peace is still the one before the exchange. And, after the S/S’ exchange, it is the peace according to the opposite system re synchronized clocks peace that is in turn connected through the R factor with the actual system re synchronized clocks peace. But again, these untouched clocks speed cannot differ by the R factor from the one belonging to the same system re synchronized clocks that at the end have only seen their lancets moved back or forth by some amount. There is no physical meaning in this prediction.

Hence IT model fundamentals are disconnected by physical good sense. To be remarked that this enormous unsolvable paradox is the only weak point that affects IT model that has at least the merit to restore absolute simultaneity concept among theories that admit time dilatation among different inertial systems. The residual paradox is due to the survived attempt to keep two way light speed constant in every inertial systems. This is a counter proof of the physical inconsistency of such paradigm that cannot hold, neither in an alternative model with respect popular SR model.

A & B twin separation and reunification experiment.

Twin A is forever stopped on board an inertial system S. Twin B, initially at rest with A, moves far away (after having been submitted to a short starting acceleration provided by its space sheet reactor) and at a certain point it briefly accelerates, again by using its space sheet reactors, this time towards twin A until he joins the same constant speed module of the departure journey, this time causing him to reunite with twin A. When twin B finally reunites with twin A, a last short acceleration (in module exactly equal to the first starting acceleration but with opposite versus) is impressed by its space sheet reactor to allow him to land again at rest with twin A. Given twins personal clocks were exactly synchronized before separation started, what will be the relative clocks situation after reunion? Twin A clock measurement advances twin B clock one or vice versa? Or the clocks are still synchronized?

Note that system S' is really split into two separate inertial systems: the first one at rest with twin B when twin B travels at constant departure speed as seen by twin A and the other one at rest with twin B when twin B travels at same constant return speed (with inverted versus) as again seen by twin A.

G and LC models deal with an absolute time common to all the observers uniformly moving with respect each other. This is expressed by the simple (9.2) relation. So twins that separate and reunite cannot see their clocks signing different times for any reason. This is predicted by both S and S' points of view again through (9.2). Also, and this is obviously valid for all the next cases too, acceleration does not affects clocks peace (this was already used when discussing the muon life elongation experiment in chapter 5).

SR model is affected by the paradoxical disconnection of S and S’ points of view (already highlighted in previous considerations regarding muon life elongation experiment). This disconnection definitively avoids twin experiment predictability by use of SR model.

Note that historically accepted relativistic paradigm of younger age for twin submitted to acceleration during its cinematic evolution is wrong because it uses positivistic permission of different physical realities (acceleration versus gravity) function of the purely change of inertial system point of view. The author believes in objective realism and in doing so opposes to mentioned improper use of different physical realities, upon simple point of view change done by relativistic paradigm, and adopts Selleri critic (at least this is the author interpretation of the scientist clever notes). Reality is unique for definition, and is independent by the selected point of view. So the following is the twin B (S’ point of view) unacceptable choice of reality. It is unacceptable simply because it is not shared with twin A (S point of view). Twin B feels the force due to sheet reactor that is causing him to accelerate towards twin A when the departure journey is completed. He “knows” his system S’ is no more inertial because accelerated from its sheet reactor but he decides to misinterpret this reality with another one, the brief presence of a gravitational field due to a mysterious and brief mass apparition at the sheet opposite side of twin A. He also “imagines” to be anchored to a structure at rest with this big mass. This is what allows him to feel the gravity. Instead twin A freely falls in the gravitational field so he is not aware of this brief magic situation while its cinematic approach is seen and explained by twin B (system S’) as due to mentioned gravitation. Twin A (system S) in turn still believes that twin B cinematic evolution is only due to sheet reactor induced acceleration and consequently predicts twin A and twin B clocks unbalance at reunion, with twin B clock in delay with respect its own clock, only due to its detected uniform twin B speed. This is done through SR model application (twin B clock measured start and stop times are in the same S’ location while twin A clock measurements happen into the different S locations where Twin A sees twin B to travel). It is really the abusively invented gravitational reality holding only for twin B (S’ point of view) that magically recovers the time unbalance seen this time by twin B system S’ point of view, (this time unbalance is just the opposite of what seen by twin A system S point of view), that is accumulated by the departure and return journeys due to SR model application (twin A clock measured start and stop times are in the same S location while twin B clock measurements happen into the different S’ locations where Twin B sees twin A to travel). More precisely from twin B point of view the twin A clock delay with respect its own clock is more than recovered (because the final result must be a clock A anticipation to fit twin A point of view) by the brief immersion in such extemporary gravitational field. At the end twin B prediction on clocks agrees with the one done by twin A.

The fact that the far is a clock from a gravitational field source the quicker is its speed (with respect a clock closer to the source) is a physical phenomenon whose evidence is accepted by many theories.

But it is not possible to arrogate a “personal” gravitational field only for system S’ and not for system S as done by relativistic philosophical methodology to recover twin B system S’ and twin A system S disconnected predictions on clocks status at reunion. This makes the above presented magic recovered agreement to be unacceptable. Again, gravitation field impacts clocks peace, acceleration does not!

If logic (and not positivistic dogmatism) was pursued the relativistic demonstration would have been faked by the following simply consideration. If it is gravity to start reunion of twin A and twin B, then gravity needs to be considered also by twin A computation. Twin A must be kindly advised by twin B that it was indeed a short gravitational field to induce the cinematic sheet motion reverse and not the on board reactor activation. Unfortunately, being twin A freely falling into such extemporaneous gravitational field, he has no chance to realize this unexpected situation. He relies only on the honesty of twin B that (if it was secured by relativistic philosophy) should invite twin A to include gravity into its computation. The twin A cinematic prediction remains unaffected (equivalence principle holds for cinematic trajectories), but a correction on top of clocks unbalance due to pure twin A SR point of view is unavoidable.

Definitively, also twin A should include into its computation of final clocks status the presence of the brief gravitational field “invented” by twin B at its turning point in place of the effective propulsion given by sheet reactors.

The following is the unavoidable correction twin A should include in its computation. Twin A sees twin B clock to be closer to the extemporary gravitational field source so it almost instantaneously (at the journey turning point) accumulates another delay contribution. At the end it sums up with the one expected by twin A in the case only canonic acceleration (the ones that does not impact clocks peace) was considered. This further correction fakes the complicated relativistic explanation of reuniting twins! If gravitational field is not omitted by twin A system S computations (it must not be omitted because reality is univocal no matter S or S’ systems point of view selection), then the twin B system S’ clock delay (as predicted by twin A system S) becomes excessive with respect the one as predicted by twin B system S’ point of view. This invalidates the relativistic conclusion of twin predictions agreement.

As said at the beginning, if relativistic approach “honestly” does not include gravitation for both systems, SR model is affected by the paradoxical disconnection of S and S’ points of view (each one predicts its clock to be in advance with respect the other system one). This conflict has already been highlighted in current chapter considerations regarding muon life elongation experiment. Conclusion: no way for SR model to coherently predict A & B twin separation and reunification experiment.

IT model is able to predict the twin experiment outcome without conflict between S and S' point of view. The predicted outcome is not unique by the way. It depends upon system S and S' dislocation with respect the Inertial Transformations model Privileged System (that is the inertial system that hosts light speed isotropy in IT model theory). To show this let take the following two distinct cases.

First case: the Privileged System is at rest with the twin A system S (the twin that remains inertial during the whole experiment because no reactor force acts on it). It is easy to understand that in this case IT model shows (9.6) relation between twin A and twin B clocks:

$$\mathrm{Tb} = \mathrm{RTa} \tag{9.24}$$

Being

$$\mathrm{R} = \sqrt{1 - \frac{v^2}{c^2}} \tag{9.25}$$

Where v is the speed module twin A sees twin B firstly separate and after reunite with him. Tb is the time marked by twin B clock and Ta the one marked by twin A clock at their reunion. (Provided both clocks where synchronized Ta=Tb=0 at the separation start up). Pointless to remind that twin B system S' clock is submitted to acceleration phases but they do not alter its peace and this is shared by both systems S and S' points of view. This is an evidence accepted by all the theories here examined (a part the relativistic one that invents a gravitational field in place of acceleration for twin B system S' point of view only, this statement has been already deeply analyzed in current chapter).

Second case: the Privileged System is the inertial system that sees twin A and twin B separating at the same speed in opposite directions during twin A departure journey. By mean of (9.6) it is possible to realize that in this phase twin A and twin B times at the turning point are related to Privileged System time T by:

$$\mathrm{Ta} = \mathrm{RT} \tag{9.26}$$

$$\mathrm{Tb} = \mathrm{RT} \tag{9.27}$$

Being v the speed module Privileged System sees twin A and twin B separating by him. And R is given again by (9.25). Privileged System, starting from the turning point, while continuing to see twin A separating as before, evaluates twin B speed module (now oriented toward twin A) to be increased by three times (3v) in order the reunion happens in another Privileged System time T. This ensures in turn that twin A appreciates the reunion to happen in another twin A time Ta due to (9.26). And by this way second case works exactly as first case as far as twin B speed module evaluation is performed by twin A (the twin that remains always at rest with an inertial system). At the end of the reunion the following are twin A and twin B final times as function of Privileged System time 2T (note that before overall process starts it is T=Ta=Tb=0):

$$\mathrm{Taf} = 2\mathrm{RT} \tag{9.28}$$

$$\mathrm{Tbf} = \mathrm{RT} + \mathrm{R'T} \tag{9.29}$$

Being:

$$\mathrm{R'} = \sqrt{1 - \frac{9v^2}{c^2}} \tag{9.30}$$

Where 3v is the speed module Privileged System sees twin B during its reuniting journey. From (9.28) and (9.29):

$$\mathrm{Tbf} = \frac{1}{2}\left(1 + \frac{\mathrm{R'}}{\mathrm{R}}\right) * \mathrm{Taf} \tag{9.31}$$

Before comparing (9.24) and (9.31) it must be put inside (9.25) expression (for first case) the same speed module of twin B as seen by twin A that holds for the second case. That is, by using (9.4) and (9.6):

$$v\mathrm{b} = \frac{v}{R^2} \tag{9.32}$$

This ensures the correct evaluation of Privileged System different assumptions impact on twin clocks final marked time. So putting (9.32) inside (9.24) it results in:

$$\mathrm{Tb} = \sqrt{1 - \frac{v^2}{R^4 c^2}} * \mathrm{Ta} \tag{9.33}$$

R is still given by (9.25). Now it is possible compare first case (9.33) and second case (9.31) Privileged System positions hypothesis for selected v values in order to see the different clocks ratios:

v=0

Tb=Ta=Tbf=Taf   This means no discrepancies between case 1 and case 2 due to trivial common situation that the separating process never starts hence both twins remain at rest with Privileged System for both case 1 and case 2.

v=c/3 (note that this is the maximum v value allowed by (9.30) in order to not violate IT model maximum light speed module c).

$\mathrm{Tb} = \frac{\sqrt{55}}{8} * \mathrm{Ta}$ Case 1   (9.34)

$\mathrm{Tbf} = \frac{1}{2}\mathrm{Taf}$ Case 2   (9.35)

It is clear that Tb=0.927Ta is very different by Tbf=0.5Taf. Case 1 implies a very limited twin B clock delay versus twin A one at reunion. Case 2 implies a delay much more heavy (twin B clock has accumulated a delay corresponding to half twin A clock measure).

Conclusion: the initial assumption is confirmed. Twin clocks delay at reunion is dependent by IT model Privileged System assumed position.

IG model is dependent by its Privileged System assumed position too. It is easy to show this adopting the same two cases of Privileged System dislocation just discussed for IT model. Mathematic is almost equivalent due to absolute link between both systems inertial equations. The second case formal equation is still (9.31) provided R and R' are no more given by (9.25) and (9.30) but by following new expressions:

$$R = e^{-kv/c} \tag{9.36}$$

$$R' = e^{-3kv/c} \tag{9.37}$$

The first case formal expression changes from (9.33) because of new (9.36) for R factor and because the twin B speed module as seen by twin A (9.32) changes into:

$$v\mathrm{b} = \frac{v}{\mathrm{R}} \tag{9.38}$$

Inserting (9.36) and (9.38) into (9.24), the new first case formal expression is:

$$Tb = e^{-kv/Rc} * \mathrm{Ta} \tag{9.39}$$

Now it is possible compare first case (9.39) and second case (9.31) Privileged System positions hypothesis for selected v values in order to see the different clocks ratios:

v=0

Tb=Ta=Tbf=Taf This means no discrepancies between case 1 and case 2 due to trivial common situation that the separating process never starts hence both twins remain at rest with Privileged System for both case 1 and case 2.

v=c/3 (note that this is no more a maximum threshold for actual paradigm. Light speed module is not limited by IG model).

$\mathrm{Tb} = 0.031 * \mathrm{Ta}$ Case 1 (9.40)
$\mathrm{Tbf} = 0.553 * \mathrm{Taf}$ Case 2 (9.41)

It is clear that Tb=0.031Ta is very different by Tbf=0.553Taf. Case 1 implies a very heavy twin B clock delay versus twin A one at reunion. Case 2 implies a less delay (twin B clock has accumulated a delay corresponding to roughly half twin A clock measure).

v--> infinite

$\mathrm{Tb} = 0 * \mathrm{Ta}$ Case 1 (9.42)
$\mathrm{Tb} = 0.5 * \mathrm{Ta}$ Case 2 (9.43)

The asymptotic situation is materialized. Case 1 sees definitively frozen twin B clock, Case 2 is exactly seeing twin B in delay of half the twin A time.

The above prediction analysis using the various models for the two considered not practically feasible experiments is summarized in the following table:

Not yet practically feasible experiments	**Exchange of S and S' systems.** (Possible physical ambiguities following this operation)	**A & B twins separation and reunification experiment as seen by S (at rest with A) and S' (at rest with B)**
Galilean Model	plenty coherence. G is a fully relativistic model	coherent result holds independently by S or S' point of view. A & B twin age remains equal.
Inertial Galilean Model	plenty coherence. Both S and S' systems can exchange themselves through opportune rescale of their clocks peace. (by mean of the exponential factor E, dividing t'/E for intervention on S' and multiplying E*t for intervention on S).	coherent result holds independently by S or S' point of view. A & B twin relative age depends on their cinematic evolution with respect Privileged System. But A age is always higher than B age.
Lorentz Contraction Model	plenty coherence. Both S and S' systems can exchange themselves through opportune rescale of their x axis. (by mean of the R factor, dividing x/R for intervention on S and multiplying Rx' for intervention on S').	coherent result independently by S or S' point of view. A & B twin age remains equal.
Lorentz Special Relativity Model	plenty coherence. SR is a fully relativistic model	Historically accepted paradigm of younger age for twin not submitted to acceleration during its cinematic evolution is wrong. (Please see chapter 9 discussion). So SR model remains affected by the sneaky paradox on the twins age prediction of S' that is in opposition to S one (the same ambiguity pointed out for muon life elongation experiment, due to SR symmetrical mathematical construction)

Inertial Transformations Model	a sneaky ambiguity arises after S and S' exchange because this operation is performed only through S and S' respective clocks resynchronization that simply means moving back or forth the clock lancets. This cannot alter their relative peace (please refer to chapter 9 discussion)	coherent result holds independently by S or S' point of view. A & B twin relative age depends on their cinematic evolution with respect Privileged System. But A age is always higher than B age.

Fig.2

Looking to current chapter Fig.1 and Fig.2 summaries, it is immediate to realize that the solely model able to withstand the correct prediction of both experimental class outcomes is IG model. The competition of IT model is very strong. Unfortunately IT model falls with the “Exchange of S and S' systems experiment” prediction inability due to the sneaky ambiguity previously discussed. By the way IT model philosophy is “defended” by IG model. Restore of absolute simultaneity and ability to predict the other intriguing outcomes, where the presence of anisotropic light behavior is needed, is pursued. MM experiment obviously needs the supposed positive outcome (not achievable by actual interferometer technology interpretation). The IT model fault has been the trigger for present author to start the challenge of this new IG model theory proposed with actual tractate. The personal scare felt by discovering the IT model unfortunate paradox stimulated the author to find a new solution able to defend all the wonderful philosophical patrimony learnt by IT model. In other words IG model proposal is merit of cultural background and curiosity stimulated by Inertial Transformation dissertations that captured the present author after a first casual meeting with Selleri ideas on the web. For sure further conclusions, linked to IG model proper theory, are proposed along these chapters. They go well beyond what learnt on the web with IT model theory and are pure responsibility of the writer. Also it is not author arrogation to think that all the present concepts can be accepted by the minds of scientists available for critic re discussion of macroscopic physic fundamentals or by philosophers or clever thinkers or whatever kind of free lancer people. This remains a personal proposal freely developed first at all for personal cultural fun.

Chapter 10

Wrap up of the relevant ideas matured along the current journey. A very strong theoretical unification is ported by the New Galilean paradigm through Adapted Galilean Principle because the only distinction between different (in term of Compton frequency) emitted particles is quantitative and is accounted by coefficient H. A strong new stimulus is offered by new Galilean paradigm to Quantum Mechanics further developments. A polite critic to physical theories widely accepted by scientific community because founded on attractive mathematical cosmetic despite their fundamental paradoxes is presented. The chapter ends with some relevant conclusions on IG model theory and with a final remark on the non relativistic essence of Energy.

Along the first chapters of current tractate it has been firstly extended the Galilean velocity vector addition principle to the photon motion. This is not against local embedding in all inertial systems the invariance of electromagnetic laws provided that light is emitted by masses at rest with them and their detectors and there is no disturbance provided by other masses floating in the nearby. Under this condition each inertial system sees light propagate isotropic ally. Instead, if light is emitted by an isolated mass not at rest with a given inertial system detector, the mentioned vector addition principle accounts for the influence of the isolated mass velocity on the light speed detected by the inertial system.

In order to account for Sagnac experiment outcome, that in turn points to evidence of a (not at rest with the rotating platform) inertial frame hosting light speed isotropy, an Adapted Galilean velocity vector addition principle has been postulated. It simply substitutes to the emitting mass velocity the velocity of the center of mass of the whole mass aggregation floating in the nearby of the emitting mass. By the application of such principle, our planet center of mass becomes the privileged reference able to see light propagating always isotropic ally despite the motion of the emitting mass. This principle furthermore disrupts mentioned electromagnetic invariance between the different inertial systems instantaneously moving with respect our planet center of mass because their rest masses are not isolated by our planet whole mass. If these reference system masses could be moved sufficiently far away from our planet mass influence and also far away by their reciprocal influence, then everyone of these reference systems would see restored its proper electromagnetic invariance provided that light is still emitted by their own rest masses.

To be noted that this paradigm points to an infinite number of cosmic inertial systems that are able to see light propagate isotropic ally even if it is emitted by a mass not at rest with them. They are the center of mass of every cosmic mass aggregation and are instantaneously inertial but in nature a true inertial system is hard to be found! (They are centered on stars, planets etc..). Each one represents one local “ether”. Local ether theory explains Sagnac experiment and also not yet achieved MM experiment positive outcome. This one will be possible with a progress in interferometer technology of at least two magnitude orders in beam delay detection because our planet center of mass drift seen by terrestrial lab is 0.465 km/s at equator worst case.

As by chapter 3 deep discussion, the Adapted Galilean velocity vector addition principle generally describes the nearby masses influence in "launching" a given sub atomic particle on top of the solely contribution expected by the local emitting piece of matter (atom). More specifically if the emitting atom is sufficiently isolated by other surrounding atoms, it is the solely responsible of both velocity vector components (anisotropic and isotropic one) of the emitted particle as seen by a detecting inertial system in motion with respect emitting atom. That means the emitting atom acts to build the particle isotropic vector component (this velocity component is really a universal invariant that holds in relativistic way for any emitting atom no matter what is its motion status). If the emitting atom is not isolated by other masses, it is still the solely responsible of the action to build the isotropic velocity vector component of the emitted particle but the surrounding atoms cooperation provide the action necessary to build the particle anisotropic vector velocity component. Every surrounding atom acts at distance on the particle (quite instantaneously when the emitted particle exits the emitting atom already owning its isotropic speed) to force the particle to vector ally add a speed component equal and opposite to the one owned by the emitting atom when the particle was emitted. Every individual force is weighted by the related atom pondered mass through (3.1). It acts at distance and impresses to emitted particle an acceleration that is function of current emitted particle mass (in turn its mass depends by its absolute velocity module as seen by Privileged System) and of course by the analogue forces acting on the emitted particle from other surrounding atoms. At the end of a certain time evolution the emitted particle reaches his equilibrium because the resultant force acting on it reaches the zero value. This corresponds to emitted particle vector anisotropic velocity steady state (as seen by Detecting System that is assumed for sake of simplicity to coincide with Privileged System) that is given by famous $\boldsymbol{vp}$ anisotropic component expressed by (3.2).

The particle travelling Compton Energy before its launch and its travelling mass are respectively (the Detecting System is at rest with the Privileged System):

$$Ec = h\gamma * e^{-\frac{kv0}{c}} \tag{10.1}$$

$$m = \left(\frac{h\gamma}{c^2}\right) * e^{-k\frac{|\boldsymbol{v0}|}{c}} \tag{10.2}$$

Where $h\gamma$ is the particle Compton Energy if the emitting atom (and consequently the particle itself) was at rest with the Privileged System. So $\boldsymbol{v0}$ is the emitting atom velocity module as seen by Privileged System that coincides with Detecting System.

Using (3.2), the expression of $\boldsymbol{vp}$ (emitted particle anisotropic velocity component) can be decomposed into surrounding atom mp(i) solely contribution. It is:

$$\boldsymbol{vp(i)} = \frac{mp(i)*\boldsymbol{v}(i)}{\sum_{j=0}^{n} mp(j)} \tag{10.3}$$

Where n is a very larger number that identify the total surrounding atoms including emitting atom. The emitting atom is atom 0, **v**(i) is the surrounding atom mp(i) velocity.

Using (3.1) and (8.2):

$$\boldsymbol{vp(i)} = \frac{h\gamma(i)/c^2 * e^{-\frac{kv(i)}{c}} * e^{-H*|\boldsymbol{r}-\boldsymbol{ri}|}}{\sum_{j=0}^{n} h\gamma(j)/c^2 * e^{-\frac{kv(j)}{c}} * e^{-H*|\boldsymbol{r}-\boldsymbol{rj}|}} * \boldsymbol{v}(i) \tag{10.4}$$

The mp(i) atom acts with a force at distance on emitted particle to bring it at its pondered velocity **vp(i)** quite instantaneously but the other surrounding atoms are in turn influencing the particle with the same purpose, this results in a final particle anisotropic velocity **vp** in place of **vp(i)** as it would be by individual atom effort.

On top of the anisotropic velocity component built through work spent (or gained) by the surrounding atoms cooperation, the emitted particle already owns an isotropic velocity component that is built through action spent by the solely emitting atom. This action is performed before the anisotropic velocity component **vp** is built and the particle is still inside emitting atom orbital.

Coming back to the anisotropic process, its behavior is particularly appreciable the lighter is the emitted particle. It can be accounted noting that coefficient H inside (3.1) must be function of the emitted particle travelling mass (10.2) or equivalently function of its travelling Compton frequency (10.1) as are seen by Privileged System. The lighter is the emitted particle mass the smaller is H. This allows (3.1) to include atoms more and more far from the emitting location. This explains why photons (in new Galilean theory they are anyway massive particles, see also chapter 9) are launched with a velocity offset that is realized through the cooperation of matter even very far. How much far? Sagnac experiment with big radius and fixed platform (see chapter 4) points to the inclusion of at least all the planet mass because the positive interferometer outcome depends by the Focault rotation component of our planet at the concerned latitude. The following experiment remaking should be interesting to further characterize H.

To perform fixed platform Sagnac experiment at equator (here Focault rotation component is null). An eventual non zero outcome would point to the needed inclusion of extra planet influence. This influence, following Local Ether Theory paradigm in supposing H so small to involve all the solar system mass in building the anisotropic light component, is originated by vector contribution of our planet center of mass instantaneous rotation around solar system center of mass (the component parallel to platform orthogonal) with additional platform instantaneous rotation about our planet center of mass (but this is zero at equator). Solar system center of mass is mainly determined by Jupiter displacement around Sun. Jupiter takes around 12 years to complete his circulation. This allows considering that yearly terrestrial Sun circumnavigation happens in presence of an almost fixed solar system center of mass (it is also located in the immediate neighbors of the Sun or even internally to Sun itself). So our planet center of mass mainly rotates with respect solar system center of mass with ω1=2*10^-7 rad/sec (the same value as the center of mass was exactly located in the center of Sun). The component of such rotation oriented parallel to terrestrial equatorial plan is ω1p=cos(23^o) * 2*10^-7 = 1.84*10^-7 rad/sec where 23^o is the angle between terrestrial rotational axis and ecliptic plan. This is the maximum rotational value of the fixed platform about solar system center of mass that happens twice every day (when the axis orthogonal to platform plane is parallel to **ω1p**). So ω1p=1.84*10^-7 rad/sec leads to fixed platform minimum radius R=880mt to account for interferometer effect raised by solar system center of mass (when it is better detectable due to maximum twice daily **ω1p** contribution). This minimum R value can be derived using (4.7). In practice the Michelson – Gale fixed platform Sagnac experiment uses mirrors positioned at the corners of a rectangular perimeter whose major side length must be in the same magnitude order of mentioned R. Due to not circular mirror dispositions the following formula holds **(1)**. For current discussion let instead refer to a “classic” Sagnac very large diameter and fixed platform that is ruled by (4.7). If instead H value is sufficiently large to account only for terrestrial and lunar masses, then terrestrial and lunar center of mass circulates around terrestrial center of mass with a period of 28 days. In this case this value can be used to build ω1=2.59*10^-6 rad/sec for reciprocal circulation of our planet center of mass about terrestrial and lunar center of mass. The component of such rotation oriented parallel to terrestrial equatorial plan is ω1p=cos(28^o) * 2.59*10^-6 = 2.28*10^-6 rad/sec where 28^o is the angle between terrestrial equatorial plan and **ω1** (this derives by the fact that lunar orbital plan is inclined of 5^{o}with respect ecliptic). This is the maximum rotational value of the fixed platform about terrestrial and lunar center of mass that happens twice every day (also in this case when the axis orthogonal to platform plane is parallel to **ω1p**). So ω1p=2.28*10^-6 rad/sec leads to fixed platform minimum radius R=250mt to account for interferometer effect raised by terrestrial and lunar center of mass (when it is better detectable due to maximum twice daily **ω1p** contribution). Please note that both above ω1p values are anyway negligible if compared with ω2=5*10^-5 rad/sec that is present at Milan latitude only considering fixed Sagnac platform rotation about our planet center of mass. Let include the value of cos(17^o)*2.28*10^-6 = 2.18*10^-6 rad/sec in computing the more exact minimum radius at Milan latitude (**ω1** bends of minimum 17^o with respect **ω2** once time every day). It is enough to add 2.18*10^-6 rad/sec to ω2=5*10^-5 rad/sec. Again using (4.7) this leads to minimum R=52mt against minimum R=53mt got in chapter 4 by simply including only ω2 value. So it is practically impossible to account for extra planet influence well outside of equator. In conclusion a fixed Sagnac platform experiment at equator (the platform radius being at least 1km) presenting zero interference points to an high H value so that (3.1) becomes negligible after some thousand kilometers far from light emitting location, while not zero values for **Δ**t between beams would point (using (4.7) explicated in term of ω1) to ω1 value to be carefully interpreted if caused, through H values more and more lights, only by lunar influence or by nearest planets ones (at the time the experiment is performed) or by whole solar masses.

As just proposed, all these coming new experiments should be oriented to clarify with a decent approximation the entity of H coefficient into (3.1) for the photon case (emitted particle is a photon). Moreover it is more likely that will be possible only to estimate a high limit for H (this will point to a minimum spatial range of far masses influence for photon case in term of emitted particle).

Passing in gradual way to heavier sub nuclear particles, it could be interesting to attempt a Sagnac experiment by mean of electrons made opposite beams. Surely this is a difficult experiment because real electrons speed must be not altered by collimation circuits. The path should consist of a vacuum channels polygonal (one for each opposite beam). Every polygonal segment should be connected to the next one by mean of an electron mirror (it consists of a high and constant electric field controlled volume). The two opposite polygonal should terminate on a common silver plate target. Due to the known particle waveform dualism that is a property also of electrons (this property is proved by double slit experiment performed with electrons), an interference fringe figure is expected to be collected by an electron microscope able to detect the secondary electron emission caused by electron beams impact on the silver plate. Let see what should be the needed Sagnac platform speed to get the minimum detectable **Δ**t between opposite electron beams. For sake of conservative approach let consider that the minimum separation between fringes detectable for electron beams case is limited by 10^5 times the electron Compton wavelength (considering the electron travels into polygonal at 10^7mt/s). By rearranging (10.2), that in this new Galilean paradigm holds for any kind of particles, the travelling electron Compton frequency is:

$$\gamma = \left(\frac{c^2}{h}\right) * m * e^{\frac{kv0}{c}} \qquad (10.5)$$

Where m= 9,109382616*10^-31 kg is the rest electron mass as seen by Privileged System that (as remarked several times) can be assumed to coincide with terrestrial lab simply accounting this assumption inside k=3.3648219 coefficient error. $v0$=10^7mt/s is the electron considered speed. h=6.6260695729*10^−34 J*s is the Planck constant. So the electron travelling Compton wavelength is:

$$\lambda = v0 * T = \frac{v0}{\gamma} = v0 * \left(\frac{h}{mc^2}\right) * e^{-\frac{kv0}{c}} \qquad (10.6)$$

λ =7.23*10-^14 mt. With the above conservative assumption the minimum separation between fringes detectable by electron microscope for electron beams case is around

7.23*10^-9 mt. This leads for the minimum detectable **Δ**t between opposite electron beams to:

$$\Delta t = 7.23 * \frac{10^{-9}}{v0} = 7.23 * \frac{10^{-9}}{10^{7}} = 7.23 * 10^{-16} \quad (10.7)$$

By reusing (4.6) also for electron Sagnac experiment, it is needed to consider $v0$ in place of light isotropic speed. This is the exciting deal ported by new Galilean age. The same qualitative treatment holds for any kind of sub atomic particles. And it would be surprising enough to explore what happens at over atomic macro molecule level! By the way Anton Zeilinger and Vienna university cooperators were able in 2003 to show an interference pattern built by mean of a double slit experiment using macro molecule made up of 60 carbon and 48 fluorine atoms! What would be the result of a Sagnac experiment using such big macro molecule? The author is in favor of a positive fringe shift event given the platform radius is selected sufficiently large to point out this effect. The general rule being: the heavier is the launched particle the negligible is the surrounding mass influence on it. This would imply a very high (but finite) H value. A finite high H value can anyhow let some influence from nearest masses even if very small. By (3.1) formula it is possible to confirm this extrapolation. But even a very few surrounding mass influence is able to build the anisotropic speed component of a launched particle. For this reason a point at rest with the platform center and lying on the platform axis is the center of mass of the pondered surrounding mass (as by Adapted Galilean velocity vector addition principle) until H becomes really so high to disrupt the surrounding masses center of mass simmetry about platform center (that causes the Sagnac interference). Finally, progressing furthermore in H increase, the only anisotropic component tends to be ascribed only to solely emitting mass (as by classic Galilean velocity vector addition principle). This definitively cancels any interference phenomena. A macroscopic ball (football or cricket ball) is in condition to not be appreciable affected by any surrounding mass anisotropic influence. It would be interesting to investigate also macro molecule with Sagnac experiment. The suspicion is that Sagnac interference would disappear only when emitted particle mass is so high to practically neglect its dualism particle waveform. So the anisotropic external influence on an emitted mass could be ascribed to the same quantum phenomenon that originates its dualism.

Just to go step by step, coming back to electron case the demonstrated by double slit experiment relevant interference property leads to investigate if H is still sufficiently low to confirm surrounding mass pondered center of mass still sees the platform to fully rotate about him. The Galilean paradigm expects to reuse (4.6) as for photon case. The Sagnac effect depends only by isotropic electron speed $v0$ (now in place of light isotropic speed) versus platform tangential border velocity. In general the portion of platform tangential border velocity component, corresponding in turn to the component of platform angular velocity (evaluated with respect the platform orthogonal axis), that is still parallel to the fixed axis (connecting the same pondered center of mass with platform center). By mean of rearranging (4.6) in function of platform border speed and considering $v0$ for electron case:

$$v1 = -\left(\frac{2\pi R}{\Delta T'}\right) + \sqrt{\left(\frac{2\pi R}{\Delta T'}\right)^2 + v0^2} \qquad (10.8)$$

Using **Δ**t'=7.23*10-16 s and v0=10^7 mt/s the minimum platform border speed component to detect interference becomes v1=0.005 mt/s. (This with R=1mt to make an appropriate compare with photon case that gives v1=0.15 mt/s, see chapter 4). From one side the higher (less detectable) **Δ**t limit would tend to increase v1 speed but this is more than compensated by v0 isotropic speed of electron beams (at least for the considered experimental setup) because 10^7 mt/s is 30 times less than isotropic light speed. This fact over compensate and move the needed minimum platform border speed to an even lower limit with respect photon case. The conclusion is:

Provided that a technologically difficult Sagnac experiment based on electron beams could be prepared, the positive outcome of this experiment (electron interference fringe shift detection at electronic microscope) would point (also for electrons) to the existence of an isotropic reference system not rotating with platform. It should host the plenty speed isotropy of emitted electrons no matter the speed of the emitting system (mounted on board of the rotating platform). Please note that mentioned isotropy is not constant as for the light case but the isotropic speed depends by the variable amount of kinetic energy released to the electron by the emitting system. Definitively the isotropic electron speed is not a universal constant (in above example it has been taken to be 10^7 mt/s as it happens in a television cathode tube). Otherwise a negative outcome, double checked with rotating platform border speed well above v1=0.005 mt/s, would point to the invalidation of mentioned hypothesis. That is quantum particle wave dualism does not automatically reflect into anisotropic external influence from surrounding masses pondered center of mass. On the contrary the positive Sagnac outcome, especially if confirmed in the forecasted computation that is 300 times more sensitive than photon case, could open frontiers to the H coefficient estimation in function of the emitted particle mass. In this case we have the electron mass whose rest value is 9.109382616*10^-31 kg. In the photon case the photon rest mass is evaluated by use of (8.4) without exponential term due to zero speed as seen by Privileged System. This leads to:

$$\mathrm{m} = \frac{\mathrm{h}\gamma}{c^2} = \frac{\mathrm{h}}{\mathrm{c}*\lambda} \qquad (10.9)$$

Where λ is 589nm (Na wavelength is selected to build the photon case). This gives m=3.752493891*10^-36 kg. This is kind of 3*10^5 less than electron one and in turn ensures that Sagnac experiment performed with electron beams points to exploration of a very different emitted particle mass range. H should assume a very much higher value when emitted particle is an electron. So it would be interesting to investigate if a restricted radius of action of the pondered surrounding masses would be able to alter the rotation component of the platform about a fixed axis passing by its center and by the surrounding masses center of mass. This rotation component is responsible of the beams delay of any Sagnac experiment. It is possible that, if electron beam based Sagnac experiment is performed in the middle of a flat isolated land, the mentioned axis is still parallel to the platform plane orthogonal so that the full angular rotation impressed to the platform is useful to produce the beams delay. Instead it could be, obviously this depends by the H value possibly sufficiently high to limit the surrounding masses influence within a few kilometers radius, that in case the platform is positioned on a land very close to a very hard slope of a big mountain (present asymmetrically only beside one platform side), then the mentioned axis results strongly deviated by the platform plane orthogonal. This would cause, at same level of impressed angular rotation, an abated platform rotational component about that axis. This effect could be revealed by a limited fringe sift in turn signature of a reduced delay between beams.

Definitively, the higher the emitted particle masses used in a Sagnac type experiment (by mean of emitted electrons or even by mean of most heavy macro molecules), the higher should be the H value, the limited should be the surrounding masses extension to build the pondered center of mass. This would at least discard far masses influence because no more than a ground spherical portion of some kilometer radius around the Sagnac platform should survive to the pondering mechanism action, may be less depending by the employed emitted mass value. The higher is this H value, the easier is the inspection of not uniform detectable delay between beams as function of relevant asymmetric big masses variable position with respect the platform. This behavior agrees with (3.1) model estimation of a compatible high H value in order to estimate annihilation of those far masses influence. The author hopes these difficult experiments with electron or even heavier particle beams will be tried in a not so far future to confirm the depicted expected outcome.

Please note the nice unification of qualitative treatment of all the emitted particles. (That applies exactly in the same way from photons to macro molecules). H value pushes in the same universal model the needed quantification. This is another remarkable behavior of the New Galilean Theory. Definitively the marvelous philosophical aspect of the H coefficient based model lies on the fact that it qualitatively applies to all the sub atomic particles without any qualitative distinction no matter other peculiar characteristics or quantum properties they can hold. The only distinction is quantitative and it is ported by the H value (it is higher the higher is the concerned emitted particle’s mass). So a very strong theoretical unification is ported by the New Galilean paradigm through Adapted Galilean Principle.

To summarize the following are the main challenges proposed to Quantum Mechanic future developments by the new Galilean paradigm. Quantum discipline should try to find out the intimate mechanisms that rule at microscopic level these new Galilean observed phenomenon:

- It is needed the formulation of a Quantum principle able to explain the action at distance of surrounding masses in building the anisotropic velocity component of a sub atomic emitted particle. This cooperative action is executed in a time difficult to be determined because dependent by the unknown Quantum Mechanism that regulates surrounding masses intervention. Moreover every individual action (force) at distance is function of the related surrounding mass pondered weight (with distance from emitted mass) of course multiplied with its vector velocity in order the dominant forces come from the surrounding masses equipped with bigger motion quantity at net of their pondering. *Is there a superluminal messenger that transports this action? How does it work? How does the emitted particle mass / energy play in limiting the surrounding masses influence? (as depicted in macroscopic New Galilean Theory by H factor).*

- The second phenomenon that needs to find its root into Quantum Mechanics is constituted by the interactions between a travelling particle (in motion as seen by Privileged System) and the Privileged System itself inner skeleton. As already remarked in chapter 6 and in chapter 8 these interactions are responsible of two intimate connected processes. From one side they tend to regulate the internal frequencies of the travelling particle (with a non kinematic process) according to the variation of its speed in the way described by IG model inertial equation. So a non kinematical work is gradually spent by the travelling particle against such contrast interactions at each delta particle speed increase, when a certain amount of its Compton travelling energy is released to the Privileged System. From the other side the quantum contrast interactions tend to oppose to the travelling particle speed itself (this kinematic process happens through constant contrast acceleration). Obviously in presence of no kinematic external work applied to the travelling particle, the particle is landed by mean of the second process to a rest status with respect Privileged System. Consequently it recovers from Privileged System inner skeleton its total Compton (rest) energy. The flux of Compton energy to or from Privileged System (non kinematic process) is much more relevant than releasing or acquisition of kinetic energy (kinematic process). *What is the sub atomic material (ultra fine structure) that constitutes the Privileged System inner skeleton? What are the quantum actions that intimately rule the two mentioned intimately connected processes? What is the radius width that includes the ultra fine structure instantaneously acting with the travelling particle? Or is it a pretty local interaction that happens exactly at the instantaneous particle location of the Privileged System framework? Or simply the radius of action depends by the particle mass as by previous point?*

A philosophical concept is raised because it is time to do it. Mathematic is a wonderful discipline but its use cannot be abused. It means that it should remain at service of Physics. Nice attractive models due to their self parity and symmetrical mathematical aspect can be a mistaken interpretation of Physics. They hide (and even in a rough manner) trivial paradoxes and inconsistencies because have been stipulated with perfect lose of physical good sense following the inconsistent claim that reality should behave perfect and symmetrical. These perfect mathematical models are stipulated on axioms that are in turn based on experimental outcomes that are not definitive because affected by evident lack of technological precision. This ambitious age started at the beginning of last century and its dogmatism is still mainly accepted by a wide scientific community. It seems that nice mathematical cosmetic should drive reality. This is the dangerous positivistic heredity that is still conditioning the progress of theoretical physics of macroscopic systems. The following contribution presented by the author is oriented to put some added value in building an alternative paradigm based on available experimental results, sometimes advancing in turn hypothesis still a little beyond them. This proposal is apparently not affected by any sneaky paradoxes and seems to be perfectly suitable to reconcile a macroscopic theory with quantum discipline because all the findings can be interpreted as consequence of laws ruling the world of microscopic particles. As before already remarked, this makes the new Galilean theory able to offer new stimulus to Quantum Mechanic progress.

At the end the conclusion is that Galilean transformations are able to withstand also the new cosmological frontiers and interpreter the phenomena of high speed systems through the already mentioned appropriate change into time equation.

The portion of universe observable by our radio frequency telescopes seems not in expansion, the Galilean relativism of all possible inertial systems (instantaneously floating in it) is no more an abstract concept but its soul is based on the existence of a common true reference: The Privileged System. Whose soul (ultra fine structure) is still a mystery. All universal clocks frequencies are consequence of their speed with respect this frame that has the honor to dictate the Absolute Time of the universe (with its rest reference clock selected to be sufficiently far from nearest masses in order to cancel any gravitational disturbance on its absolute peace). The Absolute Time is distributed to all other inertial systems, freely running as seen by the Privileged System, that are affected by a ruled (according to IG model inertial equation) freezing of their times as seen by Privileged System, whose point of view becomes the solely authorized to interpreter the non relativistic essence of Energy.

This is the last relevant concept that is highlighted by current tractate. Energy cannot be a ghost that appear or disappear in function of the observer speed. An observer at rest with a travelling particle cannot measure the real particle travelling Compton energy (or related frequency) that is function of the particle speed with respect Privileged System as by new Galilean Theory. This is due to the fact that observer frequencies are altered by its speed with respect Privileged System in the same way as is altered the particle Compton frequency. Another observer equipped with a different absolute speed is destined to measure a different Compton frequency for the particle. Who is right? Nobody of them is right. The only right observer is the one at rest with Privileged System for the obvious reason Energy is related to Compton frequencies and these frequencies can only be evaluated by a not conditioned clock. The absolute one owned by an observer at rest with Privileged System and not affected by any gravitational influence. He observes the true particle rest Compton Energy (when the particle is still at rest with the observer) and also notices the diminished particle travelling Compton Energy when the particle moves with a certain speed. (The missed Compton Energy is transferred to Privileged System ultra fine structure that is built by a homogeneous low energy density skeleton). Again, observers not at rest with Privileged System are misinterpreting Energy because their own energetic level reference is conditioned by their proper speed. This can be easily seen through IG model inertial equations composition to point out the relation between observer proper time and moving particle proper time as function of the observer and particle absolute speed status with respect Privileged System.

For the same reason the Privileged System rest detecting frame is the solely authorized to evaluate the anisotropic work (spent or gained by the surrounding masses to a generic particle emitting system) in building the anisotropic velocity component of the same emitted generic particle. Other inertial detecting frames see a different work because they do not perceive the right absolute velocities of the emitting system and its surrounding masses hence their work computation is conditioned by their proper absolute speed. The same comment applies to emitted system isotropic work (whatever spent or gained by it) computation because isotropic emitted particle velocity depends by the isotropic constant that holds in the detecting system. For photon case it is related to the one that holds as seen by Privileged System by (2.7) where c'' collapses to c (Privileged System isotropic light velocity):

$$c' = c * e^{\frac{k(v')}{c}}$$

Not privileged systems sees isotropic component c' > c hence they calculate a bigger work spent by the emitting atom to build the isotropic photon component.

Also If IG model is discarded and classic G model is used in place of it, Adapted Galilean Principle seems to be still applicable. Unfortunately a dodgy ambiguity appears when the effective isotropic and anisotropic works are questioned. They depend by the selected detecting inertial frame as before. This time the plenty equality of the pure classic Galilean inertial frames leave the questionable subject on what is the right energy spent or gained by emitting system and by surrounding masses in building the emitted particle velocity components. Only Privileged System postulation (with corresponding new Inertial Galilean model introduction) can restore the objective essence of the energy transferred to or from the emitted particle.

(1)

The formula that rules the Michelson-Gale-Pearson apparatus is:

$$\Delta\mathrm{t} = \frac{4\omega A \sin\theta}{c^2}$$

Δt is the delay between the opposite light beams, ω is the terrestrial angular velocity, θ is the concerned latitude, A is the rectangular beam path area, c the isotropic light speed module.

It is very impressive that this experiment, performed in 1925 at θ=41° 46’ latitude, resulted in a fringe shift fully confirming the Δt value exactly expected at that latitude. It is difficult to realize that a so strong proof that light is not adapted with a system rotating at a certain angular speed given by concerned latitude about a fixed axis connecting its center with our planet center did not break the relativistic paradigm that claims light speed is constant as seen by any inertial system (in this case infinite inertial systems are selected to be instantaneously at rest everyone with a different generic point of the rectangular perimeter. Relativity avoids by definition for all these inertial systems any non uniformity in opposite light beam speed, so that it always predicts Δt=0).

Appendix A

This is the numerical program used to compute (4.3), (4.4) and final result (4.5) that is the delta time between beams.

Inputs:

R, v, vis, v1

Output:

delta_time_between_beams

Program

```
R=200                  this is the platform radius in meters
vis=299792458          this is the isotropic component of light in mt/s
v1=465                 this is the planet mass center speed seen by S' in mt/s
v=5                    this is the platform border tangential speed seen by S' in mt/s

y1=(1/(v1*sinϑ+(vis^2-(v1*cosϑ)^2)^0.5))     this is 1/c1
Ta=R*intg(0,%pi*2,y1)
ϑ0=0
Taccording=Ta
while Taccording > (R*ϑ0)/v
ϑ0=ϑ0+(10^(-12))*%pi
Tinc=R*intg(0,ϑ0,y1)
Taccording=Ta+Tinc
end
ϑ1=0
Topposite=1
while Topposite > (R*ϑ1)/v
ϑ1=ϑ1+(10^(-12))*%pi
Tinc1=R*intg(0,ϑ1,y1)
Topposite=Ta-Tinc1
end
delta_time_between_beams=Taccording-Topposite
```

Appendix B

This is the numerical program used to estimate k factor of IG model inertial equation exponential term.

Inputs:

c’, v’, k initial value (if terrestrial lab storage ring was at rest with Privileged System)

Output:

Kfinal (final value after program iterations)

Program (case **A** of storage ring orientation)

```
e=2.71828182845904523536028747135 27
v’=1000                     Privileged System speed as seen by terrestrial lab
c’=299792.458               isotropic light speed detected by terrestrial lab
ϑ’= %pi/2
kfinal=log(28.87)*((v’+(v’^2+0.9994^2*c’^2+2*v’*c’*0.9994*cosϑ’)^0.5)/(0.9994^2*
c’+2*v’*0.9994*cosϑ’))
```

Program (case **B** of storage ring orientation)

```
e=2.71828182845904523536028747135 27
v’=1000                     Privileged System speed as seen by terrestrial lab
c’=299792.458               isotropic light speed detected by terrestrial lab
k=3.3648219                 k initial value
delay=0
kfinal=0
while abs(28.87-delay) > 0.000001
teta’=0
f_ϑ’=e^(k*((0.9994^2*c'+2*v'*0.9994*cosϑ’)/(v'+(v'^2+0.9994^2*c'^2+2*v'*c'*0.99
94*cosϑ’))^0.5)
delay=(1/(2*%pi))*intg(0,%pi*2,f_ϑ’)
```

```
k=k+0.00000001

end

kfinal=k
```

Appendix C

This is the numerical program used to estimate intrinsic Quasars red shift values with Galilean approach to separate Doppler Effect estimated in function of ϑ angle between the laboratory sight view and the Quasars running velocities. This is done working on already available Quasars intrinsic red shift data that were separated by Doppler Effect through relativistic approach applied to observed nude data (these last ones are not available).

Inputs:

c isotropic light speed as seen by laboratory, k (factor into exponential term of IG model inertial equation), ϑ angle between laboratory sight view and Quasars running velocities, intrel (intrinsic red shift retrieved by observed data through relativistic approach).

Output:

intrgal (intrinsic red shift estimated through Galilean approach from intrinsic relativistic data)

```
c=299792458

k=3.3648219

intrrel=1.96

deltaz=0.00000000000000000000000000000001

ϑ=%pi/4

n=0

for n = 1:30

galileo=((1+1/deltaz^2 )^0.5-1/deltaz)/(1+((1+1/deltaz^2 )^0.5-1/deltaz))

relativit=(1-deltaz/(4+deltaz^2 )^0.5)^0.5/(1+deltaz/(4+deltaz^2 )^0.5)^0.5

intrgal=intrrel+galileo+relativit-1

v=c*(1/k)*log(intrgal+1)

vsight=v*cos(ϑ)

deltaz=(2*vsight*c)/(c^2-vsight^2)

end
```