Part 1c- Paradoxes and criticisms

2(6) - Paradoxes and criticisms

2(6)1 - Twin paradox [9]

According to the bending characteristic of H particle-paths of a moving H system respect to an observer at rest, *Sec. 2(1)1b, Fig. 2(3);* in each frame of references *R , R'*. The time or length is the same respect to their own observers *O* and *O'* provided that each of the twins constituting H system of the same inertia, *Sec. 2(1)4.* In other words, the reference frames *R, R'*, of related bodies must have equal masses in viewpoint of H particle-paths hypothesis; therefore rest time Δt_0 , *Eq. 2(97)2, Consequence 2(6)1a*, depends on the inertial mass magnitude, *Sec. 2(6)2a,* please refer also to *Consequence 2(3)1a.* Thus, there is no twin's age paradox regarding the internal motion and curvature of H system's H particle-paths in the cases of equal inertia. The clock of the twin traveler is the same as the twin at rest at the end of journey in the reference frame systems constituting of equal inertia or masses, *Notes 2(6)1a*, *2(6)2a1*; please refer also to *Sec. 2(1)1b*, *Remark 2(1)1b1.* "Time travel is impossible, some say, because if it were possible we should have seen a lot of time travelers by now, but nobody has encountered any time travelers. And time travel is impossible because when time travelers go back and attempt to change history they must always botch their attempts to change anything, and it will appear to the rest of us at the time as if nature is conspiring against them. Since, we've never witnessed this apparent conspiracy of nature, there's no time travel" [434] *part 5*. Moreover, there are many controversy explanations of twin paradoxes [115], *part related to Al Kelly, paragraph 5*. By the way, referring to [230], an example is given that has no need for acceleration and depends only on steady velocity and duration of traveler twin journey.

Resuming, the time dilation of each of the twins depends on two factors as following:

1) - Inversely to their inertial masses (or inertia) respect to their center of masses preferred reference frame, *CMPRF*, *Secs. 2(6)2a, b*.

2) - Directly to their relative velocities respect to their *CMPRF.*

Consequence 2(6)1a- In fact, the traveler twin at the receding motion has proper time interval, ΔT_B , and at approaching one, ΔT_F ; thus, the averaging of the two stated above proper times is equal to ΔT_0 , according to *Sec. 2(6)4b, Eq. 2(114)b*, in case of equal inertia; please refer to *Sec. 2(10)* in this regards. Noteworthy, according to *Remark 2(6)4b1*, and *Sec. 5(9)3d,* the path-length of travelling twin respect to twin's CMPRF are equal irrespective of their relative velocities.

Note 2(6)1a- Generally the reference frame at rest consist of a mass-body (an H System), that is constituted of H particle-paths in a reversible back and forth reversible motion in all the direction, *Secs. 1(1), 1(3)*; thus, the light beam (another H system) that is constituted of H particle-paths in a single direction of motions is considered as a powerful mean of comparison. However, the moving frame respect to the rest one is consisted of H particle-paths in a reversible back and forth motion plus single direction (or irreversible) H particle-paths in a common motions. Generally speaking, according to *Sec. 2(6)2*, the true time running depends on the inertial masses that constituting the reference frame regardless of time interval variation related to the same masses considered as non-inertial in *GRT*, i.e. dual characteristics of a mass-body.

2(6)2- Inertial reference frame

2(6)2a-Relativity- inertia dependence

According to *Note 2(3)3b, Eq. 2(97)2, Sec. 2(6)2a, Note 2(6)2a1*, and regardless of gravity conceptions; the returned time δT , *Eq. 2(109), Sec. 2(6)5b,* depends on α , *Eq. 2(7),* i.e. the ratio of single direction H particle-paths to the reversible ones nominating" deviation degree from reversibility". Now, supposing a body of mass *M,* e.g., The Earth; the twin traveler leaves the Earth through spaceship with a total mass m at v speed, the rest twin H system has mass *M-m (M>>m).* Thus, the rest twin grace of mass M has nearly zero velocity relative to center gravity of reduced mass of *M & m* system due to impulsion effect of spaceship of traveler one. Therefore, we can consider the former as a reference frame at rest; thus, its returned time δT_M is negligible, *Note 2(6)2a1,* respect to spaceship returned time δT_m , *Example 2(6)2a1*. In other words, according to *Fig. 2(3), Sec. 2(1)1b,* the spaceship undergo more *Delta Effect*, i.e. more time dilation or length contraction due to γ^{-1} contraction factor, *Sec. 2(6)5b* [respect to the Earth observer of *CMPRF, Sec. 2(6)2b*] related to its H particle-paths bending respect to the Earth; similarly, the burned fuel gas molecules respect to spaceship, *Remark 2(6)2a1*. Now supposing traveler twin spaceship accelerates by its chemical fuel rocket; thus, spaceship H particle-paths bend slightly respect to the propellant gas molecules of fuel ones due to their inertia differences. In other words, δT_m of spaceship or its speed is lower than that of exhaust fuel gas molecules. As a result, in order to reduce paradoxes, we must take into account the concept of inertia, *Comment 2(6)2c1*, and the Newton third law in the *SRT* principle; these improve the question which clock of twins must really goes slower; please refer to *Consequence 2(3)1a*. Moreover, according to the experiment down on the basis of global positioning system *(GPS).* The velocity effects were also inconsistent with special theory of relativity in that they depend on the velocity relative to the Earth-centered frame, rather than the velocity of the receiver relative to the source, as the special theory predicted; please refer also to [62], *Examples 2(1)2, 2(1)3,* and *Remark 2(6)2a2.* As a result to each inertial reference frame besides its four time and space coordinates and relative velocity respect to center of mass, a 6^{th} specification, i.e. its inertial mass considering center of masses, must be attributed. Generally speaking, all of the mass-bodies in the Universe are correlated in the vacuum through interchanging of H particle-paths at c speed, *Sec. 7(6), Note 7(6)1*, as a unique H system, *Sec. 8(5).* Please refer also to *Sec. 5(9)3*. Based on *Note 2(3)2b1*, in case of two inertial reference frames R, R' moving relatively at linearly constant speed, we have:

A) Supposing the center of mass of m in an isolated inertial reference frame R is coincided with the origin o of the reference frame R. Now, imagines that the notation of m to m', o to o', R to R' are changed irrespective of linearly relative motion of O respect to o' or vice versa in spatial medium.

B) Based on item *A*, supposing that at constant m, by increasing m, by decreasing m, the universal time interval Δt, will be unchanged, decreasing, increasing respectively. Similarly, the same result is valid by changing the prime notation separately. Thus, observer o is In the frame, *Sec. 2(8)2*, *case A*, observer of R; moreover, o' is In the frame observer of R' due to ignorance of the relative motions of R, R'.

C) Based on *Sec. 2(1)1a,* in case of *item B*, supposing $m = m'$ from viewpoint of observer o, $\Delta t'$ is dilate respect to Δt, *Sec. 2(1)1a, Eq. 2(12).* In other words, some part of rest mass m reversible H particle-paths, *Note 2(1)3b*, is converted to single direction H particle-paths (in prime notation) of reference frame R'. Thus, the rest mass m is diminished to m', *Sec. 2(2)1, Eq. 2(43),* and *Comment 2(2)2b,* instead of remained unchanged. In other words, the Δt is related to stay time interval, *Sec. 7(4)2f, part A*, of purely reversible part of H particle-paths in an H system; while in R', $\Delta t'$ depends solely on reversible H particle-paths and is independent of single direction part of H particle-paths based on *Sec. 5(6)1*. The observer o is nominating In the frame, *item B*, in reference frame R, and Out of frame, *Sec. 2(8)2, case B*, in R'. Noteworthy, the time related to single direction part of H particle-paths of an H system depends merely to *T*-symmetry, *Sec. 2(3)3*, of nil time arrow, i.e. related to mono-directional time arrow, *Sec. 5(16)7J.*

D) In all of the above items, it is recommended to measure, the universal time interval solely at the origin of *CMPRF* of R, R' (or m, m').

E) In case of gravitational field, based on *Fig. 5(8) of Sec. 5(16)1b, part A*, each main cell on a gravitational sphere of mass *M* in spatial medium, *Sec. 7(4)3, part A*, obeys the *Eq. 7(8)* $E.\Delta t = \hbar$ or *Eq. 7(5)1* $\Delta p.\Gamma = \hbar$

Where:

E, Total energy of the main cell (or expandon, *Sec. 5(16)1c, part A3,* as a particle) of Δp related momentum.

Δt , the stay time interval, *Sec. 7(4)2f, par t A*, of the main cell

Γ The path-length limit of the main cell, *Fig. 5(8)*

In fact, Δt is the universal time unit, *Note 7(4)1a*, on a gravitational sphere.

G) According to *HPPH*, the origin of an isolated inertial reference frame R, (or R') must be considered respect to the *CMPRF*, *Sec. 2(6)b1,* of that frame. Thus, the unit of time Δt (or $\Delta t'$) in a reference frame must be regarded based on this origin and its total inertial mass of R, (or R'). Therefore, by an external interaction of the frame e.g. R, the unit of time in this frame is altered, or, better to say the R *4*-coordinate will be changed accordingly. Factually, the ratio of single direction H particle-paths to that of fully reversible one, i.e. α, *Sec. 2(1)1a, Eq. 2(7),* of R defines the *4*-coordinate of newly defined reference frame in this interaction; please refer also to *Sec. 7(4)3, part J* in this regards.

Example 2(6)2a1 - Supposing N_{0M}, *Eq. 2(2),* the H particle-paths number of mass *M*, e.g., the Earth, N_{0m}, *Eq. 2(2),* the H particle-paths number of mass m, e.g., the satellite, spacecraft; thus, the sum N_{0M} number of δT_M, *Eq. 2(14),* (or δl_M), *Eq. 2(13),* of the mass *M* is equal to the sum N_{0m} number of δT_m (or δl_m) of the mass m as following:

$$N_{0M} . \delta T_M = N_{0m} . \delta T_m \qquad 2(108)1$$

$$N_{0M} . \delta l_M = N_{0m} . \delta l_m \qquad 2(108)2$$

That is based on the paths constancy, *Sec. 2(1)2,* moreover the effect of mass equivalent to energy can be viewed through, *Eqs. 1(124), 1(125),* in case of single mass-body; please refer also to *Sec. 5(16)1c*.

Note 2(6)2a1(proposal)- According to *Sec. 2(3)3, Note 2(3)3b,* the time interval is consist of two parts: *1)* the proper time, ΔT_0, related to the reversible motion of H particle-paths analogous to special theory of relativity that give rise to the twin paradox, *Sec. 2(6)1. 2)* Time δT, *Eq. 2(97)2*, related to the returned single direction ones as that in case of H particle-paths hypothesis. Therefore, the average of the stated above time intervals must be considered as total time interval regarding γ^{-1} contraction factor, *Sec. 2(6)5b,* due to reversible H particle-paths combination with that of single direction ones, *Sec. 2(10)3*. According to this statement, we must consider the time related to the single direction motion as non-scalar ones according to the motion direction, i.e. vectoriel or directional; thus, the *Eq. 2(97)2*, *Note 2(3)3b,* after returning of traveler twin must be regarded as:

$\Delta T_{FB} = \Delta T_0 = \Delta T_B - \delta T$, 2(109)$a$ and $\Delta T_{FB} = \Delta T_0 = \Delta T_F + \delta T$, *Sec. 2(6)5b,* 2(109)b

Where, ΔT_0, the time interval according to the twin at rest, and one-way forward time interval ΔT_F and backward time interval ΔT_B, related to journey of traveler one respectively; moreover, it is equal to average time interval, ΔT_{FB}, obtained according to *Eq. 2(114)b*. As a result, *Eqs. 2(109)a, b,* are time relations on the basis of H particle-paths hypothesis. In other words, time and spatial dimension magnitude depend on the behavior of H particle-paths, i.e. reversible or single direction one. Moreover, the time related to reversible motion is scalar as internal energy, *Eq. 2(43),* and the time related to single direction one is directional as linear momentum, *Eq. 2(30),* that are in conformity with , *Sec. 2(1)1, paragraph 3C of Consequence 2(1)1b1,* and *Sec. 2(6)2*; please refer also to *Sec. 2(10),* and *Sec. 5(16)1c,* for more information.

In fact, the hidden returned times $\pm\delta T$, *Eq. 2(109),* can be revealed through Sagnac experiment, nominated as Sagnac effect, *Secs. 2(6).* As H particle-paths are in a forward and backward motions in a moving matter, $+\delta T$, is referred to the forward direction, i.e. path contraction, whereas $-\delta T$, is attributed to the backward motion, i.e. path dilation, related to counter-currency mode of motion, *Sec. 3(12),* that is in accordance with Sagnac effect; please refer to *Sec. 4(3)1, Part B.* In other words, δT have a simultaneous back and forth behavior respect to the time coordinate, *Consequence 2(1)1b1, paragraph 3c,* that eliminates its reciprocal effects. Thus, ΔT_0 *[or* $\Delta T'$, *Sec. 2(6)5b], Eq. 2(109),* can be attribute as proper time of the reference frame *R* (or *R*') regardless of $\pm\delta T$, i.e. two-way averaged time intervals; whereas, during Sagnac experiment $\pm\delta T$ reveal separately in case of two opposite light beams. In all of these discussions we must take into account the effect of inertia, *Sec. 2(1)4,* on the degree of relativity α , *Sec. 2(6)2;* please refer also to *Sec. 5(16)7a.*

Noteworthy, according to *Sec. 5(16)7*, *Example 5(16)7b*, *B1*, the light speed is not smooth, but quantized. The light emitted in both forward, or, backward direction of source motion respect to a observer (or detector) relaxes in equal number of quantized H hall packages, *Sec. 5(16)3a*, of vacuum texture, *Sec. 5(16)3b*, each of path-length value *h, Sec. 5(16)3g*, due to path-length constancy, *Sec. 2(1)2*, with the difference that the H hall packages of vacuum texture in the approaching direction of motion is contracted. Whereas, receding ones is dilated respect to rest state. In other words, the light in the two the two above cases sweeps equal number of H hall packages during its propagation. In fact, the path-length of emitted photons in the both cases are regarded as an indicator (or scale), *Sec. 5(16)3b, part D2*, because of correlation of the light photons with the related source, *Sec. 8(9)1.*

Remark 2(6)2a1- In fact, history of past events, (impulsion phenomenon, or, third law of Newton) related to the inertia of an H system at rest, *Sec. 2(1)4,* has a main effect on relativity conception as in, *Note 2(1)4a*, that is not considered in *SRT*, *Comment 2(6)2c1*. Thus, inconsistencies such as twin paradox arise. Please refer also to *Sec. 5(16)3b, part E2, Note 5(16)3b, E1*, *Note 8(1)1.*

Remark 2(6)2a2- According to *Sec. 7(6),* energy, space and time connected at quantum level; similarly at macroscopic scale such as present section space and time, i.e. path-length, *Sec. 2(1)2,* from view point of H particle-paths hypothesis must be correlated with inertia or mass, i.e. energy equivalent.

2(6)2b- Preferred reference frame

As a result, the relatively preferred reference frame depends on relative inertia or masses, *Sec. 2(1)4,* of two objects moving uniformly at a straight motion respect to each other; according to *Examples 2(1)2, 2(1)3*, the Earth-centered non rotating (quasi) inertial frame[62] can be considered as a preferred reference frame for satellites. The anisotropy of cosmic radiation is used to define a preferred reference frames based on approx. 400 *Km/s* cosmic motion [66] for the Milky way galaxy. In other words, "a dipole anisotropy detected in Cosmic Microwave Background of Radiation *(CMBR)* which would be zero in a frame moving at 390 ± 60*Km/s w.r.t.* the Earth" [67], *part related to CMBR*; refer please to *Note 2(6)2b1, Sec. 5(5)2,* and [65]. In fact, "the cosmic background radiation establishes for us the local reference frame which is moving with the expansion of the Universe [*77*] *Q&A No. 93.* According to Bondi and Gold, a preferred motion is given at each point of space by cosmology observation, namely the redshift-distance generated by the Hubble Effect. It appears isotropic for a unique rest frame [292], *part 2.2.* The preferred reference frame for two mass-bodies moving at v speed in a linear uniform motion respect to each other is the reference frame at these center of masses, *CMPRF*, *Remark 2(6)2b1*. In other words, the origin of that is the center of gravity of the two mass-bodies system; *Note 2(6)2b2*. Thus, respect to this reference frame each of the mass bodies moving at a linear uniform motion according to the related mass or inertia, contrary to *SRT* in which there is no preference between the reference frames of the two mass-bodies; please refer to *Note 5(11)1,* and *Comment 2(6)2c1*. For example, in case of satellite launched from the Earth, for the reason of Huge mass inertia of the latter respect to the former one, the center of gravity of the stated above mass-bodies is coincide approximately with that of the Earth-centered non rotating (quasi) inertial frame, *Example 2(1)1b3*. Please refer also to *Examples 2(6)2b1,2*, *3*. There are also two experiments, i.e. Sagnac test and Fizeau test, which obey the preferred reference frame, *Secs. 2(6)3, 2(6)4.*

Generally speaking, based on this assumption in case of two bodies at different inertial masses, *Secs. 2(6)2a*, *5(3),* the time of the lighter body, i.e. satellite, dilates more in comparison to the heavier one, i.e. the Earth, or, respect to the time of their center of mass preferred reference frame *(CMPRF, Note 2(6)2b3)* time. In other words, we are dealing only with one observer in *CMPRF*, the H particle-paths of that respect to its observer moving at c speed in different direction and can be calibrated with nil *Delta Effect, Sec. 2(1)1 b*, respect to the mass and velocity of its mass-bodies constituents. Thus, in case of a very light object such as satellite and very heavy object such as the Earth *CMPRF* is coincide approximately with the center of gravity of the Earth. Factually, only the satellite time dilate respect to that of the Earth, i.e. the Earth time remain unchanged, respect to the satellite observer or, in other words, don't dilate respect to the observer of the satellite. Moreover, the time dilation according to *GRT* due to the gravitational (non-inertial) mass as in, *Sec. 5(16), Fig. 5(8),* must be considered also; please refer also to *Sec. 8(7), Example 8(7)1a1*. As a result, if we calibrate, *CMPRF*'s *Delta Effect, Sec. 2(1)1b,* i.e. supposing it has no *Delta Effect*, each of the two objects have its owns *Delta Effect* respect to their *CMPRF*, the momentum of each body of the two bodies system is equal in magnitude and opposite sign respect to its origin. Furthermore, on the basis of inertial *CMPRF* assumption, both inertial mass and velocity of the two bodies respect to this common frame must be considered, through that the local space-time reference frame fixed to each of the two bodies, *LFRF, Sec. 2(6)2c*, must be calibrate regarding the *CMPRF* space-time coordinate coordinates.

Whereas, according to special theory of relativity only the relative velocity of the two bodies respect to each other, i.e. two relative space-time reference frames must be viewed, *Note 2(6)2b4*, that leading finally to paradoxes such as twin one, *Examples 2(6)2b1*, *2(6)2e1,* and contradiction such as *Comment 2(6)2b1*. Please refer also to *Sec. 2(1)1b, Comment 2(1)1b1,* and *Experiment 2(6)2b1, and Sec. 2(6)5c.*

In fact, due to mass dependent characteristic of a preferred reference frame, i.e. *CMPRF*, system as stated above, any of its mass-bodies with its, *LFRF* , *Sec. 2(6)2c*, system is usually in a non linear motion respect to the former as a direct effect of gravitation. As an example the sun can be assumed as preferred reference frame of the Earth in its non-linear orbital motion respect to the former, or, the sun respect to the center of mass of Milky Way galaxy, etc; moreover, synchronization of the clocks is affected by the mass. "Recent measurements on the propagation of radio waves over cosmological distance seem to indicate that our Universe possesses a preference frame" [114], or, in other words, as if the Universe has an axis, please refer to *Secs. 4(4), 5(16)5,* for additional information.

Noteworthy, as an attempt to generalization of the Lorentz transformation if there is a preferred reference frame refer to [112], at the present this work is one of the four test theories of *SR*; "different test theories differ in the assumption about what form the transform equations could reasonably take" [204], *Section 1, introduction*.

Finally, according to a definition based on *Consequence 5(9)3d1*, in an isolated H system the path-length of any of two of its ingredients has equal magnitude at opposite direction to each other, and at any time interval respect to their common *CMPRF's* observer at any related time intervals, *Sec. 5(9)3d*. In case of many particles system at quantum level, the path-length has constant value h for each of its particles, e.g., photon, electron, etc., *Sec. 8(7)4, paragraph R*. Moreover, the algebraic sum of path-lengths of particles in this system respect to observer *A, Sec. 8(9)2*, at their *CMPRF* origin is equal to zero, *Consequence 5(9)3d1*. This due to the correlation of H particle-paths of mass-bodies within spatial medium, *Sec. 5(9)3*. According to path-constancy, *Sec. 2(1)2*, any reference frame, e.g. during transformation, must be reduced ultimately to *CMPRF* (or reference frame A), *Example 2(6)2b3.*

Experiment 2(6)2b1- There is an experiment designed by F.J. Muller [82] that can be explained on the basis of *CMPRF*, *Sec. 2(6)2b*, preferred reference frame and H particle-paths hypothesis:
Supposing a radial conductor *OR* rotates together with a cylindrical (or ring) magnet with angular speed ω ; the *B* field enters perpendicular to the paper, as indicated by $\times$'s, *Fig. 2(6)1*.
In spite of the absence of relative motion between magnet and wire a potential difference is induced between *O* and *R* due to the absolute rotation of the system at angular speed ω and proportional to it. Or, better to say due to the preferred reference frame, *CMPRF, Sec. 2(6)2b*, between the two mass-bodies, i.e. the Earth and the above system, that is coincide with that of the Earth (lab), for the sake of following reasons. Please refer to *Sec. 2(6)2a, Example 2(6)2a1*)

1) All the velocities are tangential to the magnetic edges.

2) The system at rest or at motion at an arbitrary angular speed ω , the magnetic field-lines H particle-paths according to the preferred reference frame are moving at c speed whatever to be the angular velocity ω . In other words, according to the above statement related to magnet motion or magnetic field the induction depends solely to *OR* motions as stated above. Moreover, any linear motion as in, *Fig. 2(6)2*, is a special case of, *Fig. 2(6)1,* in which $OR \to \infty, \omega \to 0$, or, in other words, we are dealing here with a little section of *OR* with nil potential difference, *Remark 2(6)2b2*.

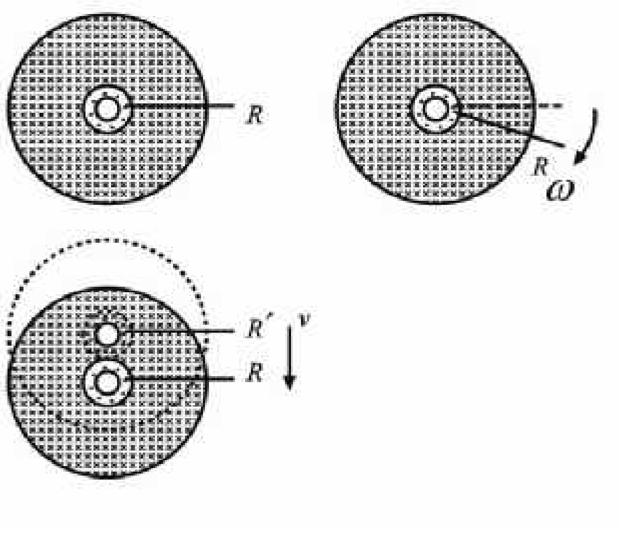


Fig. 2(6)1- A radial conductor OR rotates together with a cylindrical (or ring) magnet with speed omega. The B field enters the paper, as indicated by X's. (Top picture)

Fig. 2(6)2- If instead of rotating the system we move it with linear speed v, then there is no induction along OR. Why? The B field is the same, the speeds also are similar, and no relative motion exists. Why the difference, (Bottom picture)

The above experiment is based on the Rowland's experiment; it consisted of measuring the magnetic field produced by a gold plated disk that had been electrostatically charged and was rotated at a high *RPM*. "The problem is that there is a theorem that states that given a right circular magnet placed in a box and rotated about its magnetic axis is impossible to determine if the magnet is rotating or not solely by measuring the field outside the box"[84]. Please refer to *Sec. 4(3), Fig. 4(5),* to have a schema of magnetic field H particle-paths motion, *Sec. 7(4)4,* and to *Sec. 2(6)5c, Proposal A, last paragraph*.

Example 2(6)2b1- In case of the *Feenburg's twin paradox* [83] for the reason of huge mass of the Earth and star respect to the moving twin one according to *Example2(6)1*, the preferred reference frame *[CMPRF, Sec. 2(6)2b]* is at rest respect to the Earth and star and the time dilation of the traveler twin and its motion must be analyzed respect to the coordinate of *CMPRF*. Moreover, the traveler twin's *LFRF*, *Sec. 2(6)2c*, received equal cycles of starlight as the rest one, i.e. origin 9or location) of *CMPRF*, during its traveling till return to the home.

Example 2(6)2b2- One of the twin paradoxes that can be solved on the basis of *CMPRF, Sec. 2(6)2b,* is " the paradox of antipodes"[88]. Thus, "two antipodes, e.g., men or spacecrafts situated at the equator (one person in Brazil, the other one in Indonesia), and at two opposite sides, differ by fact, that due to the Earth rotation they move relative to each other at constant speed at each time instant. Here, the origin of *CMPRF* of the whole system is coincide with the Earth-centered non rotating (quasi) inertial frame[62], *part related to velocity effects,* due to the symmetry of the Earth inertial mass respect to this reference frame; please refer to *Example 2(1)1b3.* Therefore, both the time and velocity of each of the antipodes must be calibrated respect to the origin of *CMPRF* , *Comment 2(6)2c1,* instead to each other as in *SRT.*

Example 2(6)2b3- A satellite moving around the Earth or the Earth moving around the satellite. By introducing the *CMPRF* of the Earth-satellite, this paradoxical enigma can be solved. In other words, the clock tick on both satellite and the Earth must be compared respect to observer A on the origin of the *CMPRF*. In this special case, according to path-constancy due to huge inertia of the Earth respect to satellite, the origin of *CMPRF* of the system coincides with that of the Earth. Therefore, the time in satellite dilate respect to the Earth observer, i.e. lab. While, the time on the Earth remained unchanged respect to the observer in satellite or the *LFRF* frame, *Sec. 2(6)2c*.

Note 2(6)2b1 - To reach a basic time, the inertia of an H system at rest, *Sec. 2(1)4*, or, in other words, rest mass *M* must be increased; thus, the Sun rest time ΔT_0, must be considered respect to the Earth and spaceship. Similarly, center of Milky way galaxy rest time respect to solar constellation and so on till the whole Universe final basic rest time, i.e. Universal time. However, on the other hand, rest time ΔT_0, related according to general theory of relativity [55] to the gravity of the mass; please refer to *Sec. 2(6)2,* for complementary information.

Note 2(6)2b2- The *CMPRF* of a massless particle and its non-zero mass detector is coinciding with the latter one.

Note 2(6)2b3- "Synonymous terms for the centre of mass are the centre of gravity and the centre of inertia" [36] *section 3*. Therefore, the *CMPRF* is the frame of reference the origin of which is located on the centre of mass of an H system (e.g., particle, many particles system, mass-bodies system, etc.) from viewpoint of both inertia, and gravity concepts. The ingredients of each H system (e.g. mass-body, particle, expandons, *Sec. 5(16)1c, part A3*, etc.) is evaluated by an observer at this location according to its own *4*-space coordinates. Noteworthy, mass has inseparable dual characteristics, *Note 2(6)1a*, that reveal that reveal as inertial, and gravitational depending on its interactions.

Note 2(6)2b4- According to a proposal of modification of *SRT* based on Loop quantum gravity nominating *DSR*, *Note 8(1)1b*. "The relativity of inertial frames is broken and there exists a preferred frame. In this case, the analysis has to be done in that preferred frame. The most likely assumption is that the preferred frame coincides with the rest frame of the cosmic microwave background. In such theories energy and momentum conservation are assumed to remain linear."[588] *the near term experimental situation*. Factually, according to *HPPH*, the preferred frame in a system of particles or mass-bodies is its *CMPRF* one, *Comment 2(6)2c1*. Thus, in case of two systems also the *CMPRF* of their, is the preferred frame and so one up to whole Universe. The rest frame of *CMB* radiation that is in equilibrium state with the mass-bodies and particles of rest mass in the whole Universe may be regarded as such universal *CMPRF* frame.

Comment 2(6)2b1- According to [89], *division 2* and *Eqs. 2(18), 2(27),* we can simply deduce:

$$x' = (x - vt)\gamma, y' = y, z' = z, t' = t(t - {vx}/{c^2})\gamma$$

The reciprocal $x' = 0, t' = 0$ imply $x = 0, t = 0$, only if both:

$x - vt = 0$, and $t - {vx}/{c^2} = 0$, i.e. $v = c$

Then, $v = c$, if v is greater than 0; but according to *Sec. 1(1),* at the case of mass body or particle it will be $v < c$; therefore, at all the cases $0 < v < c$ by no means:

$t' = 0, x' = 0$, when $t = 0, x = 0$

Similar deductions can be obtained by referring to [229, 233].

Thus, we can reduce such a contradiction by introducing directional part of the time, *Consequence 2(1)1b1, 3c*, *case II* and *CMPRF* assumption; please refer also to *Sec. 2(10),* that introduce the concept of time's arrow, *Sec. 5(16)7a*, along with space expansion and time's arrow reversal related of space contraction from viewpoint of H particle-paths hypothesis.

Remark 2(6)2b1 – Noteworthy, in this section the system of mass-bodies is considered as isolated, and its *CMPRF* is regarded as inertial. Please refer also to *Sec. 5(9)3d*, in case of *CMPRF* of orbiting mass-bodies.

Remark 2(6)2b2- In fact, during rotational motion, *Fig. 2(6)1*, the free electron at *O* is at rest in the wire, and as we going from. *O* to *R*, the free electron is accelerated more and more till to *R* point in a constant magnetic field of magnetic field-line at c speed; therefore, we have a potential difference between *O* and *R*. For this reason in case of the translational uniform motion as in, *Fig. 2(6)2,* there is no potential difference.

2(6)2c-Locally fixed reference frame

Inertial masses of two inertial reference frames moving at a straight paths and constant velocities respect to each others, affect inversely their relative time dilations, i.e. time dilation in a reference frame affected by both its velocity and inertial mass respect to the observer of other reference frame, *Sec. 2(6)1*. In fact, transformation from *CMPRF* must be done to local reference frame fixed to the moving mass-body, i.e. *LFRF,* in an infinitesimal space-time regarded in a straight path uniform motion respect to *CMPRF*. In a *LFRF* coordinates system no moving mass-body investigation is allowed, because it has own fixed *LFRF*; thus solely the stationary mass-bodies and zero rest mass H systems (e.g., electromagnetic wave, photon light, field) the interval, *Sec. 2(5),* of which are null or invariant during Lorentz transformation can be considered, *Comment 2(6)2c1*. As a result, the relative motion of *LFRF* respect to *CMPRF* that causes the dynamical effect of length contraction, time dilation and other relativistic effects. By this assumption, relative motion of a small mass body respect to a massive one is not equivalent with the massive mass-body respect to small one taken as stationary.

Comment 2(6)2c1- "Each particle can be viewed as having its own personal "proper" time"[571] *Programming Spacetime in a Simulation.* According to *Sec. 2(6)2c*, each moving mass body has its own time, *Note 2(3)2b1*, i.e. proper time, *Eq. 2(12),* related to its, *LFRF* dilation that depends on both its rest mass and velocity respect to *CMPRF*. Whereas in *SRT*, each inertial reference frame has its own specified time coordinate for all of the moving mass-bodies regardless of intrinsic times of the latter. According to *HPPH*, each moving mass-body or particle can be regarded as a moving reference frame *(LFRF)* with its own space-time coordinates, *Sec. 2(6)2e*. Therefore, the relatively moving inertial reference frames in *SRT* are applicable solely for zero rest mass H systems, e.g. light, photon, and electromagnetic wave moving at c speed of zero invariant intervals during their *Lorentz transformation*. "The concept of invariant scalar is compatible with the fundamentals of Einstein special relativity in the 4-dimential space-time when and only when it is equal to zero"[89] *division 9(10),* i.e. the case of light at c speed. Thus, only $x=ct$ satisfies *Minkowski* invariant"[89], *division 9(10),* or, in other words, "the Minkowski invariant is incompatible with any equation of motion different from $x=ct$, "[89] *division 9(12),* "there is incompability between particle dynamics and *Minkowskian* invariant. Factually, *"SRT* is compatible only with field theory; it is incompatible with particle dynamics and with equations of motion"[89] *division 9(11). Minkowski* invariant presupposes four independent coordinates; whereas, particle dynamics has as goal finding the dependence of x, y, z on the time parameter" [89] *division 9(12).* According to the above statement, the need of the applicability of *LFRF* is revealed respect to *CMPRF* in case of moving particles or mass-bodies.

2(6)2d- H particle-paths viewed in an inertial reference frame

In a 4-dimentional Minkowskian inertial reference frame, *Sec. 2(1),* a moving mass-body moving at v speed along x-axis consisted of H particle-paths moving in a reversible mode of motion at c speed in all direction. Therefore, it can be viewed analogous to two combined or correlated light signals, i.e. forwarding and backwarding along x-axis at counter-currency mode of motion, *Sec. 3(2)1*. As an example refer to *Fig. 4(4)*, a moving particle at v speed, e.g., electron; according to this assumption. The Minkowskian invariant is equal to zero*, Sec. 2(6)2,* for this kind of H particle-paths motion, *Sec. 7(4)4,* individually in a 4-dimentional *CMPRF, Comment 2(6)2c1*. For additional information, please refer to *Sec. 2(1)1b.*

2(6)2e- The time coordinates in CMPRF

The fourth coordinate of *CMPRF* frame, *Sec. 2(6)2b,* i.e. time in Minkowskian space-time is only valid for mass-bodies at rest and zero rest mass H systems, *Comment 2(6)2c1*. So, to a moving mass body according to its relative velocity and inertia in each instant we can appropriate a time coordinate at the same rate as time coordinate of its related 4-dimential *LFRF*, *Sec. 2(6)2c*. Hence, in a *CMPRF*, the fourth dimension time coordinate is not the same as uniform rate time coordinate as in *SRT*. In other words, during investigation of each moving mass body its attached *LFRF* time coordinate must be considered as *CMPRF* time coordinate at each instant during motion of that moving mass respect to the latter, i.e. a *CMPRF* reference frame with separate time coordinates as *LFRF* for each moving body in that. It must be noted that time coordinate in each *CMPRF* system is similar to that of *SRT* solely during the study of zero rest mass H system, e.g., light, electromagnetic wave, fields, (i.e. purely single direction or irreversible H particle-paths)and mass-body at rest (i.e. purely reversible H particle-paths), Please refer also to *Comment 2(6)2c1* .

According to above statement, in *Sagnac test, Sec. 2(6)4* , the obtained $c+v$ and c-v formal velocities due to positive fringe shift results must be corrected respect to δT , i.e. average time difference of forward, ΔT_F , and backward, ΔT_B , time intervals, [*paragraph 7, Fig. 2(5) Explanation,* considering γ^{-1} contraction factor, *Sec. 2(6)5b*, and *Sec. 2(10)3,* in the cases of mass-bodies with reversible H particle-paths motion, *Sec. 7(4)4*]. Furthermore, ΔT_F and ΔT_B must be considered as forward and backward time interval, *Sec. 2(6)2a, Note 2(6)2a1*, of *LFRF* of the moving mass body, respect to *CMPRF*, i.e. lab reference frame, *Example 2(6)2e1.*

Example 2(6)2e1- Considering an isolated system consisting of mass-bodies $m_1, m_2, ..., m_n$, at velocities $v_1, v_2, ..., v_n$, respect to their *CMPRF* and times $T_1, T_2, ..., T_n$ of their related *LFRF* respectively, and respect to their *CMPRF's* observer. Thus, during the studies of this moving bodies system we must take into account times $T_1, T_2, ..., T_n$ (proper time of *LFRF, Eq. 2(12)*) of the *CMPRF* as its fourth time coordinate individually for each $m_1, m_2, ..., m_n$ mass-bodies, as if each mass body is considered independently. Each of these mass-bodies during motion has the same path-length, *Sec. 2(1)2,* at opposite direction respect to an observer at the origin of their *CMPRF's* observer at any time interval of the latter. Moreover, the total path-length in this system is remained unchanged*, Sec. 5(9)3d*, i.e. the total path-length variation of the whole system is zero (constant path-length). Factually, the constancy of path-length is related in a system with T-symmetry, *Sec. 2(3)3*, characteristic. During an intrinsic time's arrow of the system, this constancy is broken along with H hall package, *Sec. 5(16)3a*, generation related to increment of entropy such expansion of a gas in an empty box, *Sec. 5(16)9d, part A*, or, vice versa.

2(6)2f- Absolute motion

"If we are going to accurately model space then we must do so without reference to any background substrate as there is no such thing as absolute space: "There are no absolute axes of reference for space or time outside the universe *(see the Cosmic Universe page).* So in the absence of any absolute global time or position, both time and position must be relative". "If we want to model space accurately, all particle position must be relative to the other particles, and not specified with respect to absolute axes. This is called background independence"[571] *Programming Spacetime in a Simulation.* Contrary to the concept of relativity, absolute motion is accepted by some authors, De Meo [90], Cahill [98], on the basis of Miller [90], Illingworth [101], De Witte [601], Marinov [167] works; moreover, according to Thim [245], Allais [247] works similar results are obtained; please refer to *Experiment 2(6)2f1*. The *CMPRF system, Sec. 2(6)2b*, according to Cahill Process Physics [109] may be compared with that of quantum foam system reference frame, i.e. absolute motion respect to this preferred frame. "Of particular significance is that the direction of the absolute motion of the solar system was determined by Miller interferometer studies in a direction different from that of the motion of solar system with respect to the cosmic microwave background defined frame of reference. This again is a manifestation of gravitational in flows, this time into the Milky Way galaxy "[109], *part 10-1*. On the basis of H particle-paths hypothesis this gravitational in-flows can be compared with the H particle-paths counter-current, *Sec. 3(1)2,* reversible flow between two orbiting masses as in, *Sec. 5(9)3, Fig. 5(5)1*. On the other hand, the quantum system can be compared with H hall, *Sec. 5(16)3a*, quantization of space from viewpoint of H particle-paths hypothesis that had a hard link with the related matter itself. In addition, either cosmic microwave background or Cahill's quantum foam as an unique H system can be regarded as relatively preferred reference frame instead of *CMPRF, Sec. 2(6)2b,* or, in other words, according to *Sec. 2(6)2a,* the more massive H system is related to more preferred reference frame. The Michelson–Morley [72], Illingworth and New Bedford [111] experiment, all used Michelson interferometer or its equivalent in gas mode and all revealed absolute motion [109], *part 10-8*. However, there is null result in case of vacuum mode [70] as if there is a steady H particle-paths counter-current, correlated flow, *Sec. 5(9)3, Fig. 5(5)1*, between the gas bulk end the mass related to the preferred reference frame. Therefore, the single direction H particle-paths of the gas bulk are in direct interaction with that of the test light beam of the interferometer that its velocity, i.e. c is independent of the related source motion. Whereas, gas bulk has the same speed as the source grace of its H particle-paths at reversible motion, or, in other words, the light beam is a tool that scans the motion of gas bulk through the space. Therefore, the light beam is a convenient "handle" by means of which we can explore the floating motion of gas bulk through probing it from outside.

The concept of relative motion of a mass-body respect to the reference frame of a huge mass H system (regarded as reversible H particle-paths in all directions at c speed, thus constituting an unique H system, *Sec. 8(5),* with the former), has been misinterpreted as an absolute motion. Whereas, the latter can not be regarded as a static H system according to Hubble law; and for the reason of individual motions of its constituent particles and electromagnetic waves. As a result, we must seek for a huge mass H system respect to which the motion of the interferometer (lab) is detected according to Miller, De Witte, Illingworth works other than *CMB, Sec. 2(6)5.* According to [121] *introduction,* "specifically, his (Maurice Allais) experimental work relating to the anomalous behavior of the *paraconical* pendulum (a modified *Foucault* pendulum) relating to a solar eclipse". "Depending on a solar eclipse found evidence of a systematic nature detailed in Millers results" [122]. "The observations and data record by Miller were found to substantiate the claim that absolute reference frame were being detected, such that the existence of a directions of anisotropy of space, which varied with time "[121]."During the eclipse, the pendulum took an unexpected turn, changing its angle of rotation by 13.5 degree"[130], *part related to an abrupt excursion*. From viewpoint of H particle-paths hypothesis, this change may be attributed to some extent on the fortified counter-current H particle-paths flow between the Earth and combined solar-moon H system during eclipse, *Sec. 5(9)3*, or, to some kind of rock-wall effect, *Sec. 5(19)*; moreover, referring to [118]" Einstein's theory predicts an absolute motion in the absence of matter".

Finally, from view point of H particle-paths hypothesis a modified *SRT* considering the preferred *CMPRF, Sec. 2(6)2b,* reference frame is accepted, according to which the relative inertia of constituting mass-bodies, *Sec. 2(6)2a,* is taken into account in this regards, *Note 5(11)1*, and *Comment 2(6)2c1*. These mass-bodies are correlated through exchange of H particle-paths at c speed, *Sec. 5(9)3*; thus, constituting a unique H system, *Sec. 8(5).* "In the context of an asymptotically flat spacetime, the boundary conditions are given at infinity. Heuristically, the boundary conditions for an asymptotically flat universe define a frame with respect to which inertia has meaning. By performing a Lorentz transformation on the distant universe, of course, this inertia can also be transformed."[512] *Mach's principle in modern GR*. Generally speaking, all of the mass-bodies in the Universe constituting an unique H system through interchange of H particle-paths; therefore, the relative motion of each of these mass-bodies respect to their center of masses of the Universe reference frame, i.e. Universal, *CMPRF*, can be regarded as an absolute motion; please refer also to *Sec. 5(16)5*. In other words, by introducing the effect of inertia in the relative motion of these mass-bodies, we are approaching roughly to the concept of an absolute motion. Please refer also to *Sec. 2(8)1.* Quantum field theory requires a non local and thus, non relativistic state model the prediction of quantum field theory are the same in any frame of reference but the mechanisms that generate no local effects must be operate in absolute frame of reference. Quantum uncertainty made this seemingly paradoxical situation possible. There is a no local effect but we can not tell if the effect went from *A* to *B* or *B* to *A* because of quantum uncertainty" [347]; please refer to *Secs. 8(4) to 8(7).*

Experiment 2(6)2f1- According to [245], in order to reliably detect an absolute frame of reference where the speed of light is constant and equal to $1/\sqrt{\varepsilon_0 \mu_0}$ an experiment setup allowing measuring the one-way velocity of an electromagnetic wave must be used. In this presentation a microwave set up will be described which uses *125 GHZ* signal traveling along a *3m* long signal path. This set up should be capable of detecting the absolute velocity of our solar system relative to Cosmic Background (*~360 Km/s*) by simply choosing the orientation of the signal relative to the direction of the absolute velocity in a manner as Marinov had done in 1979.
Moreover, according to [246], however, Smoot et al have observed that radiation coming from the direction of constellation *LEO* is blue shifted, whereas radiation coming from opposite direction is red shifted. Putting the measured shifts into the Doppler shift equations yielded the absolute motion of our solar system to be approximately equal to *340 Km/s* in the direction of *LEO*. Hence light propagation in anisotropic in our solar system.

2(6)3- Fizeau's test and SRT

Fizeau experiment [68, 69], is one of the example of relatively preferred reference frame, *Sec. 2(6)2b,* in which the stationary laboratory frame attached to the Earth is preferred respect to the moving object, e.g., water ,air, etc., on the behalf of the huge inertia of the former respect to the latter one. Thus, by decreasing the effect of inertia, i.e. the *Fizeau experiment* performed in a low mass space ship, one can reach to its compatible experiments on the basis of special theory of relativity. In fact, the more compatible result obtained at the case of equal inertia of the two mentioned above systems moving at linear straight uniform respect to each other; moreover, reversible H particle-paths of the laboratory H system have the same geometrical shape as that of the second object at rest before starting its linear motion . In other words, H particle-paths *Delta Effect*, *Sec. 2(1)1b*, of the low mass moving object is under influence of external effect of H particle-paths of the massive laboratory reference frame in the order of their relative inertia (tendency to an unique H system , *Sec. 2(4), last paragraph*). On the other hand, this relative effect of inertia can be viewed in the framework of their reciprocal gravitational effects, *Sec. 5(14),* due to H particle-paths behavior of these two objects H systems. Generally, the inner H particle-paths reversible motion at laboratory location by referring to *Sec. 5(16)1b, part A, Fig. 5(8),* have main effects on the single direction H particle-paths of the moving objects that revealed as ratio of inertia of the two objects. In other words, in the order of the ratio of population of H particle-paths of the laboratory to that of moving one; please refer also to *Sec. 5(4)4*. Remarkably, the reversible H particle-paths of the moving object, e.g., water, undergoes γ^{-1}contraction*, Sec. 2(6)5b,* during its motion on the behalf of *SRT* along with the effect of inertia, *Sec. 2(6)2a*, and *Comment 2(6)2c1*.

2(6)4- Sagnac effect [59]

2(6)4a- General Aspect

Supposing a reference frame *R* at rest and related time T_0 , another one *R'* at uniform linear motion at v_r speed, time *T* as in, *Sec. 2(1)1; Figs. 2(1), 2(2).* Two light signals emitted from source *S* at location *o'*, and at two opposite directions, i.e. co-direction and counter-direction of *x, x'* axes. Now, considering the Doppler Effect, the co-direction signal is a contracted form of single direction H particle-paths that undergoes Delta Effect, *Sec. 2(1)1b, Fig. 2(3),* related to it a returned time $+\delta T$, and opposite direction (or counter-direction) is dilated form of H particle-paths (-δT returned time) of the light signals respect to the observer at the origin *o* of the reference frame *R* at rest. Please refer to *Sec. 2(1)1b, Consequence 2(1)1b1, paragraph 3c*. Similarly, two light signals emitted at opposite directions through *x, x'* axes from origin *o* of rest frame *R*, i.e. lab. Now, according to the above discussion, and the statement, "the Sagnac Effect applies to uniform straight-line motion, just as it does to rotational motion"[60]. Supposing the above test in a circular path as in Sagnac Effect in the rim of the rotating disk of a moving source *S* at *o'* location circulating at uniformly *v* speed tangentially under no tangential acceleration, *Note 2(8)2a*, $+\delta T$ must be added to the forwarding co-direction motion travel time and -δT must be deduced from backwarding counter-direction accordingly respect to the time ΔT_0 of rest reference frame (lab). In fact, internal time interval T_1, *Sec 2(6)4b, Eq. 2(110),* of an H system at rest in a reference frame is related merely to the reversible motion of H particle-paths in all of directions. The returned times $+\delta T$, *Eq. 2(112)a,* and -δT , *Eq. 2(112)b,* is related to their single direction forward and backward propagating light signals through uniform motion along *v* speed (or *x, x'* axes) respectively. As a result, the returned time δT revealed in case of single direction motion of H particle-paths as in case of the light signals propagation, i.e. in the absence of fully reversible motion of H particle-paths, *Consequence 2(6)4a1*.
In the *Sec. 2(6)4b, Figs. 2(5), I, II, III*, three cases of light propagations are illustrated respect to inertial laboratory reference frame *R* [as a preferred reference frame. i.e. The Earth, *Note 2(6)4a1*, and *Sec. 2(8)1*] observer. On the basis of path constancy, *Sec. 2(1)2,* we have:
1) Case *I*, the turn table is at rest, and the time of one turn of light in two opposite directions is the same respect to equal number of neutropas of H particle-paths, *Sec. 1(5),* $\delta T = 0$, related to zero path travel of *SD*.

2) Case *II*, the light propagates at the same direction of the turntable rotation at increased neutropa H particle-paths respect to equal number of neutropa of the above case *I*, i.e. $+\delta T>0$, related to *SD* path travel.
3) Case *III*, the light propagates at opposite direction of the turntable rotation at decreased neutropa H particle-paths respect to equal number of neutropa in the case *I*, i.e. $-\delta T<0$, related to exceeded *SD* equivalent path travel.

In the three above cases, the H particle-paths confined in an H hall quantized package, *Sec. 5(16)3a,* that is wrapped, *Sec. 1(12), Note 1(12)1,* in a circular path of radius *R* and path-limit Γ, (or proportional to Γ), starting from the source and terminating to the detector. Please refer also to *Sec. 3(1), Comment 3(1)1.* Moreover, the light source location at starting point in these cases is nominated *S* and at detection point *D*, i.e. observer.
As a result, the Sagnac Effect [97] gives us a schema of internal motion of H particle-paths of an H system (round table) at rest or at motion, *Comment 2(6)4a1*. Considering, *Fig. 2(5),* in case of co-direction motion, i.e. case *II*; the rest observer (lab) at *D* receives more neutropa cells or cycles, i.e. higher energy or shorter forwarding wavelength λ_F, *Eq. 2(82),* than cases *I &III*, for one complete turn of signals. Moreover, the counter-rotating , i.e. *case III*, observer at *B* will received less neutropa cells than *cases I &III*, as shown in, *Fig. 2(5),* for one complete turn of signal, i.e. lesser energy or longer wavelength, λ_B, *Eq. 2(82),* as is shown in, *Fig. 2(5), Sec. 2(6)4c*; moreover, at the stationary *case I*, we have $\lambda_F=\lambda_B$. For additional information please refer to *Sec. 2(3)1*, *Sec. 2(6)5b,* counter-currency mode of motion, *Sec. 3(1)2,* and Sagnac test in vacuum, Sagnac Effect in matter waves [95,96], *Remark 2(6)4a2*.

Generally, Delta Effect, *Sec. 2(1)1b, Fig. 2(3),* is consequence of Doppler & Sagnac Effects. In other words, the contraction in the direction of motion and dilation in the opposite direction of the propagation of the light signals as if its wavelengths are compressible / extendible and exist in a wave train, i.e. the light path in co-direction (*case II*), and counter-direction of motion (*case III*) contracts and dilates respect to the stationary *case I.* Please refer to *Sec. 5(16)3b, part D2* for further information. Noteworthy, the path-length in the three above cases are equal.

Factually, "Michelson-Morley measured the distance; they did not measure a change in the wavelength. Moreover, the equation for the phase shift of a rotating interferometer, used in Sagnac, can be derived from the Doppler Effect "[115], *Part related to Pari Sploter*; please refer also to *Note 2(6)4a2, Sec. 2(6)4b, part c*, and *Sec. 2(10),* for an interpretation based upon H particle-paths hypothesis.

The Sagnac Effect in case of a moving electron instead of a light photon alone is discussed in *paragraph IX of Fig. 4(4), explanation.*

Experiment 2(6)4a1 (*proposal*) - According to *Sec. 2(3)1, Eqs. 2(73), 2(74),* the number of H particle-paths in the forward direction of motion, n_F, *Eq. 2(73),* is higher than the backwarding one; thus, the difference of the mean, *Eq. 2(76),* leading to De Broglie matter wavelength.
Now, supposing an isolated frictionless rotating round table system as in *Sagnac Test* (e.g., a rotational space station) emitted two light beams by a long life battery at the co-direction (forwarding) and counter-direction (backwarding) of the rotating system respect to a non rotating preferred reference frame's observer, at rest respect to the center of rotating system, *Comment 2(6)4a2*. Moreover, assuming the light beam can escape from the whole rotating system. Therefore, according to the difference of *Sagnac* photon energies, ε_F, *Eq. 2(50),* and ε_B, *Eq. 2(51),* i.e. ΔE_{FB}, *Eq. 2(59),* the rotating system decelerates by exit of single direction H particle-paths of the whole system down to reach equilibrium, i.e. stop of rotation,; moreover, ΔE_{FB} drop accordingly. In other words, the single direction H particle-paths of the whole system are exiting through light beams emitted at two opposite directions. As a result, the wavelength of forwarding and backwarding H particle-paths inner the rim of the rotating disk are proportional to the wavelength of co-direction and counter-currency wavelength of light beams respectively, *Sec. 2(3)1, paragraphs I & II.*

Consequence 2(6)4a1 – In fact, during forwarding co-direction motion a contracting (i.e. wavelength contraction) is taken place due to time's arrow reversal, *Secs. 5(16)7,9,* that is compensate by returned time $+\delta T$ in a full round-trip; similarly, during backward counter-direction motion we encountered with time's arrow direction (wavelength dilation) that must be reduced by returned time $-\delta T$ during a full round-trip.

Note 2(6)4a1– "It is confirmed that special relativity can also be used to describe effects on rotating disk. The rim of the disk can even be seen as an inertial system as long as the radial degree of freedom, in which the acceleration acts, is not probed by physical experiment"[61], part related to *Sagnac Effect*. Moreover, in case of *Sagnac's* test, *Sec. 2(6)4,* similar to *Fizeau's test*, *Sec. 2(6)3*, due to huge inertia of the Earth, i.e. laboratory, respect to that of rotating table, the Earth can be regarded as relatively preferred reference frame, *CMPRF*, *Sec. 2(8)1*. Therefore, the geometry of the round table at rest H particle-paths is the same as that of the lab (i.e. the Earth), it is altered by the single direction H particle-paths on the rim of round table during its rotation.

Note 2(6)4a2- Regarding, *Sec. 2(6)4b*, *item B, C,* and referring to [73], part related to *thinking Man*, the *Sagnac Effect* (fringe shifts) is due to a change in traveled path with no role ascribed to *Doppler Effect*. By extending the *item B* to *Michelson-Morley Experiment* , there will be no Doppler Effect in the latter by exception that *MME* must be done in a full closed path as the Earth orbit around the Sun in order to have a positive result; please refer to *Sec. 2(6)5c, Proposal A*, and [113], *part 4-1*. In other words, the H particle-paths of the light beam must be having the same proportionality as that of the Earth's orbit (refer to *Sec. 2(3)1, Eq. 2(55)1*) in viewpoint of shape and direction similarly to *Sagnac Experiment* ; moreover, please refer to *Fig.2(5),* in order to have a general aspect in this respect. Therefore, by frequent short cutting the main path of the light beam regardless of the effect due to

Mirror image Effect, *Sec. 6(2)3,* as in case of *Sagnac Experiment*, the fringe shift through successive back and forth reflection in *MME* are compensate by successive averaged time dilation and length contraction effects, *Fig. 2(7)*, i.e. null result due to H particle-paths arrangement break down. Please refer to also to *Sec. 2(6)5c, Proposal A,* and *Sec. 2(9), Note 2(9)1.*

Note 2(6)4a3 - This result is a direct consequence of the *Compton Effect, Sec. 3(1)1*, on the basis of that the schema for a free moving electron, *Sec. 4(3)1, Part B, Fig. 4(4)*, is deduced.

Comment 2(6)4a1- By simulating the cases *II* and *III* to the counter-current mode of motion, *Sec. 3(1)2,* i.e. forward and backward internal motions of H particle-paths in a moving mass-body at v_R speed, the single direction H particle-paths, *Sec. 2(6)4c*, in the direction of motion (here rotation) can be visualized accordingly. Factually, the frequencies of internal motion of H particle-paths in a mass-body are assumed proportional to that of its emitted light signals; in order to have a schema, please refer to *Sec. 2(3)1, Note 2(3)1a,* and *Sec. 4(3), Fig. 4(4)* related to a free moving electron model.

Comment 2(6)4a2- Supposing this test is performed in an inertial reference frame *R'* moving relative to *R*, at uniform straight motion and considering an observer, o, at rest in the origin of the latter, as in the, *Sec. 2(1)1a*. It evaluates the light signals emitted by the source, *S,* at the origin, o' of the former in the direction of motion at two opposite directions. Thus, there is energy drop, i.e. ΔE_{FB} changed, in this regards respect to non preferred reference frames. Factually, to avoid paradox the experiment must be supposed respect to a preferred reference frame, *Sec. 2(6)2b,* if acceleration (or deceleration) occurred during the motion. Please refer also to *Sec. 2(8)1.*

Remark 2(6)4a1-

Remark 2(6)4a2- In fact, during an interaction, e.g., collision, *Sec. 6(2)1a*, of a mass-body at rest with other moving one, the equality between H particle-paths number at forward and backward motions as in the case *I*, is broken by entrance of single direction H particle-paths of colliding (moving) mass-body, *Experiment 2(6)4a1*. It is basis on of Mirror image Effect, *Sec. 6(2)3,* and exit of appropriate number of H particle-paths of the mass-body at rest to the colliding mass-body (or vice versa). Thus, the former (rest one) starts to move due to returned single direction H particle-paths, *Sec. 2(3)1, Note 2(3)1a.* By simulation, the lack of neutropa cells related to case *II* is compensated with excess of case *III* H particle-paths. In other words, the co-direction (forwarding) and counter-direction (backwarding) light signals respect to round table rotation (motion direction) completed a full round as a result of interaction due to Mirror image Effect, *Sec. 6(2)3,* refer also to *Note 2(6)4a3,* and *Sec. 3(1)1, Fig. 3(3).* The only difference exist in this respect instead of two opposite directions entangled light signals, *Sec. 8(7),* we encountered with correlated internal motion of H particle-paths on the basis of counter-currency mode of motion, *Sec. 3(1)2*, in case of mass-body.

2(6)4b- Explanation of the Figure 2(5)

A) Viewed from the lab frame (source on round table) [76]:

1- Supposing three circles of circumference P *Sec. 1(12),* of radius *R*, nominated as *I, II, III*, as full round path of light signal around the rim of round table at three cases *I, II, III*, respectively.

2- Supposing a light source at rest on the location, *S,* of the rim of round table emitting simultaneously two light signals at two opposite directions around the circle *I* periphery (case *I*).

2-1- At the above case, the light signals is emitted by source *S* at co-direction (counter-clockwise) and counter-direction (clockwise), simultaneously. These opposite direction signals have the same wavelength, λ_0, *Sec. 2(6)4c*. Thus:

$$T_1 = \eta_0 \Delta T_0 = \frac{P}{c} = \frac{\eta_0 \Gamma_d}{c} = \eta_0 a_d^{-1} = \eta_0 \, K_m^{-1} . \Delta T_\Gamma \text{, Please refer to } \textit{Sec. 7(4)1a} \qquad 2(110)$$

Where:

η_0, the light signal neutropa, *Sec. 1(5),* cycles on path P.

ΔT_0, the partial time interval, related to time T_1 at a full round trip.

a_d, Media coefficient related to vacuum medium of time inversion dimension, *Sec. 1(2), Note 1(2)1.*

Γ_d, The path-limit through gravitational field free vacuum medium, *Sec. 7(4)3.*

P, The spatial path of light signal, *Sec. 3(1)1, Eqs. 3(2), 3(3).*

K_p, the proportionality factor of path P with path-limit Γ_d, *Note 2(6)4b1.*

K_m, a dimensionless constant, *Sec. 2(10)1*, *Eqs. 2(116), 2(117).* According to

Please refer also to *Sec. 5(16)1c.*

2-2- The both signals, during their successive counter-current travels around circle *I* circumference, making a stationary wave-like pattern.

3- Now, supposing the light source, *S, moving* at a uniform rotation of tangential velocity v at counter-clockwise direction related to cases *II & III.*

3-1 – Considering, *Sec. 2(3)1,* assuming η_F, *Eq. 2(73),* and η_B *Eq. 2(74),* co-direction and counter-direction light signal neutropa cycles to complete a full round of the circles *II, III*, and λ_F, λ_B, *Eq. (82),* related wavelengths respectively; therefore, according to *Eq. 2(110),* and considering, *Sec. 2(3), Note 2(3)2a1, Eq. 2(86),* we have:

$\eta_0 \lambda_0 = \eta_F \lambda_F = \eta_B \lambda_B = P = K_p \Gamma_d$, *Note 2(6)4b1*, and *Remark 2(6)4b1* 2(111)a

$\eta_0 \Delta T_0 = \eta_F \Delta T_F = \eta_B \Delta T_B = T_1 =$ *Constant* 2(111)b

According to *Eqs. 2(110), 2(111)a*:

$\lambda_F < \lambda_0$, $\lambda_B > \lambda_0$, or $\eta_F > \eta_0$, $\eta_B < \eta_0$ 2(111)c

The wavelengths, λ_F, λ_B, obey the Doppler Effect as in, *Eq. 2(82),* of *Sec. 2(3), Note 2(3)3a.*

3-2- According to above statements, and *Eqs. 2(111)a, b*, we have:

$T_2 = T_1 + \delta T = \eta_F \Delta T_F + \delta\eta\delta t$ Case *II* 2(112)a

$T_3 = T_1 - \delta T = \eta_B \Delta T_B - \delta\eta\delta t$ Case *III* 2(112)b

Where:

-T_2, T_3, are the time required for the light signals to travel the path between emission and detection at the cases *II, III,* respectively, i.e. *SD* in the direction of the related signal propagation.

- $\Delta T_F, \Delta T_B$ are partial time intervals during a full round at the cases *II, III*, respectively.

Please refer to *Consequence, 2(6)4b1.*

3-3- According to *Eq. 2(112)a*, in the case *II*, the light signal propagation time, T_2 retarded by $+\delta T$ returned time interval respect to time, T_1 to complete a full round. In other words, the wavelength of co-direction signal contract in accordance with Delta Effect, *Sec. 2(1)1b,* regarding Doppler Effect. In order to complete a full round, it need to δn neutropa cycles (or cells) along with $+\delta t$ retarded partial time interval.

3-4 – According to *Eq. 2(112)b,* at the case *III*, the light signal propagation time, T_3, advanced by $-\delta T$ returned time interval respect to time T_1 to complete a full round. In other words, the wavelength of counter-direction signal dilates according to Doppler Effect; moreover, to complete a full round $\delta\eta$ cycles are in excess along with $-\delta t$ advanced partial time interval.

4- The, *Fig. 2(5),* is drawn according to path constancy, *Sec. 2(1)2*. Please refer also to *Sec. 2(6)4c*. Moreover, the neutropa cells in all of three cases *I, II, III,* have equal path–lengths but at different shapes regarding the motion direction.

5- Circles *I, II, III*, are lines (or trajectories) supposed on the rim of rotating disk of the turn table in the Sagnac Experiment, the circumference of there are imagined equal to Γ path-limit; in the practical test the circle circumference can be taken proportional to Γ, *Consequence 2(6)4b1.*

6- The disk axis of rotation is perpendicular to the reader sheet at *O* location.

7- According to *paragraph 3-2, Eqs. 2(112)a, b* and referring to *Sec. 2(1)1b, Eq. 2(16),* and *Sec. 2(3)1, Eq. 2(59),* the average partial time difference, δt and average partial time interval, ΔT_{FB} *Note 2(9)1*, and *Sec. 2(10)* are obtained as following:

$$\delta t = \frac{\Delta T_F - \Delta T_B}{2} \quad 2(114)a \quad ; \quad \Delta T_{FB} = \Delta T_0 = \frac{\Delta T_F + \Delta T_B}{2} = \frac{P}{c} = \frac{K_p \Gamma_d}{c} \quad 2(114)b$$

Therefore, the average time interval, ΔT_{FB}, is equal to time interval at rest, i.e. ΔT_0, *Eq. 2(109)b.*

Please refer also to *Sec. 2(6)5b*.

Considering, *Eqs 2(112)a,b*, $\delta\eta$ is obtained according to *Sec. 2(3)1, Eq. 2(76),* as following:

$$\delta\eta = \frac{\eta_F - \eta_B}{2} \quad 2(114)c$$

Moreover, $\eta_0.\Delta T_0$, *Eq. 2(110),* $\eta_F.\Delta T_F$, *Eq. 2(112)a*, $\eta_B.\Delta T_B$, *Eq. 2(112)b,* are based on path constancy, *Sec. 2(1)2.* Thus, the light signals travel a full round trajectory in co-direction and counter-direction simultaneously in all of the *cases I,II,III*, due to partial time intervals, ΔT_0, ΔT_F, ΔT_B, at frequencies, $\upsilon_0, \upsilon_F, \upsilon_B$, respectively, *Remark 2(6)4b2*. In other words, a direct result of equal path P (proportional to Γ, *Consequence 2(6)4b1*) in each of the stated above three cases; please refer to *Sec. 2(10), Eq. 2(116),* and *Sec. 3(1)1,* in this respect. Noteworthy, according to *Sec. 8(9)2, Fig. 8(2)* the light emitted by approaching moving source travels shorter path respect to its receding motion due to correlation of emitted photons of the light with the target (or detector); whereas, the path-length of these two paths are equal. Please refer also to *Sec. 2(6)4b, Note 2(6)4b1.*

8 – Factually, case *I* of *Fig. 2(5)* can be regarded as a stationary circle, i.e. standing wave, due to counter-current H particle-paths of equal wavelength. The superposition of the two cases *II, III*, can be considered as a circle that is moving at the same speed of the round table, i.e. v speed, *Sec. 2(6)4c*. This is the foundation of inner motion of mass-bodies according to H particle-paths hypothesis. The same result is obtained as light traveling paths which enclose an area, *Sec. 2(6)5c, Proposal A.* Noteworthy, a moving electron, *Sec. 4(3)1*, part *B*, confined in a circular path (or circulation) before measurement, *Secs. 8(4), 8(7)2, 8(9),* can be considered in this way. In reality, the single direction and reversible H particle-paths, *Sec. 1(2),* of the particles (or mass-bodies) interacts with that of vacuum texture, *Sec. 5(16)3b*, to reach an equilibrium, *Sec. 5(2)1b*. In the domain of gravitational fields a combined texture of vacuum space and gravitational field interacts with the mass-bodies, *Sec. 5(16)1b*. Note that according to H particle-paths hypothesis, the particles are not point-like and there are extended on path P, *Sec. 8(7)4.*

According to *Sec. 2(10)3,* the Sagnac Effect is an example of its case *B* as state below. Whereas, the *CMPRF* of the Earth (lab) and moving object (roundtable) for the reason of huge inertia of the former respect to the latter is coincide on the center of mass of the Earth; thus, we encountered with a classical Doppler Shift excluding γ^{-1} contraction, *Sec. 2(6)5b*, in the former case. Please refer also to *Sec. 2(8)1.*

B) Viewed through the round table rotating frame, i.e. LFRF, Sec. 2(6)2c, with its own source and detector
In this respect, one path leaves this mirror as a receding source only to reach it as an approaching detector and vice versa*, Sec. 2(6)5b*. In fact, in the both parts *A&B* by assuming the path constancy of path P , the *Sagnac Effect* is interpretable; please refer also to *Secs. 2(6)4c, 2(9), 2(10)1.* In other words, the light speed in the two cases *II & III* of *Fig. 2(5)*, are the same, i.e. constant light speed c; but, we must consider the *LFRF* proper time in the cases *II, III* on the basis of ΔT_F , ΔT_B , instead of ΔT_0 , in the case *I*, respectively.

C) Viewed outside the round table (the lab as source and detector)
According to [116], *Dufour and Prunier experiment,* "repeated Sagnac Experiment with several modification of the instrument and observed displacement of the fringes whether the light source and the camera were rotating with the interferometer or were fixed in the laboratory frame; thus, refuting the relativists argument to explain the Sagnac Effect" [115], *Part related to Pari Sploter*.
According to [218], "most such experimental variations have involved things like conducting the experiment with apparatus in a vacuum, or else inside some medium other than air; or to have the medium rotate Whereas the mirrors are held stationary with respect to the Earth. All these variations agree with Sagnac's original result, still another variation was that Dufour and Prunier who kept the light source and observer separated from and not moving with turntable on which the mirror were mounted, their result was the same as Sagnac's"; please refer to [76]. The latter test that is regarded as mutual collision of rotating mirrors and the light beam's photon (as a particle) support the *Proposal B* of interpretation that is discussed in *Sec. 2(6)5c*.

Consequence 2(6)4b1- By considering the factor of proportionality as in *Eq. 2(55)1, of Sec. 2(3)1, Note 2(3)1a,* the *Eqs. 2(74)* to *2(86),* are applied to the three cases *I, II, II*, of light signals emission as in case of mass-bodies accordingly. Therefore, according to discussions hold on the light signals emitted in the three cases *I, II, III*, a schema of counter-current internal motion of H particle-paths on the rim of the disk can be visualized, *Experiment 2(6)4a1,* on the basis of Sagnac experimental results. Please refer to *Sec. 2(6)5c*.

Note 2(6)4b1- Supposing the path P is the traveled path of the light signal H particle-paths per time unit through vacuum medium, according to *Eq. 2(111)a*, and *Eq. 1(3)*, we have:

$$K_P = \frac{a_d}{a_s} \qquad 2(114)\text{d}$$

Or generally through other media:

$$K_P = \frac{a}{a_s}$$

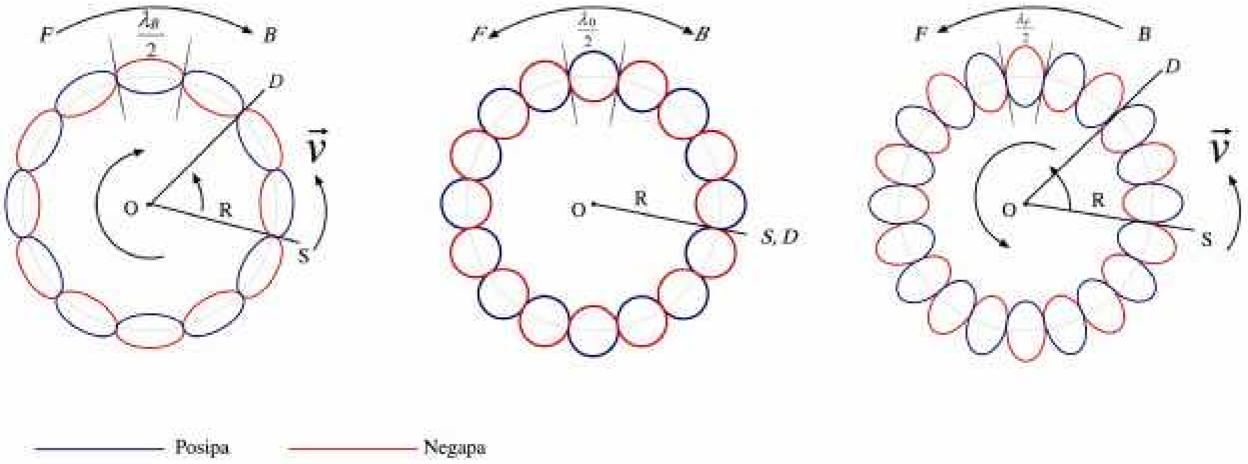
Where, a media coefficient, and $a_s = 1s^{-1}$, *Note 1(2)1.*
Considering the path P through normal vacuum in a time unit, the $\eta, \eta_0, \eta_F, \eta_B$, will be equal to the magnitude of related matter wave frequencies $\upsilon, \upsilon_0, \upsilon_F, \upsilon_B$ respectively.

Remark 2(6)4b1 – Factually referring to *Sec. 8(7)*, *Fig. 8(1),* in case of the Sagnac Experiment we encountered with two entangled pair of photon propagating at c speed and at two opposite directions in a circular path as a unique H system. Therefore they have two equal path-lengths both in clockwise and counter-clockwise directions; please refer to *Eqs. 2(111) a, b,* and *Fig. 2(5).* In other words, we encountered with two different time's arrow generation along with space expansion, *Sec. 5(16)7a*, at two opposite directions of forward and backward of light propagation Whereas the light speed remained unchanged in both cases; please refer also to *Sec. 4(6)1, Comment 4(6)1a,* in this respect.

Remark 2(6)4b2 – Referring to *Sec. 3(1)2, Eq. 3(17)2,* and considering *Fig. 2(5),* the neutropa cells are shown schematically in the form of full circles regarding the proportionality of r_P , r_N to λ_P , λ_B (here r_F , r_B to λ_F , λ_B) respectively in order to illustrate path-constancy.

2(6)4c –Rotating ring-like beam in Sagnac Experiment
Alternately in the Sagnac Experiment, the two emitting photons at opposite directions can be considered as a unique H system, *Sec. 8(5),* of entangled pair of particles, *Sec. 8(7),* during a measurement this correlation is collapsed instantaneously, *Sec. 7(4)2f, part c*, e.g., photon detected or absorbed. Factually, an entangled pair of photon before measurement (or detection) constitutes a counter-current, *Sec. 3(1)2,* H particle-paths as in, *Fig. 8(1).* It can be compared to a rotating ring (constituted initially of stationary waves at rest state) moving tangentially at common (or external, *Sec. 1(3)*) velocity v, *Sec. 2(6)4a, Comment 2(6)4a1*, and devoid of radial motion of H particle-paths. Therefore, this implies that two apparent (or false) internal component of

velocities of single direction H particle-paths in the co-direction, and counter-direction of rotation of rotating ring instead of $(c-v)\gamma, (c+v)\gamma$ due to the lack of radial motion of H particle-paths of particle of zero rest mass [contrary to the case of mass-bodies, *Sec. 2(1)1a*] are c - v, c + v respectively, i.e. its γ , or γ^{-1} contraction factor, *Sec. 2(6)5b*, is equal to one, *Note 2(6)4c1*. This phenomenon can be viewed as an example of, *Sec. 2(10)," Example 2(10)1a, hypothesis I"*. In case of single beam experiment (the light propagation in one direction, i.e. co-direction or counter-direction), the measurement is performed successively by the reflecting mirror, *Sec. 6(2)3*, therefore, the reflected light during each reflection can be assumed as a single direction photon beam, *Sec. 2(5)c, Example 2(6)5c1*. In fact, this single direction beam along with its reflected conjugate may be constitute a co-moving entangled pair of particles, *Sec. 2(10), Example 2(10)1a, hypothesis I*. Please refer also to *Sec. 2(6)4b, part A, paragraph 8*.



Case III- Counter-direction state *Case I –Rest state* *Case II- Co-direction state*
Fig. 2(5) - Sagnac Effect respect to the observer of inertial reference frame R in view point of H particle-paths hypothesis

Noteworthy, the non locality discussed in *Secs. 8(7), 8(9)1*, plays a main role in case of Sagnac effect. In other words, the light beam at co-direction (*case II*), and counter-direction (*case III*) that are propagating at c speed, are correlated with the source s before striking at detector *D* (i.e. detection, or, measurement*, Sec. 8(7)2*), please refer also to *Fig. 2(5).* Resuming, the light propagated from the source in three *cases I, II, III*, regardless of their traveling distances, and related wavelengths have equal path-length at the moment of measurement, *Sec. 2(6)4b, part A, paragraph 4.*

Note 2(6)4c1- Noteworthy according to *Sec. 1(3)*, the total velocity of H particle-paths of the rotating ring is the sum of its external (or common) motion component, i.e. v, and its internal apparent components i.e. $c-v, c+v$ in the co-, and counter-direction of tangential rotation respectively. In other words the total velocity in each of the stated above directions is constant, i.e. equal to c, respect to an observer at rest, i.e. lab.

2(6)5- Discussion
2(6)5a- General Aspect

As a result, we can fixed a local reference frame, *LFRF*, *Sec. 2(6)2c,* on the rim of the disk of round table in *Sagnac Effect*, *Sec. 2(6)4*, moving liquid or water in *Fizeau test, Sec. 2(6)3,* the air or gas medium [109] *part 10-2*, e.g., helium [101], in the arm (or light path) of Miller's interferometer [90] at high altitude, *Sec. 5(16)2c.* Especially in case of latter test, the *LFRF,* can be considered respect to *CMPRF* of the Solar system, i.e. air molecules as a whole can be regarded as a unique freely moving or floating) H system. In other words, in case of disk at rest in *Sagnac Effect*, stationary water in Fizeau test and *MME* test, *Remark 2(6)5a1,* at the sea level, the *LFRF* is at rest state and coincide with *CMPRF* of the lab. Especially in the latter test the air molecules floating common motion in the arm (light path) is damped by the Earth gravitation respect to the back and forth of the light beams, i.e. nil fringe shift, *Sec. 5, Experiment 5(16)3.* This result is confirmed by *Shamir-Fox experiment* [100] using solid state *Michelson interferometer* used light from a *He-Ne laser* and used *Perspex* rods with lengthy *0.26m* for the reason of damping effect of *Perspex* molecules respect to back and forth light beam no fringe shifts were seen during rotation of the interferometer. In this sense at transparent solid medium shares this outcome with the vacuum itself [98], *Section 2-13*

Generally, *Miller* [90] positive result can be interpreted on the basis of interaction of a bulk gas and light beam according to *Sec. 5(2),* to reach local equilibrium, *Fig. 5(2),* regarding attenuated damping of gravitational field effect on common motion according to the Earth motion as, *LFRF,* respect to the solar system as *CMPRF.* In other words, Miller interferometer is a tool for evaluating of gas bulk motion respect to lab frame. Moreover, the Miller experiment has been confirmed by a non-interferometer experiment such as the *Torr-Kolen Experiment* [99], and DeWitte [98,110]. The latter one-way method uses *1.5Km* coaxial cable (the refractive index of the insulator within that is 1.5) between two clusters of atomic clocks. So the obtained data after sending signal, i.e. the one-way *RF* travel time is in excellent accordance with the Miller's data *Comment 2(6)5a1;* please refer also to *Sec. 2(8).* In fact, according to [98], *Section 2-10*, "absolute motion (*AM*) (or *LFRF* motion of the Earth respect to *CMPRF* in this article, *Secs. 2(6)2b,c*) of the Solar system has been observed in the direction ($(\alpha = 17.5h, \delta = 65°)$, *Note 2(6)5a1*, up to an overall sign to be sorted and, with a speed of $417 \pm 40 Km/s$". This velocity is different to that associated with the cosmic microwave background, *(CMB)*, relative to which the solar system has a speed *369Km/s* in the different direction $(\alpha = 11.20h, \delta = -7.22°)$. Please refer also to *Sec. 2(6)5c, Proposal A.*

Finally Sag*nac Effect, Sec. 2(6)4*, *Fizeau Effects, Sec. 2(6)3,* as *Compton Effect, Sec. 3(1),* are direct proof of path-limit, Γ, *Sec. 1(12),* [of H hall quantized package, *Sec. 5(16)3a*].

Note 2(6)5a1- α, δ are right ascension, declination coordinates of the ecliptic respectively. "By 1933, Miller concluded that the Earth was drifting at a speed of *208 Km/Sec.* towards Dorado, $(\alpha = 4h.54 \min, \delta = -70^o 33')$"[90], *part 1*; moreover, Marinov in [167], *section 1,* wrote" Indeed, I measured three times optico-mechanically and one electromagnetically, the Earth's absolute velocity; its magnitude is $350 Km/Sec$ with equatorial coordinates of its apex $\delta = -20^o, \alpha = 12h.$ (approx.)".

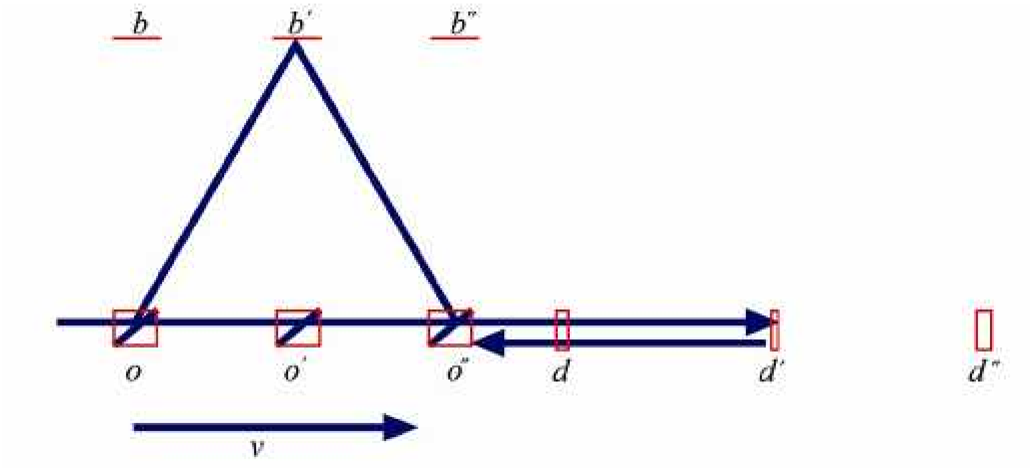


Fig. 2(7) - The Michelson-Morley Experiment

Comment 2(6)5a1- According to [185], *part related to stellar aberration*, " The period between two successive eclipses of Jupiter's moon Io, appears smallest when the Earth happens to be moving directly towards Jupiter and largest when is moving directly away from it. These variations could be explained by taking into account the time it takes light to get from Jupiter to the Earth. The velocity of light calculated on the basis of observations of stellar aberration was of the same order of magnitude as the velocity of light calculated on the basis of observations of eclipse of Io.
In fact, the above results similarly to De Witte [98,110] can be considered as one-way results comparing to that of Michelson-Morley experiment [69] as 2-way or round trips one. However, in case of Jupiter's moon Io (related to Roemer's one-way method [230]) and stellar aberration [193, 196] at two opposite positions of the Earth's orbit around the sun, and considering the wavelengths of light signal as compressible/extendible, *Sec. 2(6)4*. Based on classical Doppler Effect and Delta Effect, *Sec. 2(1)1b, Fig. 2(3),* the path-length (excluding external effects) can be considered as constant. Here, the Earth in its two opposite positions around the Sun can be considered as detector, *Example 2(6)5b1*. Please refer to *Sec. 2(1)2,* path constancy.

According to the above statements, we encountered with two time intervals, ΔT_F and ΔT_B due to forwarding and backwarding motion of Stellar systems of Jupiter and the Earth respectively; please refer to *Sec. 2(6)2a, Note 2(6)2a1.* Remarkably, *SRT* is based on round trip *MME* [69] experiment, in which the average time of internal forward-backward motion is taken into account, *Note 2(9)1*. Generally speaking, the path-length, *Sec. 2(1)2*, on each of the ways (i.e. forwarding or backwarding) are remain unchanged on the basis of H particle-paths hypothesis; please refer also to *Sec. 2(3).* By referring to *Sec. 2(10),* the light speed in the two stated above cases are constant, i.e. c, but traveling times, $\Delta T_F, \Delta T_B$, differ through the vacuum constituted of H hall quantized packages, *Sec. 5(16)3a,* as ultimate expanded form of H particle-paths flow through the Universe. Please refer to *Sec. 2(1)1b*, *Consequence 2(1)1b1, paragraph 3, Sec. 2(6)5c, Proposal A, Sec. 5(16)3b, part D2, Remark 5(16)3b, D1,* and *Sec. 5(16)10,* in this respect.

Remark 2(6)5a1- By comparing the, *Fig. 2(7),* with that of, *Fig. 2(3),* i.e. *Delta Effect*, *Sec. 2(1)1b,* the path $ob'o''$ has proper time interval ΔT_0, the path $oo'o''$ has its proper time interval ΔT; thus, on the basis of *Eq. 2(15),* we have:

$$\frac{ob'o''}{\Delta T_0} = \frac{oo'o''}{\Delta T} = c \qquad 2(115)$$

Please refer to *Sec. 2(8)1* in this regards.

2(6)5b- Effect of γ^{-1} contraction Factor

The total path P (that is proportional to path-limit Γ, *Sec. 2(6)4b, part A*, of the related medium) in the three *cases I, II, III, Fig. 2(5)*, is constant, *Note 2(6)4b1*. Therefore, merely the light wavelength alters accordingly, i.e. the λ_F, and λ_B undergo contraction (or dilation) respectively based on *Fig. 2(5)*, and classical *Doppler Effect, Note 2(6)5b1.* As an example, please refer to *Sec. 3(1), Fig. 3(3),* and *Sec. 4(3)1, Part B,* of a free moving electron to have a schema of constancy of P during motion in this respect. Therefore, the γ^{-1} contraction factor, *Sec. 2(1)a, Eq. 2(8),* does not applied to path P (or path-limit Γ), during relative motion of particle of zero rest mass, i.e. purely single direction H particle-paths, e.g., photons. Thus in the latter case only, their wavelengths or frequencies alter as in, *Figs. 2(5), 4(4)*. However, in case of macro-body with rest mass, the moving length, *Remark 2(6)5b1*, in the direction of uniform motion contrary to particle's path-limit, Γ (or path P) subjected to γ^{-1} contraction, *Eq. 2(11),* due to combination of speeds of single direction H particle-paths with that of reversible ones according to *Sec. 2(1)1,* in both parallel and perpendicular directions to the motion direction. Therefore, the two sides of, *Eq. 2(114)a, b,* are subjected to this contraction. In other words, δT, *Sec, 2(6)4b, Eq. 2(112)a, b,* depends on α, *Eq. 2(7),* and $\Delta T_0 \rightarrow \gamma^{-1}\Delta T_0 = \Delta T'$, *Eq. 2(16).* Alternately, it is better to say, *Eq. 2(109),* undergoes contraction by γ^{-1} factor. The above results can be attributed to the dual characteristics of mass-body at rest, *Note 2(6)1a*, constituted of reversible H particle-paths and particle of zero rest mass purely constituted of single direction non reversible H particle-paths, *Sec. 1(3),* as a result obtained from Compton Effect, *Sec. 3*. The stated above statements explain the contradiction arises related to Stellar Aberration [193], *Comment 2(6)5a1,* and Sagnac Effect [59], *Sec. 2(6)4*, considering *SRT*. According to [200], *part related to Lorentz transformation Equations*, "If relativistic modifications of wavelength and frequency are indeed an experimental fact, they necessarily be attributed to the course of emission or contained in the nature of light itself". Alternately, according to [230], "the velocity of light is independent of the velocity of its source". Whereas, based on H particle-paths hypothesis, the light photon emitted by the source is correlated with the latter, *Sec. 8(9).* Thus, in this respect we must into account the *CMPRF* of emitter and detector, *Sec. 2(8)1.*
According to *Sec. 2(10),* the Sagnac Effect, *Sec. 2(6)4,* is an example of its related *case B*; where, the *CMPRF*, *Sec. 2(6)2b,* of the Earth (lab) and moving object (round table) for the reason of huge inertia of the former respect to the latter is coincide on the center of mass of the Earth. Thus, we encountered with a classical (or false) Doppler shift excluding, γ^{-1} contraction factor, as a result of correlation of H particle-paths of moving objects with that of the Earth, *Sec. 8(7)2, part B.* In other words, the two entangled pair of light signals at opposite directions can be viewed as a purely closed single direction H particle paths in this respect, *Sec. 2(6)4c*. Whereas, the moving object in its straight path respect to a massive one (or their related *CMPRF*) as detector during receiving the light signal from massive one, obeys the classical (or false) Doppler shift, *Sec. 2(8)1*. But in the cases such as the light emitted from binary stars, we encountered we relativistic Doppler shift due to the existence of right angle (or perpendicular) H particle-paths speed combinations of this Unique H system, *Sec. 8(5);* please refer to *Example 2(6)6b1,* and *Sec. 2(10)3*, in this regards.

Resuming, the relativistic Doppler shift (γ^{-1} contraction due to constancy of light speed) takes place in case of correlated light emitted by a massif mass-body as a unique H system. The true light speed measured by the detector is independent of its motion (i.e. equal to c, *Example 2(6)5b1*). Therefore, it must be considered respect to *CMPRF* of both source and detector, or, vice versa.

Example 2(6)5b1 – Considering a massif mass-body *M* acts as a source of photon emitting; thus, the whole H system (i.e. mass-body plus its entangled pair of photon, *Secs. 8(7), 8(9)1*) can be regarded as a unique H system, *Sec. 8(5)*; please refer also to *Sec. 8(6), Remark 8(6)1a*.

A) Now, considering a low mass-body *m,* (*M>>m*), regarded also as a source, the velocity of emitted photons by both *M & m* bodies respect to the observer of their common *CMPRF* is equal to c.

B) Therefore, both mass-bodies *M & m* respect to their common *CMPRF's* observer affected by related γ^{-1} contraction factor due to constancy of light speed; please refer to *Sec. 2(8)1* for more information in this regards.

C) Now considering the mass-body m as detector of the light emitted by the source *M*. The velocity of photon emitted respect to observer of m is equal to virtual velocities $c \pm v$ according to the direction of relative velocity *M,* and m, *Sec. 8(7)2, part B.* Since, according to the above condition the mass-body *M* and its emitted entangled photon constitute a correlated H system of velocity $\pm v$ respect to m regarded as detector. But according to *Delta Effect, Sec. 2(1)1b*, the velocity of photon emitted by *M* is also equal to c respect to m, by the difference that the time interval based on *Sec. 2(6)2a, Note 2(6)2a1*, is not equal to ΔT_M, but $\Delta T_M \pm \delta T$ depending on the direction of relative velocity v.

D) Now, considering a system of rotating binary stars, we encounter with true rotational velocity of its stars respect to their common *CMPRF*. Therefore, the emitted photon by this system is correlated with that as a unique H system. In this case there is a γ^{-1} contraction factor due to the rotational motion of its binary stars that is revealed as constant light speed c by a non-correlated detector.

Note 2(6)5b1- According to *Sec. 5(16)3b, part D2*, the light traveled paths in approaching and receding direction respect to detector (or observer) of a moving source is shorter and larger respect to the path of the source at rest state. In other words, the related time intervals is also contracted and dilated respect to the stationary state in such a manner that the light speed in all the cases remained unchanged, i.e. c. As a result, the difference in the stated above paths leading to positive results in Sagnac test.

Remark 2(6)5b1- According to H particle-paths hypothesis instead of length contraction it is better to say wave-length reduction due to internal motion, *Sec. 2(3)1, Note 2(3)1a, Eq. 2(77),* affected by γ^{-1} contraction factor instead of length of macro-body in the direction of motion.

2(6)5c- Sagnac test interpretations

Three principal specifications in an H system which is based on constancy speed of light must be considered basically in this section as following:

I) The γ^{-1} contraction factor, *Sec. 2(6)5b*.

II) The external and internal velocity components of H particle-paths of a moving H system, *Sec. 1(3).*

III) At an equal path-length, the traveled path of a light beam emitted by a source in case of receding is shorter than approaching one respect to an observer at the *CMPRF's* of the system consisting of emitter and detector, *Sec. 8(9)2, Fig. 8(2)*; please refer also to *Sec. 2(10)*.

Proposal A- According to *Sec. 2(6)2a, Notes 2(6)2a1, Eq. 2(109),* and *Sec. 2(6)5b,* a two-way trip (round trip, *Sec. 2(9), Note 2(9)1*) light travel similar to Michelson-Morley Experiment [72], *Remark 2(6)5b1*, in vacuum compensate each other, i.e. $\Delta T'$, *Sec. 2(1)1b, Eq. 2(16),* that is the average time of its back and forth motion, *Sec. 2(9),* and *Sec. 2(6)4b, Eq. 2(114)b*. Thus, we encountered with an averaged of one-way trips for light as in Roemer's method. Whereas, in case of Sagnac test, the light beam correlation, *Sec. 8(7),* with the source is extended all over the mirrors on a circle, which is regarded as a one-way trip in a rotating motion. De Witte [601] according to *Eq. 2(109)* of *Sec. 2(6)2b* gives an alternate result respect to a relatively preferred reference frame as if the light speed add respect to this frame, whereas according to H particle-paths hypothesis only time dilate, or contract, in an one-way trip on the basis of, *Eq. 2(109)*. Therefore, the light speed also remain unchanged, i.e. c, as an immutable universal constant, *Sec. 7(4)4*. Thus, similar interpretation on the basis of light speed consistency can be done in case of *Sagnac Effect*, *Sec. 2(6)4;* please refer to *Comment 2(6)5a1*, *Sec. 5(16)10,* and *Sec. 5(16)3b, part D2*. According to [113], *Part 4-1,* "as light traversing paths which enclose an area behaves differently from light traversing path which do not. An example is provided by *MME* and *Macek-Davis Experiment*. If the apparatus of the former is rotating the interference fringes do not shift. If the ring laser in the latter is rotating, then the interference fringes do shift", i.e. a closed light path, *Note 2(6)5c1*; please refer to *Sec. 2(6)4b, part A, paragraph 8*, and *Sec. 2(6)4a, Note 2(6)4a2*. According to the above statements in case of ring laser, the synchronization of a series of clocks around a closed path by successive clocks return back to the place of first clock. The last clock is not synchronized with first one in an inertial reference frame at an uniform motion and, in a non-interrupted closed paths such as Sagnac Effect, *Sec. 2(6)4.*

Proposal B – According to *Sec. 2(6)4c*, in the Sagnac Experiment the circulating beam that is constituted of counter-current H particle-paths in a ring path can be considered as an object of quasi rest mass moving tangentially at v speed, and devoid of radial motion of H particle-paths. In other words, it is excluded of H particle-paths normal to the direction of tangential motion, i.e. γ , or, $\gamma^{-1} = 1$, respect to the lab observer, thus, inducing classical Doppler Effect, *Sec. 2(8)1.*

Proposal C- Two mass-bodies that are attached through their masses constitute a single mass-body, i.e. with a unique γ^{-1} contraction factor irrespective of their relative motion. Generally speaking, a mass-body that is in contact through Mirror Image Effect, *Sec. 6(2)3*, to an H system, (e.g., a mass-body, or a massless particle can be regarded as a single H system with a common γ^{-1} contraction factor, *Example 2(6)5c1,* and *Example 2(6)5c2*.

According to above proposal the paradoxical Thim Experiment [203] and Sagnac Test [59] can be interpreted.

Example 2(6)5c1- Considering two mass-bodies *M* and m as in *Example 2(6)5b1*, are attaching to each other through their surfaces (or masses), according to this assumption, we have the following items:

A) Based on Mirror Image Effect (a modification of Newton third law), instead of two separate path-length values, $M.\Delta T_M$, $m\Delta T_m$, as in *Sec. 2(6)2a, Example 2(6)2a1*, the two mass-bodies have a unique (or common) path-length $(M+m)\Delta T_{M+m}$, and a unique time interval ΔT_{M+m} at the contacting location. In other words, the whole system has a unique γ^{-1} contraction factor irrespective of relative motion of objects *M* and m respect to their common C*MPRF's* observer contrary to case of two separate mass-bodies *M & m*, *Sec. 5(9)3*.

B) In case of mass-body m regarded as source of photon emission at the moment of collision (or reflection) of the photon with the mass-body *M* as detector, we have a single H system *M &* m. Factually, the latter single system that takes form on each reflection of photon can be regarded as a source of photon emission by its part m at the point of reflection, *Sec. 2(6)4c*, and *Sec. 6(2)3*.

C) Now supposing:

I) The both mass-bodies *M* & m (*M*>>m) have spherical shape, and constituted of a rigid (or solid) objects with frictionless contacting surfaces.

II) The mass-body m is rolling on the surface of object *M* in such a way that the center of mass of the former, respect to the latter (or better to say respect to their *CMPRF's*) observer, is at v speed.

Thus, according to above descriptions, there will be a question "The object m is rolling on object *M*, or *M* on m. The human logic say that m is rolling on *M* due to huge inertia (or mass) of the latter one", i.e. there is a preferred reference frame on *M*, or, according to this Example a part of single object (or system) *M* & m , i.e. m, is moving on surface of its other part, i.e. *M*.

According to *Sec. 6(1), paragraph I, Fig. 6(1),* there is a steady flow of equal number of H particle-paths through contacting surface s. As a result, in case of *part* c of this example, at each instant of rolling, there's a steady flow of H particle-paths through contacting location at the same internal speed components, and at right angle (or perpendicular) to the motion direction, i.e. single direction H particle-paths of the object m regarded as moving respect to common *CMPRF* of *M* & m. It is coinciding on center of mass of object *M* due to its huge inertia respect to m. Consequently, the contraction factor γ^{-1} instead of $\sqrt{1-v^2/c^2}$ is approximately equal to one, i.e. the common contraction factor of objects *M* & m regarded as single object (or system) respect to an observer at its *CMPRF*. Noteworthy, according to Delta Effect, *Sec. 2(1)1b, Fig. 2(3),* the internal shape of H particle paths of the moving objects *M* & m depends on their velocities respect to an observer at their common *CMPRF* at the contact location up to reach levitation (or separation), *Sec. 5(2)2*. At the latter stage, the two-body system obeys the *Sec. 5(9)3a*, i.e. two identical correlated mass-bodies through vacuum texture, *Sec. 5(16)3b, part A*, each of equal path-length during their motions, *Sec. 5(9)3d*. In other words, the two objects have its individual γ^{-1} contraction factor respect to their unique *CMPRF*, *Examples 2(6)4a, 2(6)5b1*, contrary to case of contacting two-bodies system.

D) Supposing the spherical object m is fixed by two equally divided springs between two points *A, B* on the surface of spherical object *M*. At this case, the springs have equal length, and equal spacing between two adjacent spirals. Thus, by a far analogy equal path-length and wavelength accordingly. Now, assuming the sphere *M* is rotating in accelerated mode of motion along its axis, and normal to *AB* line, or in *BA* direction. The spring *A*m in co-direction of object m is contracted respect to stationary case. In other words, the *A*m length is contracted, and the spacing between spirals is contracted accordingly. By a far analogy, the path of the light beam emitted by source m in m*A* direction is shortening along with its wavelength, whereas its path-length is remained unchanged. Similarly, in counter-direction of motion, i.e. m*B*, the spring is dilated respect to the stationary case. In other words, by a far analogy the path of the light is increased along with its wavelength; whereas, its path-length is remained unchanged comparing to the latter and stationary cases. As a result, the vacuum gravitating quantized texture around mass m is fixed to the latter, *Sec. 5(2)1d, part A2*. Thus, it resists to the motion of photon of the light beam emitted by source m depending on its geometrical shape and density, *Sec. 5(16)3c*. Moreover, it is stretched (or dragged) during the motion of mass-body *M*. On the other hand, in case of *AB* normal to the motion direction, there is no variation in the spacing of spring spiral in the projection normal to the direction of the motion. Noteworthy, based on Mirror Image Effect, *Sec. 6(2)3*, during photon emission by source m, an acceleration is implied to the mass-bodies system m & *M* system accordingly.

Three main results are obtained from the stated above discussions:

I) Two mass-bodies at the moment of contact (or collision) act as a unique H system, i.e. a single system. the γ^{-1} contraction factor must be considered respect to an observer at their at their common *CMPRF*. Therefore, in case of a mass-body of huge inertia respect to the other one their *CMPRF* is coincided with the center of mass of the former.

II) A particle, e.g. photon, at the instant of collision with a mass-body, e.g. mirror, is correlated, *Secs. 8(7), 8(9),* to the latter one. As if , the mirror acts as a photon emitter up to new collision with other mass-body, and so on.

III) While, the light signal travel path from signal to the detector in the co-direction and counter-direction of motion is differ, the path-lengths of this signal in the two directions are equals. In other words, the signal travel times are altered accordingly respect to that of stationary case, *Example 2(6)5b1*, i.e. light velocity c is remained unchanged in all of the cases.

Example 2(6)5c2-Supposing a train is moving on a rail, its length is slightly more than the tunnel on the way. According to Lorentz contraction at speed more than a specified speed, the length of the train must be diminished an become equal or less than the tunnel. In other words, at an instant the whole train can be hidden in the tunnel. However, according to *Sec. 2(6)5c*, there is no length contraction in this case, because of the train and the Earth constituting a unique H system, i.e. γ contraction factor is equal to one. But, the condition is changed in case of no attaching objects, e.g. a satellite moving around the Earth undergoing Lorentz contraction. Please refer to *Sec. 5(16)3b, part D2* in case of contraction of path-limit Γ and *Sec. 7(4)3* in different media.

Note 2(6)5c1- Similar result first obtained during the Michelson and Gale experiment [472]. "This is essentially the Sagnac experiment, but on a much larger scale. They constructed interferometer fixed on the ground with a size of *0.2mi* by *0.4mi* (about *320m* by *640m*). They did indeed detect the rotation of the Earth"[67] other experiments. Noteworthy, in this experiment, the Earth is regarded as a turntable, and the *CMPRF* of Sun-Earth is regarded as origin and related observer is of kind *A*, *Sec. 8(9)2*.

2(7) - Pseudo-particle [15]

According to *Sec. 2(1)1a, Eq. 2(7),* α , may be negative in some temporary *(pseudo)* particle, *Sec. 10(6).* In the other words, in this case [i.e. exit of H particle-paths as single direction ones or particle axeon, *Sec. 10(8)*] from an H system with rest mass constituted of reversible H particle-paths, both the velocity and motion exist without violations of the conservation law of energy. Because the total number of H particle-paths remain constant during interaction stages, i.e. in the initial, intermediate, and resulting H systems during interacting stages. As an example, "The weak nuclear force is mediated by *W* and *Z* Bosons, *Sec. 6(2)5;* because of their large mass of about $90GeV/c^2$, their mean life is limited to about $\Delta T = 30\times 10^{-25} S$ by the uncertainty principle"[137]; please refer to *Sec. 7(1), Eq. 7(10).* In other words, according to *Eq. 7(11),* these particles have existence in ΔT time interval in an quantized H hall quantized package of vacuum space, *Sec. 5(16)3a,* at a path-limit, $\Delta x = \Gamma$, *Sec. 1(12),* within the scale of uncertainty principle, *Sec. 7(1).* Thus, it can not be transferred to newly next position in space, *Sec. 7(1), Eq. 7(10),* and *Sec. 7(4)2d*, for the reason of H hall quantized package handedness restriction; please refer to *Sec. 5(16)6*, for additional information; please refer to *Example 2(7)1.*

Example 2(7)1 – According to *Sec. 10(6), Eq. 10(9),* through exit of muon neutrino, υ_μ from minus muon, μ^-, assumed as its axeon, a pseudo-particle, *Sec. 2(7),* (i.e. minus *W*-boson, W^- of α <0) is appeared within the limit of Heisenberg relationships. Factually referring to *Sec. 4(3)3*, (and attributing *Fig. 4(7)b,* to the case of a left-handed minus muon μ^- instead of electron e^-) the central axeon (or framework) of muon at *SP* configuration during a dismantling process is appeared as left-handed muon neutrino υ_μ. Moreover W^- formed during decay process as an intermediate accordingly, or, vice versa in case of right-handed plus muon μ^+; please refer to *Sec. 1, Remark 1(5)1,* and *Sec. 10(8).* "The *W* boson is very massive, and what is actually emitted in neutron decay is a virtual W boson. In quantum mechanics, rules of conservation of energy can be violated for short periods of time. Virtual particles are common in subatomic interactions, if you do not see the word virtual, note that physicists will sometimes refer to them as particles off the mass shell. Virtual particles are not just mathematical fictions. If a virtual W boson were to interact with another particle during its short existence, it could exchange enough energy/momentum with that particle to become a real boson itself (albeit one that will still decay in a short time because of the finite lifetime of real *W* bosons)"[544]. According to *HPPH*, the *W* boson (shell) is regarded as pseudo-particle, it pick up an axeon, e.g. from the d quark of neutron to become a real particle of rest mass. In other words, the negative sign of α is turned to positive. Moreover, in this example the heavy d quark become a lighter u one in the neutron.

2(8) – CMPRF's observer scenario in a isolated mass-bodies system

2(8)1 –General aspect

Considering two mass-bodies, one of huge mass *M* (or inertia), e.g., the Earth, other with low mass, e.g., a low-mass moving object m of v speed, e.g. satellite. Therefore, the *CMPRF*, *Sec. 2(6)2b*, of this system is coinciding with center of mass of the huge one, i.e. the Earth. Noteworthy, the light emitted by m due to $\gamma^{-1} = \sqrt{1-v^2/c^2} < 1$ contraction factor undergoes relativistic Doppler Effect respect to a stationary observer on the Earth, i.e. lab. Whereas, the light emitted by the Earth, and detected by observer of mass-body m due to $\gamma^{-1} \cong 1$ respect to *CMPRF* of the two bodies system undergoes classical Doppler Effect.

In other example, considering Michelson-Morley Experiment *(MME)* in vacuum medium, there is a relativist Doppler Effect of the light emitted by a source on the Earth (rather than the Sun) respect to the *CMPRF, Sec. 2(6)2a*, observer of the Sun-Earth system related to contraction factor $\gamma^{-1} < 1$. In this experiment, the lower mass-body, i.e. the Earth as a *LFRF, Sec. 2(6)2c*, can be regarded as a detector. In other words, the *LFRF* speed of the Sun respect to the *CMPRF* of the system is nil, i.e. $\gamma^{-1} \cong 1$. Whereas, the *LFRF* speed of the Earth is equal to $30Km/S$ respect to this *CMPRF*, and not respect to the Earth's lab observer, and that of the Sun at radial direction, i.e. *Sun-CMPEF-Earth*, obeys the false (or classical) Doppler Effect respect to the Earth observer (lab). In other words, the Sun, and the Earth motion respect to their *CMPRF* must be consider instead of relative motion of their respect to each other. Therefore, the effect of inertia, *Sec. 2(1)4,* must be considered in their relative motions, *Secs. 2(6)2a, b, f.* According to *Sec. 5(9)3d*, the path-length of each of two orbiting mass-bodies respect to their own *CMPRF* is equal in magnitude, and at opposite signs, *Sec. 2(8)3*.

Noteworthy, in case of *MME* Experiment respect to an observer on the Earth, i.e. lab, *Sec. 2(8)2*, the γ^{-1} contraction factor of the photon-Earth system at each reflection of the light by the mirror is approximately equal to one, i.e. γ^{-1} contraction factor of the Earth respect to the *CMPRF* of photon-Earth observer that coincides with Earth center of mass. Please refer to *Sec. 2(6)5c, proposal c*. Therefore, the two-way characteristic of latter experiment contrary to one-way one such as De Witte test [601] leading to a null result. Please refer also to *Remark 2(6)5a1, Fig. 2(7)*, and *Sec. 8(9), Fig. 8(2)*. Factually, the light (or signal) velocity measured as $c-v$, and $c+v$, are the internal velocity components, or, better to say the light path, *Sec. 2(6)5c*, along with external component v as in case of *Sec. 2(6)4c*. Moreover, to each of these internal components (or projections) of velocity is related its own time intervals $\Delta T_F, \Delta T_B$, *Sec. 2(6)2a, Eq. 2(109),* in such a manner that the total light velocity is remained unchanged as an immutable constant c, *Sec. 7(4)4*.

2(8)2 - In the frame-Out of the frame

A) In the frame is a reference frame that its observer can not detects Doppler shifts in light emitted through its own source. As an example we can refer to *Michelson-Morley* [72] and *Hoek Experiments* [191, 196] that you can not seen any Doppler shift in the different directions considering the *CMPRF* of the whole system; thus, you have null result. Similarly in this frame, the *Trouton-*

Noble Experiment, *Note 4(5)1*, also gives null *Lorentz* force; moreover, in this frame there is no relative motion of the various components of the testing apparatus. In the other words, the laboratory and the entire apparatus, e.g., interferometer, set-up are all in the same inertial reference frame intrinsically at a linear straight uniform motion.

B) Contrary to *case A*, Out of the frame is a reference frame that the observers can detect *Doppler* shift by its detector as in *Fizeau* test, *Sec.2(6)3,* and *Sagnac Experiment*, *Sec. 2(6)4*, i.e. positive result.

In the *case A* the H particle-paths of the frame moving at c speed at different directions purely in a reversible motion, *Sec. 2(6)2a item B,* with no single direction one, *Sec .2(1)1, Eq. 2(7),* i.e. rest state. Therefore, we have no *Delta Effect, Sec. 2(1)1b, Fig. 2(3),* related to single direction of motion; whereas, in *case B* besides reversible H particle-paths we have single direction one, i.e. moving state, *Sec. 2(6)2a item C*.

In fact, *Doppler Effect*, *Sec. 2(3)1, Eqs. 2(53), 2(54)*, have a hard link with *Delta Effect* in viewpoint of contraction and dilation of the H particle-paths. Supposing in the *Sagnac Experiment*, *Sec. 2(6)4*, *part B,* the detector (observer) and the light source rotating altogether in the same frame along with its own *CMPRF*, Sagnac result and Doppler shift can be detected by its rotating observer and source, i.e. out of the frame (*case B*), for the reason of the *CMPRF*, of the Earth, *Note 2(8)2a*, which is coinciding with that of rotating table-Earth system. Moreover, checking the Trouton-Noble test through an external reference frame moving at constant motion respect to the test apparatus, i.e. out of frame *(case B)* and so on, we can detect positive result.

Note 2(8)2a - In case of *MME*, contrary to Sagnac Effect, the *CMPRF* of the Earth (lab) is coinciding with both source and detector, i.e. a unique H system, *Sec. 8(5),* with a unique *CMPRF's* location (or origin); please refer to *Sec. 2(8)1.*

2(8)3 - Discussion

As a result obtained from *Sec. 2(8)1,* any isolated H system, e.g. a mass-body, particle, many mass-bodies system, many particles system, etc., has a *CMPRF*, *Sec. 2(6)2b*, respect to its origin at any time interval with the following characteristics:

I) The path-length of any two of H system ingredients (including H particle-paths of their gravitational fields) are equal in magnitude, and at opposite direction to each other respect to their own *CMPRF*, i.e. zero path-length variation of the whole system, *Sec. 5(9)3d*.

II) Each of these ingredients has its individual *LFRF, Sec. 2(6)2c*, time and three space coordinates respect to their common observer at their *CMPRF's* origin (or location). In fact, any two ingredients of the stated above H system has its common *CMPRF* along its *4*-space coordinates.

III) The *CMPRF* of an isolated H system is commoving with the common (or external, *Sec. 1(3)*) motion of the latter respect to an external observer at rest state. Therefore, the whole system including the expandons, *Sec. 5(16)1c, part A3*, of its gravitational field constitute a unique correlated H system analogous to a solid object, *Sec. 5(2)1d, part B*. The gravitational time's arrow, *Sec. 5(16)7c*, along with path-length increment and radial time symmetry of zero path-length variation of the whole H system are related to this reference frame. Whereas, the observer of other reference frames engaged with the both path-length along with translational, and tangential motions path-lengths related to *T*-symmetry, *Sec. 2(3)3*, i.e. zero path-length variations, *Consequence 2(8)3a*. The problem of aberration phenomenon of gravitational fields' potential is respect to the observer of this part of reference frames due to constancy of light speed through vacuum media.

According to above statements, the evaluation of each of two mass-bodies in a many-bodies system can be performed respect to their common *CMPRF* with 4-space coordinates of latter at any time interval (or any appropriate time interval) regardless of other ingredients, *Example 2(8)3a*.

Consequence 2(8)3a – As a result, the true gravitational field is related to time's arrow, and path-length increment. However, the inertial gravity due to an accelerated motion of *T*–symmetry characteristic has zero path–length variations, i.e. zero time's arrow. Please refer also to *Sec. 5(3)1,* and *Sec. 2(4)4b.*

Example 2(8)3a- In case of triple mass-bodies system consisting of satellite-Earth-Sun, *Sec. 2(6)6a,* the evaluation of satellite and the Earth can be performed by an observer located at their common two-bodies *CMPRF*, i.e. the Earth's lab along with its own 4-space coordinates. It is coinciding with the center of mass of the Earth due to huge inertia of the latter. It differs from the evaluation performed by an observer located at their common triple-bodies' *CMPRF* with its related 4-space coordinate that coincides by a good approximation in the center of mass of the sun.

2(9) - Forwarding and backwarding time intervals

Special theory of relativity based on double way (round trip, or, second order in v/c) Michelson-Morley Experiment [72] according to that, the average time, *Note 2(9)1,* related to forwarding and backwarding motions, i.e. ΔT_F and ΔT_B as in, *Eqs. 2(109), 2(114), 2(119),* is considered that is not consistent with stellar aberration [193, 196], and other one-way experiments (first order in v/c), such as De Witte [601], and Sagnac Effect, *Sec. 2(6)4*. Remarkably, the path-length is considered individually in forward and backward directions of motions on the basis of, Delta Effect, *Sec. 2(1)1b,* Path-constancy, *Sec. 2(1)2*; please refer to *Comment 2(6)2b1*. In fact, according to H particle-paths hypothesis, two individual time scales, ΔT_F and ΔT_B, must be taken into account separately that are correlated with Doppler Effect in macro-world, *Sec. 2(10)*. In other words, more frequency, i.e. related to the number of H particle-paths in path *P*, *Sec. 3(1)1, Figs. 3(2), 3(3),* depends on lesser partial time interval ΔT_F and vice versa, *Note 2(9)2.* On the other hand, in micro-world at quantum scale more energy uncertainty (more H particle-paths contraction), lesser time uncertainty, *Sec. 7(1), Eq. 7(10),* and vice versa; please refer, to *Secs. 2(10),7(4).* According to *Sec.*

2(6)2b, and *Sec. 2(6)2a, Example 2(6)2a1*, the true partial time intervals, ΔT_F and ΔT_B, must be considered respect to *CMPRF*, preferred reference frame *Comment 2(6)2c1*. In case of *SRT*, the proper time depends on relative velocity; please refer also to *Sec. 2(1)1b, Consequence 2(1)1b1, case 3c*; *Sec. 2(10)1, Example 2(10)1a.*

Note 2(9)1- " it is further stated by Dr. Einstein that a common time for coordinates *A, B,* occupying the same inertial frame and separated by a distance cannot be defined unless it is established by definition that the time required by light to travel from *A* to *B* equals the time from *B* to *A*. Since experiments to accurately determine the speed of light have, to this point, been averages of two-way motion, this arbitrary definition is of no practical use unless a Euclidean space-time continuum at absolute rest is assumed. Averaging is confirmed by Dr. Einstein since he states:

' In agreement with experience, we further assume the quantity, $2AB/(t'_A - t_B) = c$ *to be a universal constant'*

Where, t, t', are the initial emission and final arrival time at point A; note that with variable space-time, there is no conceivable way that a quantitative evaluation of the universal speed of light can be made"[198]. In fact, the time travel of *A* to *B*, i.e. in the direction of motion, is not equals to *B* to *A*; therefore, we must assume an averaged interval in this respect, considering opposite direction of motion; please refer to *Sec. 2(10),* in this regards.

Note 2(9)2 – According to [232], "Since I have proven in my correction to *SR* that approaching objects are not time-dilated, but time-compressed, that is, speeded up. The simplest way to see this is to think of the clocks as waves and then apply the Doppler Effect to them. Receding clocks are red-shifted, approaching clocks are blue-shifted".

2(10) - Approaching or receding binary reference frame systems

2(10)1- Single direction irreversible H particle-paths H system

The present part is related to single direction H particle-paths; thus, photon light signal moving at c speed can be attributed to this category. Supposing now, two inertial reference frames, *R, R'* are moving uniformly at straight line respect to each other and relative velocity, i.e. $v \neq 0$, respect to their origins o, o'. Now, supposing there are *N* H particle-paths (or neutropa cells) related to an H hall quantized package, *Sec. 5(16)3a,* of a massless particle (e.g., photon) between o, o' at a straight line. If o, o' moving forwarding toward each other, their H hall quantized package can be assumed contracted along with partial time's arrow reversal (*case I*). By the way, inversely if o, o' moving at opposite direction respect to each other, the H hall quantized package can be assumed dilated along with partial time's arrow (*case III*), respect to the stationary case that v=0, i.e. the two frames *R, R'* are at rest respect to each other (*case I*), *Consequence 2(10)1a*. Please refer also to *Sec. 5(16)3b, part D2,* and *Secs. 5(16)7, 7(2), 7(4).* According to the above statements at the three *cases I, II, III*, the time intervals are $\Delta T_0, \Delta T_F, \Delta T_B$ respectively in such a manner that path-length, *Sec. 2(1)2* is remained constant, [as in Sagnac Experiment, *Sec. 2(6)4*] in the all of three *cases I, II, III,* of a traveling photon, e.g., related to hydrogen atom formation. Considering relationship between energy and photon frequency of Einstein photon theory, we have:

$$\upsilon_F \Delta T_F = \upsilon_B \Delta T_B = \upsilon_0 \Delta T_0 = K_m = constant \qquad or \qquad 2(116)$$

$$E_F \Delta T_F = E_B \Delta T_B = E_0 \Delta T_0 = h K_m \qquad \textit{Examples 2(10)1a,b, Consequence 2(10)1b} \qquad 2(117)$$

$$\Delta E_F \Delta T_F = \Delta E_B \Delta T_B = \Delta E_0 \Delta T_0 = h \qquad 2(117)1$$

$$\frac{\Delta T_F}{\lambda_F} = \frac{\Delta T_B}{\lambda_B} = \frac{\Delta T_0}{\lambda_0} = \frac{K_m}{c} \qquad 2(118)$$

; Please refer to *Remark 2(10)1a,* and *Sec. 5(16)7a, Remark 5(16)7a*;

Where:

A) $\upsilon_F, \upsilon_B, \upsilon_0$, are the photon frequencies and $\lambda_F, \lambda_B, \lambda_0$ are the photon wavelengths, ΔT_F, ΔT_B, ΔT_0, are time intervals in the *cases II, III, I*, emitted at o, (or o') regarding as source in the direction of oo', *Consequence 2(10)1c*; please refer to *Sec. 2(1)4, Note 2(1)4a.*

B) K_m, is a dimensionless constant related to single direction H particle-paths; please refer to *Sec. 5(16)1c, part A1, Eq. 5(67)7.* Moreover, K_m is also depends on the relation between the clock time scale intervals in the reference frame *R* (or *R'*), and internal time intervals due to inner motion of successive H particle-paths of the related H system.

C) E_F, E_B, and E_0 are total energy of H particle-paths at forward and backward directions, and rest state respectively. Please refer to *Secs. 7(1), 7(4).*

Factually, the one-way method, *Eq. 2(118),* is comparable with double-way method, *Eq. 2(12),* at macrocosm. Moreover, by referring to *Eq. 2(117)1,* it is very similar to *Sec. 7, Eq. 7(10),* related to uncertainty principle at microcosm, *Sec. 7(4),* $K_m \approx 1$, *Consequence 2(10)1b*, that is based on, Delta Effect, *Sec. 2(1)1b*, and Path-constancy, *Sec. 2(1)2*. In fact, the relationship, *Eq. 2(116),* can be considered as Path-length constancy in this regards, *Comment 2(10)1a*. Therefore, the problem of forwarding and backwarding time intervals is overcome on the basis of uncertainty principle at quantum level. In other words, in each Unique H system, *Sec. 8(5),* partial time interval diminished as energy increases and vice versa. Remarkably, if a signal is emitted from source o' toward observer o, the time interval units according to each of the cases *I, II, III,* must be considered proportional to $\Delta T_0, \Delta T_F, \Delta T_B$, according to the traveling signal direction and relative velocity. Moreover, the emitting source that is a part of the reference frame *R*' must be regarded at rest respect to its own observer o'. According to *Sec. 2(1)4, Note 2(1)4a*, by considering *Eq. 2(116),* total number of H particle-paths in the traveling macro-body is constant; whereas, only the H particle-paths geometrical shapes are varied.

According to *Eqs. 2(116) to 2(118),* the average time interval, ΔT_{FB} can be obtained as:

$$\Delta T_{FB} = \frac{\Delta T_F + \Delta T_B}{2} \qquad \textit{Remark 2(10)1b} \qquad 2(119)$$

Please refer to *Sec. 5(16)1c*, to have an idea of time's arrow rate in a mass-body H system; moreover, the internal time intervals, ΔT_0, ΔT_F, ΔT_B, ΔT_{FB}, can be regarded as partial time's arrows, *Sec. 7(4).*

The *Eq. 2(119)* is consistent with, *Eq. 2(114)b* of Sagnac Effect, *Sec. 2(6)4*, considering classical Doppler Effect. On the basis of H particle-paths hypothesis, two separate time intervals, i.e. forwarding, ΔT_F and backwarding, ΔT_B, can be considered for each reference frame on the basis of constancy speed of light in that frame in all directions, that is consistent with one-way experiment, *Secs. 2(6)2* to *Sec. 2(6)5*, and concept of space and time coordinates, *Sec. 2(1)1b, Consequence 2(1)1b1, case 3c*.

Resuming, according to above statements, there is no equality of time in the two-way propagation, *Note 2(9)1*; therefore, the averaged time must be regarded by taking into consideration the principle of constancy of the velocity of light in all direction of an inertial reference frame. Thus, the time of photon travel in case of two approaching objects, i.e. ΔT_F, is lower than when these objects are getting away from each other, i.e. ΔT_B, respect to their own observer as in Bradley Stellar aberration [193]; whereas, light speed c is remained constant in the both forwarding and backwarding relative motions. Noteworthy, in case of forwarding motion we encountered with one-dimensional contracted space and time's arrow reversal feature; whereas, in the backwarding mode with dilated space and time's arrow respect to the observers of two inertial reference frames at relative motion. Considering the above statements, any two binary inertial reference frames moving at an uniform approaching, or, receding mode respect to each other constitute an isolated unique H system. Moreover, the space and time in these systems are defined on the basis of these two reference frames, one considered as signal emitter and other as detector and vice versa, *Note 2(10)1a*; please refer to *Sec. 8(7).* In other words, by inversing the velocity direction in case of two inertial reference frames moving uniformly respect to each other, there is an asymmetric in space-time continuum. According to [198], *part 7*, "time and space merely appear to expand and contract because of the constancy of light speed in the observer's frame"; please refer also to *Sec. 2(6)2a, Note 2(6)2a1,* and *Sec. 2(6)4b.*

Referring to *Eq. 2(109),* and according to *Eq. 2(116)* we have:

$$\frac{\delta \upsilon_0}{\delta T} = \frac{\upsilon_0}{\Delta T_0}, \qquad 2(120)a \qquad \text{or,} \qquad \frac{\delta \upsilon_0}{\upsilon_0} = \frac{\delta T}{\Delta T_0} \qquad 2(120)\text{b}$$

Where, $\delta \upsilon_0$, is the frequency shift of υ_F, or υ_B, respect to rest one, υ_0; thus, the frequency increment/decrement shift to time contraction/dilation ratio is equal to that of rest frequency to rest time ratio; please refer also to [200] *part related to Lorentz transformation equations*. Remarkably, according to above discussion, the light speed, c, in vacuum in any condition remained constant; therefore, referring to *Eq. 2(120)b* the frequency shift per frequency unit can be replaced instead of relative velocity of the two stated above reference frames (*R, R'*) including approaching / receding aspects. Furthermore the *Eq. 2(120)b* can be evolved by inserting the effect of inertia as in *Sec. 2(6)2b.* Because of H particle-paths hypothesis, considering the *CMPRF* of the reference frame *R, R'*; thus, the frequency shift per unit of frequency respect to the *CMPRF* frame must be considered as following:

$$\frac{\delta \upsilon_{0r}}{\upsilon_{0r}} = \frac{\delta N_{0r}}{N_{0r}} = \frac{\delta T_r}{\Delta T_{0r}} = \frac{v_r}{c}, \qquad r = \text{reference frame } R, \text{ or, } R', \qquad 2(120)\text{c}$$

Where:

1) δN_0, *Sec. 2(3), Eq. 2(88),* is the single direction (or returned) H particle-paths of the mass-body attached to reference frame r, i.e. *LFRF*, *Sec. 2(6)2c*, respect to related *CMPRF.*

2) N_{0r}, is the number of H particle-paths of the mass-body (regarded as rest) attached to reference frame r.

3) $\delta \upsilon_{0r}$, is frequency shift of an arbitrary spectral line, υ_{0r} of an atom in reference frame r respect to the related *CMPRF.*

4) v_r, is the relative velocity of reference frame r respect to *CMPRF.*

Furthermore, the, *Eq. 2(120)c,* can be valid for more than two reference frames.

The stated above results are valid on the basis of traveling signals, i.e. single direction H particle-paths, at c speed between the reference frames. Considering the above statement, and referring to *Sec. 2(6)5b*, the traveling particles with rest mass at v speed, i.e. $v<c$, between these frames behave differently, that cannot be interpreted by usual interpretations other than H particle-paths hypothesis.

Example 2(10)1a- Supposing an star *S* sends a photon at frequencies υ_0 related to an hydrogen atom excitation spectrum, e.g., *A*, an observer o at reference frame *R* measured, υ_0,through absorbing by an measuring device, e.g., absorption; therefore, three *cases I, II, III*, may be occurred according to *Note 2(9)1.* Thus, regarding:

Case I- the observer o is at rest respect to star *S*, thus the hydrogen atom absorb the photon υ_0 at energy packet $E_0 = h\upsilon_0$.

Case II- The observer o is approaching at v speed respect to star *S* according to *Doppler Effect*, he measured the frequency υ_F, and energy packet $E_F = h\upsilon_F$ instead of $E_0 = h\upsilon_0$. Thus, $E_F > E_0$, that cannot be absorbed by an hydrogen atom at spectrum line *A*, but it can be absorbed according to *Mossbauer Effect* [202] of an hydrogen atom moving at v speed and linear momentum $p = mv\gamma$, *Eq. 2(30),* and energy $mc^2\gamma$, *Eq. 2(32),* respect to observer o, and at rest respect to star *S.* Alternately, higher frequency photon, υ_F , can be absorbed by an hydrogen atom at rest respect to observer O to a higher quantum energy level other than *A*.

Case III- Similarly to *case II*, i.e. $E_B = h\upsilon_B$, instead of, $E_0 = h\upsilon_0$, we have $E_B < E_0$.

To overcome the above problem two hypotheses can be regarded as following:

I) - As counter-direction entangled particle is proved, *Sec. 8(7),* on the basis of Bell inequality violation [177, 178], there may be also co-direction entangled pair of photons. During absorption of a photon of the pair its H particle-paths shared in such a manner that the energy $E_F = h\upsilon_F$, extended in path-length, Γ, *Sec. 1(12), Eq. 1(3),* is absorbed by an atom, e.g., hydrogen atom at a higher energy state level than *A*, the remainder, i.e. $E_B = 2E_0 - E_F$ is released or enters in other interaction or measurement (of entangled pair, *Sec. 8(7)2*), *Consequence 2(10)1a*. Please refer to *Sec. 2(6)4*.

II) - The H particle-paths of photon are absorbed by an atom regarding their geometrical shape or orientation (lock and Key process).

Example 2(10)1b- Each particle with zero rest mass, e.g., photon, has its own *LFRF* along with related proper time [or, better to say partial time's arrow, *Sec. 7(4)*] respect to a preferred frame, e.g., *CMPRF*. Referring to [206], the dependency of light speed to its frequency without referring to an observer (or experimental reference) is given. From view point of H particle-paths hypothesis, the light speed is a Universal constant, i.e. c. Therefore, the proper time of light travels attached to *LFRF* varies respect to *CMPRF*'s observer at rest in a rate linearly proportional to the light wavelength, *Eq. 2(118),* along with space contraction and partial time's arrow reversal toward the direction of traveling photon in such a manner that the light speed remained unchanged, i.e. c, *Comment 2(10)1b*, and vice versa. Please refer to *Sec. 2(1)1b*, *Delta Effect*, *Secs. 5(4)4, 5(16)7* in this regards. According to the above discussion, the superluminality has no sense, *Sec. 5(16)10*, because we look at this phenomena based on own lab space and time scale.

Consequence 2(10)1a – Alternately, according to *Sec. 7(1), Remark 7(1)3*, and based on the idea that to an H hall quantized package, *Sec. 5(16)3a*, of a particle is related a path-length value h, *Sec. 5(16)3g,* one can suppose that a group of *X* stored (or overlapped) H hall packages in the form of a common H hall package is transferred from counter-direction to co-direction one. In other words, the forwarding part is constituted of *N* + *X* overlapped (or stored) H hall packages in a common H hall package, whereas backwarding one constituted of *N* - *X* overlapped H hall packages also in a common H hall package of path-length value h respectively. Please refer to *Sec. 7(2), Comment 7(2)1a,* and *Sec. 7(3)1, item 3*.

Consequence 2(10)1b- The *Eq. 2(117)* in case of $K_m \approx 1$ of particles is equivalent to matter wave (deBroglie wave), *Eq. 2(77)* of *Note 2(3)1a*, i.e. $p.\lambda = h$; please refer to *Sec. 7(4)2e* in this regards. Moreover, please refer also to *Remark 5(16)1C, A4,* and *Comment 5(2)1d, D1*. Noteworthy, in case of mass-bodies, K_m is related to n_s , *Sec. 5(1)1, Eq. 5(1)1*, the total number of H particle-paths on a gravitational potential sphere; but, irrespective of total number of n_s cells, or, the total cone-like cavities, *Sec. 5(2)1d, part D*, in a mass-body at quantum level. Please refer to *Comment 5(2)1d, D1,* and *Sec. 5(16)1c, part A1*. As a result, per definition of *HPPH*, in case of a particle $K_m = n_s = 1$. In other words, according to *Simulation 8(7)2, E5a* a particle is related merely in H hall package tunnel, *Sec. 5(9)3d, part c*, or a common bunch of tunnels, *Sec. 8(7)2, paragraph 11*, to an n_s cell on supermassif black hole Schwarzschild surface of the host galaxies and clusters, *Sec. 5(7)8.* In other cases of $K_m > 1$, it is nominating a mass-body that is related by K_m H hall package tunnels to the supermassif black hole. In other means, a mass-body has $K_m = n_s > 1$ cone-like cavities, Sec. *5(2)1d, part D.* Any isolated atom, e.g. Hydrogen atom, *Sec. 9(4)7, Fig. 9(3)a*, can be confined in an H hall package unit, *Sec. 5(16)3b, part A*, of path-length value h . Therefore, a mass-body constituted of n individual atoms, can have multiple H hall packages each of path-length value h , and the *Eq. 2(116)1*of *consequence 2(10)1c* can be held. In an ideal condition, K_m is shifted to n . Moreover, according to *Simulation 8(7)2, E5a, item 11*, any H hall package *Sec. 5(16)3b, part A*, is linked to the related black hole of host galaxies and clusters, *Sec. 5(7)8,* with an H hall package tunnel, *Sec. 5(9)3d, part c*. Factually, the recombined H hall packages of stored path-length, *Sec. 7(4)1, item 3*, of h value has a common H hall package tunnel and an individual reverson, i.e. $K_m = 1$, *Sec. 5(16)1b, part A, item 19 B.*

Consequence 2(10)1c- By analogy a similar equation with the *Eq. 2(116)* is hold as following:

$$n_F \Delta T_{F(mass)} = n_B \Delta T_{B(mass)} = n_0 \Delta T_{0(mass)} = K_m \qquad 2(116)1$$

Where:

- n_F, n_B, n_0, frequencies equivalent number of H particle-paths in the forward, backward, and rest state of the related mass-body. Therefore, ΔE , and λ in *Eqs. 2(117) to 2(118)* have their equivalent values ΔE_{mass} , and Λ respectively, *Note 2(3)1a, Eq. 2(57).* According to *Sec. 2(1)3, Eq. 2(35),* we have:

$$N_F \Delta T_{F(mass)} = N_B \Delta T_{B(mass)} = N_0 \Delta T_{0(mass)} = \frac{K_m}{a_1} \qquad 2(116)2$$

Where:

- N_F, N_B, N_0 , are the number of H particle-paths in Forward, Backward, and rest state respectively.

- a_1 , is the constant of media coefficient, *Note 1(2)1.*

Note 2(10)1a - Referring to *Sec. 5(9)3,* between any two mass bodies system that constituting two reference frames there is a steady flow of correlated H particle-paths.

Comment 2(10)1a - Factually, the relationship *Eq. 2(116)* can be viewed as path-length constancy in the one-way method related to purely single direction H particle-paths, e.g. photon, *Sec. 2(6)4b, part A, paragraph 3-1*; please refer also to *Sec. 2(1)2, Consequence 2(1)2a.* Noteworthy at quantum level, any photon (or particle) irrespective of their own intrinsic energy is confined in an H hall quantized package of path-length value h, *Sec. 5(16)3g*, and path-limit Γ, *Sec. 1(12), Sec. 5(16)3b, part D2.*

Comment 2(10)1b- Furthermore," The photon that travel through the material still travel at the speed of c. It has already been determined that photon never travels at a speed other than that of c; they travel through the empty space between the atoms"[214]. According to H particle-paths hypothesis the velocity $v<c$ of the photon in a dense media, can be visualized as a reversible motion of its H particle-paths at c speed. In other words, the reversible motion reduces the total speed of photon to v speed, i.e. combination of purely reversible motion of H particle-paths with that of single direction ones along with γ^{-1} contraction, *Sec. 2(6)5b*; please refer also to *Sec. 2(10)3, case A,* and *Sec. 5(4)4*. "The wavelength of light (photon) is indeed smaller in water (dense medium) than in air (or vacuum) by a factor of η , the index of refraction of water" [215]; therefore, from H particle-paths viewpoint this can be related to an average wavelength during this reversible motion; please refer to *Note 2(3)1a, Eqs. 2(73) to 2(77).*

Remark 2(10)1a - By analogy with mass-body at rest constituted of reversible H particle-paths and its internal time interval, photon of zero rest mass can be considered as single direction mass with its own internal directional time interval respect to mass-body that is considered as reversible mass along with its reversible scalar time. Please refer to *Sec. 2(1)1b, Consequence 2(1)1b1, 3c*.

Remark 2(10)1b – Similarly to *Sec. 2(3)2a, Note 2(3)2a1*, according to *Eq. 2(117),* we have:

$$E_0 = N_0 a_1 h \quad E_F = N_F a_1 h \quad E_B = N_B a_1 h \quad N_F = N_0 + \delta N \quad N_B = N_0 - \delta N \qquad 2(120)\text{d}$$

Where, $N_0, N_F, N_B, \delta N,$ are the total, forwarding, backwarding and H particle-path number deviation respect to the rest of the related main mass-body. According to *Eq. 2(119),* we have:

$$\Delta T_{FB} = \frac{K_m}{a_1} \cdot \frac{N_0}{N_0^2 - \delta N^2} \qquad 2(120)\text{e}$$

In case of low speed, or, $\delta N << N_0$ we have:

$$\Delta T_{FB} \# \frac{K_m}{a_1 N_0} = \Delta T_0 \qquad 2(120)\text{f}$$

Where:

a_1 , The constant of media coefficient a for an H particle-path, *Note 1(2)1*

h, Planck constant

Please refer to *Sec. 5(16)1c, part A1.*

As the result, the average time interval ΔT_{FB} can be regarded as time interval ΔT_0 that can be extended to all of the H system from viewpoint of *HPPH.*

2(10)2- Reversible H particle-paths H system

Any mass-body can be attributed to this category.

A) In case of macro-body and according to *Eqs. 2(32), 2(49), 2(117)* we have:

$$E_0 \Delta T_0 = E_t \Delta T_t = h K_r = Constant \qquad 2(121)$$

Where:

K_r , a proportionality factor regarding a mass-body with rest mass.

E_0, E_t , are rest and total energy of the mass-body related to internal time intervals, $\Delta T_0, \Delta T_t$ respectively.

B) In case of a particle with rest mass at quantum level, according to *Note 2(3)1a, Eqs. 2(73), 2(74), 2(35)1, 2(33) to 2(58),* and *Eq. 2(77)0,* we have:

$$E_t = h\left(\frac{n_F + n_B}{2}\right) = h\, n_t = \frac{hc}{\Lambda_t} = h\, n_0 \gamma = \frac{h\gamma c}{\Lambda_0} = \gamma\, E_0 , \qquad \textit{Note 2(3)2a1,} \qquad 2(122)$$

Where:

1) n_t , Average frequency equivalent, *Eq. 2(77)1,* of internal H particle-paths motion, *Sec. 7(4)4,* of wavelength Λ_t in the direction of motion related to the total energy package E_t of a moving particle at v speed.

2) n_0 , Frequency equivalent of internal main-body's H particle-paths motion, *Sec. 7(4)4,* of average wavelength Λ_0 , *Eq. 2(86),* related to the total energy package E_0 of the particle at rest state.
3) Frequencies equivalent n_F, n_B related to forwarding N_F, and backwarding N_B numbers of internal motion of H particle-paths of the particle main-body in co-direction, and counter-direction of particle motion respectively.
According to *Eqs. 2(32) to 2(35)1,* and *Eqs. 2(121), 2(122),* and *Consequence 2(10)1c* we have:

$$N_0 \Delta T_0 = N_t \Delta T_t = \frac{K_m}{a_1} = K_H \qquad 2(125)$$

Where:
- K_H , is the proportionality factor regarding H particle-paths hypothesis.
- N_0, N_t , are the initial, total number of H particle-paths of a mass-body at rest of rest energy E_0 and at total energy E_t motion respectively; please refer to *Sec. 2(6)2a, Example 2(6)2a1.*
Please refer also to *Sec. 5(16)9* for additional information.

2(10)3- Discussion

Considering, *Secs, 2(10)1, 2,* we encountered with a different characteristics of a particle with zero rest mass that is consistent with classical conception of one-way method (case *B*) and particle of rest mass consistent with relativistic round trip (case *A*) method. It depends on combined characteristics of H particle-paths speeds at right angle in the cases of irreversible single direction and reversible ones respectively, *Sec. 2(1)1a*, *Eqs. 2(3) to 2(8).* In other words, we are encountered with two type of reference frames respect to the observer in an inertial preferred reference frame, *Sec. 2(1)2b*, at uniform motion as following:
Case A- an inertial reference frame (for moving bodies of rest mass) of averaged proper time interval affected by contraction factor, $\gamma,^{-1}$ *Sec. 2(1)1b*, *Consequence 2(1)1b1*, due to the nature of speed composition of H particle-paths in order to have combined H particle-paths group, *Sec. 1(3),* at c velocity that is consistent with relativistic formalism as in, *Sec. 2(1).* Moreover, it is applicable for moving particles of rest mass, i.e. reversible H particle-paths speed combination with that of single direction one. In this case, the *LFRF*, *Sec. 2(6)2c,* attached to mass- body must have a velocity lesser than c, please refer also to *Remark 2(10)3a*.
Case B- An inertial reference frame of two separate times, i.e. approaching/receding, *Sec. 2(1)1b*, *Consequence 2(1)1b1, 3C, Case II*, that is consistent with classical formalism for particle of zero rest mass, i.e. purely single direction H particle-paths as in case of stellar aberration, *Comment 2(6)5a1.* Or with rest mass (for mass-bodies at rest state) with purely reversible [or closed single direction one as in Sagnac Effect, *Sec. 2(6)4*, related to rotating bodies]; please refer to *Sec. 2(6)5b*. In this case, the *LFRF*, of zero rest mass particles have a velocity equal to the speed of their (i.e. c) respect to *CMPRF, Sec. 2(6)2b*. In fact, Doppler Effect at its classical form in this case can be viewed as contraction/dilation of wavelength of a traveling photon in single direction mode of motion of H particle-paths. Please refer also to *Sec. 2(6)5b, Example 2(6)5b1*.
In the *case A*, the preferred frame, *CMPRF, Sec. 2(6)2b,* as an example is coincide with the lab, (i.e. immovable observer on the Earth), whereas at the case *B* related to Bradley stellar aberration, the *CMPRF* is approximately coincide with the star for its huge relative inertia, *Sec. 2(6)2a*, of the latter respect to the Earth. Thus, relative velocity of the star respect to the *CMPRF* is much lower (or better to say approximately zero in case of immovable source) than relative velocity of the Earth reference frame respect to star reference frame, i.e. approximately immovable source, *Sec. 2(6)5b.* In other words, we encountered with approximately a classical (or false) Doppler shift as in the *case B*, *Note 2(10)3a*; moreover at the latter case, each photon has its own proper *LFRF*, *Sec. 2(6)2c*, time interval. However, the observations of binary stars (i.e. movable source respect to *CMPRF*) prove that the visible positions of the star do not display any additional shifts (or aberration, *Comment 2(6)5a1*) due to their closed reversible motion. From *1911-1913*, De Witte convincingly proved that the speed with which light travels from stars does not depend on the motion of the star [207A]; in this case we encountered with relativistic (or real) Doppler Effect of a movable source (*case A*) respect to *CMPRF* of the latter and observer as detector.
At the two above cases *A & B*, the H particle-paths speed, i.e. c, remained unchanged in vacuum as an universal immutable constant; therefore merely partial time intervals varies considering the photons frequencies.

Note 2(10)3a - According to [205], " From the observed absence of the transverse Doppler shift, it is speculated that either the time dilation predicted by the standard theory of special relativity does not exist in reality, or, if it does, is a phenomenon which does not depend on relative velocities but may be a function of absolute velocities in the fundamental frame of the isotropic microwave background radiation", *Sec. 5(10)3, Sec. 5(16)3b*. In this case, the latter frame also can be viewed as *CMPRF* frame; thus, we encountered also with classical Doppler Effect excluding γ^{-1} contraction simply by dilation or contraction of its *LFRF* time interval in the transversal direction. Please refer also to [601], *Sec. 2(6)5b,* and *Sec. 2(1)1b, Experiment 2(1)1b1* from viewpoint of an alternative interpretation. The Thim Experiment [205] by a far analogy is comparable with Sagnac Test [59]. According to *Sec. 2(6)5c*, it depends on γ^{-1} contraction factor related to transversal H particle-paths at right angle, i.e. radial motion of H particle-paths.

Remark 2(10)3a - According to [203], the longitudinal and transversal Doppler shift agrees with modern time dilation experiments; moreover, "In *SR*, there is a non-zero Doppler effect for transverse motion, due to the relative time dilation of the sources as seen by the detector [204], *section 4*. Please refer also to *Sec. 2(3)1, Eqs. 2(73) to 2(75), Sec. 2(3)3, Eqs. 2(82) to 2(84),* of present article.