Part 3

Part 3a-Gravitation

5(1) - General Aspect

5(1)1- Scope

Gravitation law is similar to electrostatic law, *Sec. 5(16)1d*, the H particle-paths, *Comment 5(1)1a*, of an H system in each of these fields moving continuously at c speed on the geodesics of concentric potential spheres at any direction , *Note 5(1)1a*. The center of these spheres is coincides with the center of gravity of the H system. Moreover, the total equivalent number n_G, neutropas is the same for each potential sphere at radius, r, *Note 5(1)1b*. Thus, the total energy related to each potential sphere is constant, independent of radius r.

According to the above statements and *Note 2(1)3b:*

$$E_G = n_G H \quad \text{or} \quad E_G = a_1 n_G h, \quad \textit{Sec. 1(2), Note 1(2)1} \qquad 5(1)$$

Where, n_G is the total equivalent number of the H particle-paths (neutropa) related to the interaction of the gravitational field with unit of mass; thus, n_G is proportional to n_s, the total number of Planck area each related to a group of H particle-paths on a potential gravitational sphere by a dimensionless constant factor of K_G. Please refer also to *Sec. 5(7)6* in this regards.

$$n_s = K_G \cdot n_G \qquad 5(1)1$$

Assuming, D_r, the density or number of H particle- paths per surface unit *Figs. 4(12), 4(13).*

$$D_r = \frac{K_G n_G}{4\pi r^2} \qquad 5(2)$$

An H system of the mass m is moving in a region where a gravitational force exerted on it by an H system of mass *M*. Thus, the potential energy, U_r at the location of the mass m in the gravitational field of mass *M*, is obtained:

$$U_r = -G\frac{Mm}{r} \qquad 5(3)$$

Now assuming m is the unit mass; thus with comparison to electrostatic *Eq. 4(20):*

$$V_r = \frac{a_1 n_G h}{i} \times \frac{1}{r} = -GM \times \frac{1}{r} \quad \text{or} \qquad 5(3)1$$

$$V_r = \frac{a_1 n_s h}{i K_G} \times \frac{1}{r} = -GM \times \frac{1}{r} \qquad 5(4)$$

Where, V_r is the potential related to unit of mass in the gravitational field of mass *M.* Moreover, we assume $K_G = 1$, *Note 5(16)1c, A1*, in the remaining of the text except at the special cases for reason of simplicity.

According to E_{qs} *5(1), 5(2):*

$$a_1 n_G \frac{h}{i} = -GM \quad \text{or}$$

$$G = -\frac{a1 n_G \times h}{Mi} = -\frac{a1 N_G}{i} \times h = -\frac{N_G}{8\pi^2} hc(b) \qquad 5(5)$$

Where:

- N_G, the equivalent number of interacting neutropa in a potential sphere per mass unit of $b = 1kg^{-1}$ dimension, and can be considered as a fundamental constant, i.e. n_G per unit of mass.

- i, is a proportionality factor of dimension inverse length, $b^{-1}u$ in *SI* unit. $i = \frac{8\pi^2 a_1}{c}\left(b^{-1}\right)$, *Sec. 5(7)1, Eq. 5(21).*

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

- $a_s = 1s^{-1}$, *Note 1(2)1,* $b = 1kg^{-1}, u = 1m^{-1}$ of inverse dimensions based on units of dimensions in *SI* units.

Please refer also to *Sec. 5(7)7.*

Example 5(1)1- "the bright central region contains most of the mass of our Milky Way galaxy. The tangential velocity of rotation each of its stars (e.g. Sun) is obtained as following"[4], *part 14-9*:

$$v = \sqrt{\frac{GM}{r}} \qquad 5(8)$$

Where *M* refers to the mass contained within the radius r, *Remark 5(1)1b*, (r is the distance of the star from the center of our galaxy to the extent that we can ignore the effect of stars at larger radii). We would expect that v should decrease at increasing radii like $r^{-1/2}$, but the observation shows that the observed data do not agree with this behavior beyond the Sun (i.e. 2/3 of the

way out from the center of galaxy). At this case, three possibilities may be interpreted as following in order to respond the question: Why do galaxies rotate at speeds inconsistence with their apparent mass.

I) According to *Eqs. 5(6), 5(7)*, the mass *M, Eq. 5(8),* is related to the older or greater *M,* i.e. n_{Gfar}, *Eq. 5(6),* that induce more speed, according to *Eq.5(8),* to the star under investigation as one of the reasons of interpretation of this anomaly, or, in means:……

…

II) According to *Sec. 5(15)1, paragraph II;* the magnitude of α , *Eq. 2(7)* increase, *Note 2(1)4b,* thus, the star tangential velocity v, increase faster than in *Eq. 5(8),* accordingly, *Comment 5(15)1a*.

III) The existence of additional matter in the galaxy that is not visible to us exerts the gravitational force. To account for the data, please refer to *Sec. 5(1)2,* dark matter.

Note 5(1)1a- In this section at the first step as an example, we begin with the Newtonian non-relativistic gravitational law that is based on interacting forces at a distance in order to reach to a new gravitation theory, *Sec. 5(9)3*. The latter is founded on gravitational expanding closed surfaces, *Sec. 5(4),* constancy speed of light, Mirror Image Effect, *Sec. 6(2)3*, (a modification of Newton third law), space expansion along with time's arrow, *Sec. 5(16)7*, are discussed; please refer also to *Sec. 5(4)5*. For the reason of simplicity of explanation, a centrally symmetric gravitational field of an H system (related to mass *M*) at rest is discussed in this section. In fact, in this case, the potential sphere is related to a constant or static gravitational field; thus, at the other cases the gravitational fields are related to closed surfaces other than sphere's shape. Remarkably, both gravitational and electrical field decreases as the inverse of the square of the distance from the point particle causing the field that confirm the presence of potential sphere surface of the stated above fields. Please refer also to *Sec. 5(2)1c*.

Note 5(1)1b – In the large distance or time from an H system of rest mass *M*, The related quantity, n_G for its potential spheres is larger than near ones, therefore:

$$\frac{d_M}{dt} \langle 0 \quad \text{or} \quad , \quad n_{G_{far}} > n_{G_{near}} \qquad 5(6)$$

Since, the total mass diminution due to the H particle-paths of the initial H system that are left the system during long time interval in the form of n_G on the potential sphere is the main reason. In the other words, the n_G of the older potential spheres is greater than newer ones, but at the short distance or time the n_G remain approximately constant in the concentric potential spheres i.e. deviation from gravitational law at long distance due to initial mass diminution with the time.

In fact, according to cosmological Hubble relation we can deduce, *Sec. 5(15):*

$$H_o = (\frac{dM}{dt})/M = (\frac{dr}{dt})/r = (2.29 \pm 0.50)\,10^{-18}.s^{-1} = 71 \pm 3.5\, Km/s,\ per,\ Mpc,\ \textit{Remark 5(1)1 a} \qquad 5(7)$$

Where, r, H_o are the distance from the mass *M*, and Hubble parameter respectively. According to *Eq. 5(7), H* is the unit of mass diminution rate due to the exit of H particle-paths in the form of gravitational field. Please refer also to *Sec. 5(6)2*. Moreover, some part of the *dM* is constituted of H particle-paths of *SM* configuration, *Sec. 5(15)2d*.

Comment 5(1)1a- Through this part everywhere dealing with an H particle-path, it means an H particle-path or a group of their according to *Sec. 7(4).*

Remark 5(1)1a – "The Sunyaev-Zedovich Effect has been used to determine $H_o = 77 \pm 10$ *Km/s, per, Mps*. The Hubble space telescope key project team come up with the answer $H_o = 72 \pm 8$ *Km/s, per, Mps* and finely *WMAP* came up with $H_o = 71 \pm 3.5$ *Km/s, per, Mps* based on a flat *Lambda-CDM* model fit to the *CMB* angular power spectrum"[270], we have choosing the latter in this article.

Remark 5(1)1b - The mass *M* is the dark matter mass, *Sec. 5(1)2,* the latter is subsequently converted to dark energy, *Sec. 5(15)2, Sec. 5(15)2b,* during expansion of the Universe. In fact, there is an equivalency in this respect, as if, dark matter through normal matter is lost, and converted according to expansion of the Universe to its equivalent dark energy, *Sec. 5(15)2b*. Therefore, the *Eq. 5(6)* is held; please refer also to *Sec. 5(15)1*. Alternately, the actual (or local) amount of dark matter due to its conversion to expanding gravitational spheres, *Sec. 5(4)1*, is lower than its expected value, i.e. the sum of actual and converted ones. "A modified radial *CDM* density profile giving a much lower *CDM* local density. This has been implied recently by analysis of microlensing towards the Galactic bulge. A much larger number of events have been seen than expected and this suggests an unseen stellar population within the solar radius than can apparently for the local rotation speeds without the need for dark matter". "Non-equilibrium situation with on-going *CDM* infall into the galaxy"[361}, *part 3.3*.

5(1)2- Dark matter

"Dark matter is a form of matter that does not emit light, absorb light, or scatter light. Its only interactions are gravitational"[260]. The exited H particle-paths due to mass diminution as the subject of, *Sec. 5(1)1, Note 5(1)1b*, and *Example 5(1)1,* can be regarded as dark matter that can produce gravity. "Because dark matter produces gravity it can produce or enhance the lensing abilities of galaxies or clusters of galaxies in which it resides"[77], *Q&A No.154, Note 5(1)2a.* According to [256] "Dark matter generally refers to *exotic* non-baryonic matter (*WIMPs*) that interacts only weakly with ordinary matter. Whereas, no such matter has ever been directly observed in the laboratory, its existence has long been suspected. This form of matter also has no cosmology

significant pressure". "*WMAP* data reveals that Universe contents include *4%* atoms, the building blocks of stars and planets. Dark matter comprises 22% of the Universe. This matter, different from atoms, does not emit or absorb light. It has only detected indirectly by its gravity. *74%* of the Universe composed of dark energy that acts as assort of an antigravity. This energy distinct from dark matter, is responsible for the present day acceleration of the Universe expansion" [257], part related to *content of the Universe*. Therefore, the ratio of dark energy (related to single direction H particle-paths, α *Sec. 5(16)7a, Eq. 5(70)8a3* to the sum of dark matter and normal matter [related to counter-current reversible H particle-paths, *Sec. 3(1)2,* density] is approximately three fold, *Remark 5(1)2a,* at the present time. Noteworthy, *CMB* is the single direction H particle-paths moving at c speed individually; whereas, dark matter of SM configuration from viewpoint of this article is the counter-current H particle-paths at SP_l and SN_r configurations, *Sec. 3(1)2, Fig. 3(4) a, b,* moving randomly and individually, e.g., super-symmetric models such as neutralinos, *Comment 5(1)2b*. Please refer to *Fig. 5(8)* of *Sec. 5(16)1b, part A,* to have an idea in this regards. Therefore, we must seek for dark matter around the macroscopic mass-bodies H system, *Remark 5(1)2b,* contrary to the *CMBR* and dark energy, *Sec. 5(15)2,* that spread all over the Universe and the last two have bosonic H particle-paths nature (*Sec. 3(1)2, Fig. 3(4)c, SM* configuration). "Dark energy is known to be very homogeneous, not very dense and presumably does not interact strongly through any of the fundamental forced other than gravity"[263] *nature of dark energy*. Dark matter and dark energy have two common characteristic as following:

1- Their interactions are only gravitational

2- Significant portion of missing masses in the Universe.

"Galaxies show signs of being composed largely of a roughly spherical halo of dark matter with the visible matter concentrated in a disk at the center"[262] *observational evidence*.

Noteworthy, mass is converting steadily to gravitational field, *Sec. 5(1)1,* (i.e. potential energy) through expanding surfaces (or spheres); *Sec. 5(4),* during an irreversible process along with time's arrow and space expansion, *Sec. 5(16)7a,* i.e. path-length, *Sec. 2(1)2,* generation. Please refer also to *Sec. 2(1), Note 2(1)3b*; *Sec. 5(15),* for more information on the dark energy from viewpoint of H particle-paths hypothesis.

Note 5(1)2a - The dark matter has substructures in the form of halos within the galactic system. These halos by analogy to the stars and satellites in a galaxy orbiting the galactic disk. “Subhalos on orbits that pass through or near to a galactic disk perturb it gravitationally and deposit energy in it, gradually heating the disk and increasing its scale-high”. “Many of the satellites that are incorporated into a galactic dark halo do not actually merge with the central galaxy” [451] *introduction*.

Comment 5(1)2a. Until now, no successful description of dark matter on particles (such as neutrinos with its contribution, neutralinos, axions, etc.) is down. According to [262] part related to *alternative explanation*" A proposed alternative to physical dark matter particles has been to suppose that the observed in consistencies are due to incomplete understanding of gravitations". However, according to [336] *Abstract*, "We present first results (dark matter detection) after successfully running the prototype detector for a period of about 15 months in the Grand Sasso underground laboratory we analyze the result in term of limits on *WIMP*-nucleon cross section".

Comment 5(1)2b – “Although other possibilities exist, many physicist think galactic matter is a cloud of supersymmetric particles gravitational bound to a galaxy” [420] *the astronomy connection*. "These weakly interacting, massive (*1GeV – 1TeV*) particles (*WIMPs*) arise independently from cosmological considerations in supersymmetric model as neutralinos – The lightest supersymmetric particles. Direct detection of neutralinos can occur in very low background experiments, where the elastic neutralinos scattering off target nuclei is exploited. *HDMS* (Heidelberg dark matter search) is a new Germanium experiment aiming to test the hypothesis that the dark halo of our Galaxy is mad of *WIMPs*" [338].

Remark 5(1)2a – According to [1] *section 35, page 119*, the general characteristic of energy-impulsion tensor, T_{ii} of system of macro-bodies, we have the following equality:

$$p \le \frac{\varepsilon}{3} \qquad \text{or} \quad T_{ii} = -\varepsilon + 3p \le 0$$

Where, ε , p are the rest energy density and pressure of a macro-body. By a far analogy at present epoch the dark energy ratio to the sum of dark matter and normal matter, is comparable to the ratio of energy density to the maximum pressure of macro-bodies according to *FLWR* model of the Universe, i.e. 3:1. Since dark energy (i.e. returned single direction H particle-paths, *Sec. 2(2)1, Eq. 2(44),* of the total reversible primordial H particle-paths) is a part of primordial dark matter. The latter is returned to the former s now. Moreover, the sum of dark matter and normal matter is nominated total matter. By the way, the latter is assumed as reversible H particle-paths that generate expanding gravitational spheres, thus affecting the pressure, *Sec. 5(17), Example 5(17)1*.

Remark 5(1)2b – "The leading theory of galaxy formation predicts that hundreds of clumps of *cold dark matter* should be orbiting the Milky Way, each one massive enough in principle to host a visible dwarf galaxy"[271].

5(2) - Mass -Field interaction

5(2)1- General aspect

The gravitational interaction consisted of two parts that in this section is discussed in two *Secs. 5(2)1a, 5(2)1b;* please refer also to *Sec. 6*. Factually, first one (i.e. pre-equilibrium stage of gravitational dome), based on Mirror Image Effect, *Sec. 6(2)3*, regarding bi-Universe hypothesis, *Sec. 5(16)9*, whereas the second one, i.e. equilibrium stage, is based on path-length constancy.

Noteworthy, general relativity deals with the latter section. “In the geometric interpretation of *GR*, gravity is not a *force* and cannot propagates because target body motion similarly follows a curved geodesic path through *space-time* without any force acting” [437] *part 7, Carlip’s paper*.

5(2)1a – Gravitational dome

Assuming, the gravitational field of H system *M* (mass *M*) as geodesic circles of H particle-paths on the potential sphere surface around the center of gravitation *M*. The entrance or interaction of a field H particle-path of mass *M* through the H-system m (mass m with center of gravitation at point m) is assumed as entrance a segment of the geodesic circle *CF* of that at the location of interaction. As a result an impulsion H particle-path, *I*, related to H-system m is generated in opposite direction and shapes that leaving the H-system or mass m , *Fig. 5(1)*, according to *Mirror Image Effect, Sec. 6(2)3* a modification of Newton third law, *Proposal 5(2)1a1*.

The entrance of each H particle-path of the mass *M* field into m body is proportional to the acting force-line, *F*, on it. This force-line has curvature, or, in other words, acts as tangential force along the *CF* path and similarly the impulsion-line *I* leaving the m system in a tangential manner along the path *CI* at the same curvature, *Remarks 5(2)1a1, 2*. Please refer also to *Comment 5(16)2c4,* and *Comment 4(6)4a.*

Considering *Fig.* 5*(1)* , the curvature of all the entered *CF-lines* of the mass *M* field are downward and that of the related impulsion *CI* of the mass *m* are upward, *Note 5(2)1e1*, in order to have a general conception , the page of *Fig.* 5*(1)* must be turned about *M-m* axis 180°. Please refer to *Note 5(16)1a, B1*.

By studying all of the *CF* and *CI*, the summation of acting force-lines, *F*, (*gravitational dome*), shown as $\vec{F}_g$ vector, in downward direction, *Comment 5(2)1a1*; similarly, the summation of, *I* in upward as $I\vec{F}_g$ one, *Comment 5(2)2a2*. Please refer also to *Sec. 5(2)1C.*

Note that, the H hall package tunnels of *CF & CI* lines act as singularities, *Comment 5(9)3d2,* in spatial medium, *Sec. 7(4)3, part A*, of gravitational and electromagnetical interactions.

Proposal 5(2)1a1- The expanding of front of expandon, i.e. *CF*-lines, in spatial medium, *Sec. 7(4)3, part A*, of an external gravitational field related to mass-body M during their entrance in mass m medium, *Sec. 7(4)3, part D*, of mass-body m are converted to a front *CI*-lines in mass medium. In other words, during gravitational interaction of the expandons of a *CF*-line with H particle-paths of mass-body m , an impulsion *CI*-line of reversed geometrical shape, handedness, and direction of related entered *CF*-line is appeared. Therefore, during any exit of receding *CI*-line as in *Fig. 5(1)* from mass medium to spatial one, it acquired an expanding characteristic in the latter medium, *Note 5(2)1a1*. However, during the above process, contractons as gravitational force carrier are generated in mass medium that are transferred spontaneously through common H hall package tunnels (constituted of cavity reversons, *Comment 5(16)2a1*) towards, the mass-body M , *Sec. 5(9)3d, part c, Fig. 5(5)2*. As a result, the *CF*-line through propagation in mass medium acts as a front of P_R & P_L contractons, *Simulation 7(4)2e1*, emission in the direction of its curvature towards the mass-body M , and in opposite direction of expandon propagation in its front (or *CF-line*), on expanding gravitational sphere surface of mass-body M in spatial medium. Please refer to *Sec. 2(4)4*, in this regards. Therefore, a gravitational dome as in *Fig. 5(1)* is taken form within mass medium of mass-body m . Noteworthy, The H hall package tunnels of *CF-* & *CI*-lines of gravitational and electromagnetical phenomena act as singularities, *Comment 5(9)3d2,* in spatial medium, *Sec. 7(4)3, part A.*

Note 5(2)1a1- Factually, any path-limit Γ of H hall package, e.g. type R of interacted expandons on a part of entered *CF*-line is tended to its reversed handed H hall package of type L geometry reversal on CI-line. Therefore, a front of non interacted expandons (or sub-expandons, *Sec. 5(16)1a, part B*) is taken form on *CI*-line during its exit from the mass medium, into spatial medium, *Sec. 7(4)3, parts A, D,* of expandons of SN_l configuration, *Remark 5(2)1a1*. Noteworthy, SN_r configuration means, the preference of type W_R expandons over W_L ones. Similarly, SN_l configuration means the preference of type W_L expandons over W_R ones, *Comment 3(1)2b*. According to *Sec. 7(4)2f, part E*, the H hall package of e.g. W_R main-expandons of external field on entered *CF*-line is combined with an H hall package of mass medium of interacted mass-body. At the end of stay time interval ΔT , *Sec. 7(4)2f, part A*, the combined H hall package is split and a type W_L sub-expandon H hall package is appeared that is along with P_R contracton. The former is combined with H hall package of the mass medium and split to an W_R expandon that is accompanied by P_L contracton during stay time ΔT and so on. Please refer to *Simulation 7(4)2e1*.

Comment 5(2)1a1-"Einstein's theory of gravity can not explain why falling bodies near to the Earth fall straight downward"[197], i.e. falling motion resemble a whirlpool (or vertex) according to *GRT*. On the other hand, "Newton's theory assumed that gravitation acts instantaneously"[220], i.e. instantaneous, *Sec. 7(4)2f, part c*, action at a distance. Please refer to *Sec. 5(9)3*, according to that there is instantaneous action at a distance based on H particle-paths hypothesis.

Comment 5(2)1a2 - I_{F_g} has an antigravitational effect (reversed gravitational dome) respect to $\overrightarrow{F_g}$ that can be explained as gravity paradox analogous to Olber's paradox [91, 92] in the field of cosmology; "Why is the night sky dark? Why is space dark?" [92]. Why any object has not having infinite gravitational potential energy at any point in space?

Remark 5(2)1a1- The *CF* force-lines of mass-body *M* are related to right-handedly expanding gravitational spheres, i.e. expandons, *Sec. 5(16)1, part A3*, of SN_r configuration, i.e. slight preference of SN_r over SP_l configuration, *Sec. 5(2)1c*. Moreover, the mass-bodies (m or *M*) have SP_l configuration, i.e. slight preference of SP_l over SN_r configuration due to contracton formation, *Sec. 5(2)1c part c*. Thus, the *CI* impulsion lines according to Mirror Image Effect, *Sec. 6(2)3*, have SN_l configurations, i.e. sight preference of SN_l over SP_r conjugate configuration, *Sec. 5(9)3d, part c*, related to repulsive (or antigravity) characteristic. This effect can be compared to photon reflection (or collision) by an electron through which, the direction and spin of photon are reversed. In other words, the electron due to steady expansion of its main mass-body gravitational spheres do not converted to its conjugate i.e. positron, *Sec. 6(2)3, Consequence 6(2)3b*. Please refer also to *Sec. 3(1)2b, Comment 3(1)2b*, and *Sec. 4(3)3*, to have an idea in this respect. Noteworthy, the field of mass-body *M* (or m) and main mass-body m (or *M*) interaction is ended up to reach an equilibrium stage, *Sec. 5(2)1b*. Moreover, according to *Sec. 5(2)1c, part c1, SN, SP* configurations are equivalent to partial charges $-\delta|e|, +\delta|e|$ respectively. Therefore, the gravitomagnetism, *Sec. 5(2)1c*, attraction can be simulated to attraction of two opposite sign charges as in electromagnetism, *Sec. 4(5), Fig. 4(9).*

Remarks 5(2)1a2- The *CF*-lines, and *CI*-lines in *Fig. 5(1)* are the intersection of reader page with their *CF*, and *CI*- surfaces of related gravitational spheres, i.e. expandons, *Sec. 5(16)1c, part A3*. In fact, we encounter with *CF*, and *CI*- surfaces that are constituted of posipa and negapa cells, *Sec. 5(16)b, part A, paragraph 7* instead of related lines. Moreover, according to *Sec. 5(2)1d, part B*, the mass-field interactions are spontaneous*, Sec. 7(4)2f, part c*. It is similar to the case of entangled pair of particle during an interaction (or measurement) *Secs. 8(7)2, 8(9).*

5(2)1b- Equilibrium stage

According to *Sec. 5(2)1a*, as impulsion-path leaving the system m due to entrance of force -paths, the H particle-paths of the H-system *m* takes the shape of curvature as field-line of mass *M* at equilibrium stage, *Note 5(2)1d, B1*, in their reversible motion, *Example 5(2)1b1*; please refer also to *Sec. 2(4)1*. At this stage any entered H particle-paths of the H-system *M*, i.e. *M* field *CF*-line, *Comment 5(2)1ba*, is accompanied by the exit of an impulsion H particle- path from m at opposite direction, *Remark 5(2)1b1*, but with the same curvature *Fig. 5(2), Note 5(2)1b1;* therefore, angular momentum is conserved accordingly. Moreover, the path-length of *CF*-lines is equal in magnitude, and opposite signs to that of *CI*-lines, *Remark 5(2)1b2*, based on path-constancy, *Sec. 2(1)2*. Noteworthy, the single direction H particle-paths of a moving mass m in the gravitational field of mass *M* is in an equilibrium state through the geodesic of the mass *M* gravitational field curved space-time, *Sec. 5(2)1e*.

In *Sec. 5(16)1b*, we shall consider that this curved space-time is in accordance with the curved quantized texture of the vacuum medium fabric, *Sec. 5(16)3b*, under influence of gravitational field of a mass-body, e.g., *M*; please refer also to *Sec. 5(16)3f*. In case of motion of the mass m geodesic of 4-space of the mass *M*, the total action integral variation is extremum, $\delta S = \delta(S_m + S_g) = 0$, *Sec. 2(4)2*. In other words, total path-length is constant, *Sec. 2(4)4a*, at the equilibrium stage of a closed system constituted of mass-bodies m, *M* along with their gravitational fields in the whole space and between two arbitrary instants t_2, t_1, *Sec. 2(4)1, Remark 2(4)1b*. Moreover, the exit of H particle-paths in the form of impulsion line can be compared, by a loose analogy with the energy lost during radiation of gravitational waves, *Sec. 5(1)1b, part B*, of attracting masses, in the general theory of relativity.

As a result, in a gravitational interaction between two H systems *M* and m, *Sec. 5(9)3*, the total H particle-paths entered in an H system is equal to the total H particle-paths leaving that, *Sec. 8(6)2, Remark 8(6)2a*. In other words, the total number of H particle-paths, i.e. total energy of each H system remained constant. "Since there is no mass increase during free fall"[86]. Thus, only their paths shape altered according to the geodesic of interacting fields (similar to the magnetic field), *Note 5(2)1b2*; please refer to *Sec. 5(16)3d,* and *Comment 5(2)1b1*.

According to the above statements, we encountered with H particle-paths curvature of mass m, that is accompanied by impulsive mass-field interaction (Mirror Image Effect, *Sec. 6(2)3*) in a real permanent gravitational field *Figs. 5(1), 5(2)* rather than merely space-time, *Sec. 2(3)2b*, in the gravitational field of mass *M*. This kind of interaction distinguishes real field from that created during an accelerating motion regarding equivalence principle on the basis of space-time curvature. In other words, the H particle-paths of an H system bend during acceleration, *Sec. 2(1)1b, Fig. 2(3)*, *Delta Effect,* that is accompanied by mass-mass impulsive interactions, *Sec. 6*, rather than field-mass interaction at the present *section 5*; **Why**! we accept impulsion in the former interaction (collision, force application) and we are not permitted to accept the latter (e.g. field-mass impulsive interaction) regarding matter as a form and kind of energy (fields) and vice versa, *Notes 2(1)6, 5(2)5*. Factually, an equilibrium in any interaction, e.g., gravitational, electromagnetical, *Sec. 4(3)*, collision, *Sec. 6(2)1a*, is based on bi-Universe hypothesis, *Sec. 5(16)9*, i.e. the slight preference of competitive matter Universe over antimatter one, *Sec. 5(16)9c*. Therefore, any gravity theory that neglect this hypothesis in not on a right way.

Considering a moving mass m at v velocity enters in the field of mass *M* at rest, besides the bending of its internal H particle-paths reversible motion path shape; the single direction paths related to v speed are interacted as stated above in order to reach the

equilibrium (or similar curvature shaping) according to interacted force- line *CF* of mass *M*. In this respect, three states may be occurred if $M >> m$:

I) If $n_\alpha < n_g$ 5(9)

Thus, the mass m is falling on the mass *M*, *Note 5(2)1b1;*

Where, $n_\alpha = n_\circ \alpha$, *Eq. 2(22)*, $n_\circ$ is the number of initial H particle-paths of H-system m and n_g is a symbolic or imaginary number of H-particle-paths due to summation of entered *CF* force lines done in H-system m

II) $n_\alpha = n_g$ 5(10)

Continuous motion of mass m around mass *M* (Equilibrium motion)

III) $n_\alpha > n_g$ 5(11)

The escape of mass m from the field *M* takes place.

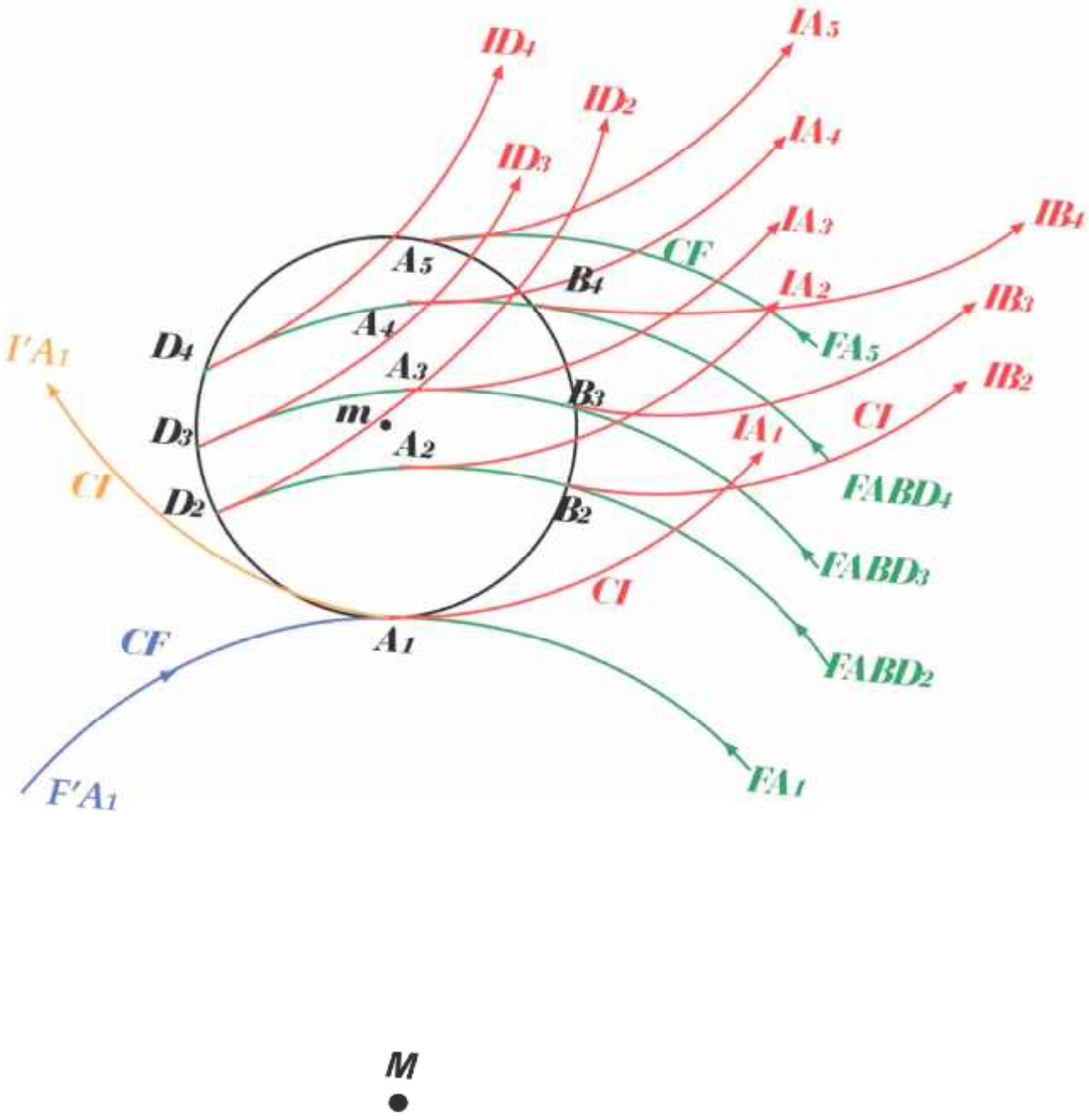


Fig 5(1) – The H particle-paths of the gravitational field of H system M interacts with mass m body and subsequent exit of released H particle- paths of the H system m at its different locations or points as impulsion force-lines.

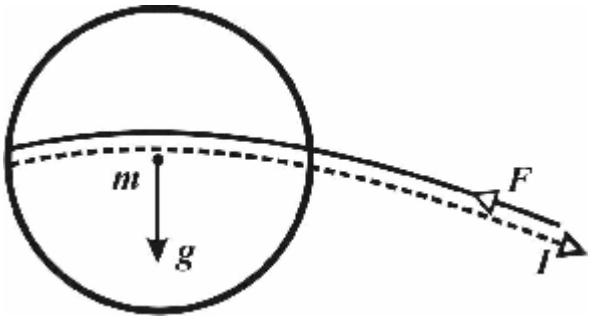


Fig 5(2) – The entrance of CF-lines and exit of CI-lines respectively, (Equilibrium state)

Example 5(2)1b1- "Contrary to what the rubber sheet analogy implies (*in GRT*), an orbiting body such as spacecraft orbiting the Earth is not following the curvature of space near the Earth. Moreover, two spacecrafts some distance apart in the same orbit could stretch a tether between them and pull it taut, thereby describing a straight line through space different from their orbital path"[103], part, related to space-time curvature. According to H particle-paths hypothesis the internal motion of the H particle-paths of stretch tether bends during orbiting the same as spacecrafts.

Note 5(2)1b1– Assuming a coin (m) is falling on the Earth (*M*), the *CF* path of the latter is perpendicular to falling direction, *Sec. 5(2)3.* Therefore, the total energy of mass m remain constant or, in other words, the number of H- particle-paths is not altered thus only the shape of the paths of motion of H particle-paths m H system is changed; refer to *Notes 2(1)5, 3(2)1.*

Note 5(2)1b2- Considering, *Fig. 5(1),* along with supposing an imaginary surface *S* passing through the center of gravity of mass m and perpendicular to the force-lines of gravitational field of mass *M*. Thus, a fixed number of mass *M* field force-lines (flux) passing through a unit area of the surface *S,* i.e. flux density, of intersecting surface of mass m body's. Therefore, the chance of interactions of mass *M* fields force-lines with that of mass m body are depend to the following items:

I) The ability of competitive interactions of reversible H particle-paths of mass m body with that of the mass *M* field through a constant flux or flux density of the latter field. Thus, a dense or massive m body, i.e. greater number of m body H particle-paths has more chance of interaction that leading to the lack of H particle-paths number of the field in a limited cross section of that. On the other hands, the relative ratio of interacted H particle-paths number to that of non-reacted ones of the dense bodies is lower than less massive ones.

II) The rate of expanding gravitational spheres, *Sec. 5(4)*, (or expandons, *Sec. 5(16)1c, A3*) of mass *M* (H particle-paths generation related to its gravitational field) and its replacement with that of the precedent interacted ones. In other words, the rate v_r of replacement of H particle-paths of newer gravitational spheres (or expandons) with that of preceding ones has finite speed less than, or, equal to light speed. Please refer also to *Sec. 5(2)1c*, and *Sec, 5(16)1b, part A, paragraph 3A*, in this regards.
"The Eotoves tests actually showed that objects fall at slightly different rates in a vacuum according to their atomic make up the more tightly packed the atomic nucleus, the slower the fall"[51]. "The effect is named after Dr. L. Nordtvedt, who first demonstrated that some theories of gravity suggest that massive bodies should fall at different rates, depending upon their gravitational self-energy". "To test for the existence (or absence) of the Nordtvedt effect, scientists have used the Lunar Laser Ranging Experiment. Thus far the results have failed to find any evidence of Nordtvedt effect, demonstrating that if it exists, the effect is exceedingly weak"[463]. "The Nordtvedt Effect related to equivalence principle violation in lunar orbit"[469]. In other words, "This would violate the strong equivalence principle that the laws of gravitation are independent of velocity and location, a principle considered fundamental by many theoretical physicists"[511] *Related theory*. "The strong Equivalence principle (that is) independent of gravitational binding energy" [469]; please refer also to [321], *part 1, Gravity anomalies*. As a result, the less massive body m falls slightly faster in the gravitational field of mass *M* according to the above cases. If it is not so, the rate v_r of expandons replacement, discussed in this *item*, is superluminal, *Sec. 7(4)2f, part c*, (or spontaneous) of the gravitational field of interacting mass-bodies that is considered as a unique H system, *Sec. 5(2)1d, part c, item 3*. Please refer also to *Sec. 5(9)3b*, *Example 5(9)3c1*, *Sec. 5(16)1b, part A, paragraphs 16, 18,* and *Sec. 5(18).*

Remark 5(2)1b1 – The entrance of *CF*-line in a mass-body and subsequent exit of *IC*-lines performed through an interaction based on Mirror Image Effect, *Sec. 6(2)3*. Therefore, the two mass bodies *M & m* reach to an equilibrium stage after interaction, *Fig. 5(2)*. As a result, the two systems initially regarded as isolated after interaction from viewpoint of gravity can be regarded as a correlated unique H system, *Sec. 5(9)3*. "Localization of an object s (or m) in space-time is only relative to the gravitational field, or, to any other object s (or *M*), to which s contiguous. There is a connection between the two, since interaction between s and o implies contiguity, and contiguity between s and o can only be check twice some quantum interaction" [382] *section 6.* Therefore, at quantum level particle m, has correlation to an object *M* via mutual exchange of their H particle-paths at the end of an interaction, e.g., gravitational one; please refer also to *Sec. 8(7)6, Comment 8(7)6b*.

Comment 5(2)1b1- The *CF*-lines cited in *Fig. 5(2)* are the combinations of track texture of external gravitational field with that of the mass-body m in interacting locations. Please refer also to *Sec. 8(3)4b* in case of microcosm combined track texture formation. As the results:

1) The combined *CF*-lines track texture can regarded as equivalent to curved space-time in *GRT*.

2) All of the mass-bodies or particles in spatial medium, *Sec. 7(4)3, part A,* obeys this combined track texture preferentially analogous to a road in a desert.

3) A particle or mass-body chooses preferentially the trajectory with maximum path-length density S/h, *Sec. 2(4)2b,* between any of its two points A, B, *Sec. 5(16)3b, Part B*.

Comment 5(2)1ba- Factually, every thing, phenomenon in the Universe ultimately reaches to equilibrium in order to stabilize. "And set up the criterion and the balance"[110]B, *Surah 55, verse 7.*

Remark 5(2)1b2- Any *CF* or *CI*-line is constituting of H hall package in the related media (or environment). Before the entrance of CF-line from spatial medium to mass medium, each of its H hall packages has path-length limit Γ_G that contract to Γ_{mass}, *Sec. 7(4)2f, part A*, within mass medium, *Remark 2(3)1b*, in such a manner that:

$$\left(\Gamma_G \cdot c\Delta T_G\right)_{CF} = -\left(\Gamma_{mass} \cdot c\Delta T_{mass}\right)_{CF} \qquad 5(8)1$$

The left-hand of *Eq. 5(8)1* is interacted with mass medium. In other words, it is compensated by exit of *CF*-line in spatial medium of the same magnitude of path-length and opposite sign respect to related *CF*-line. Thus:

$$\left(\Gamma_G \cdot c\Delta T_G\right)_{CF} = -\left(\Gamma_G \cdot c\Delta T_G\right)_{CI} = 2\hbar \qquad 5(8)2$$

Please refer also to *Sec. 7(4)3, parts A, D.*

Factually, the exited *CI*-line can be regarded as front of expandons emission in spatial medium that appears during a gravitational interaction of *CF*-line with mass medium H hall packages, *Sec. 7(4)2f, part E*. Each of the expandons has path-length value $2\hbar$, it is along with release of a contracton, *Sec. 5(2)1c part c,* of path-length value $-2\hbar$ within mass medium towards the center of mass of interacting mass bodies, i.e. δN_g in *Sec. 2(4)4a*, via related common H hall package tunnel, *Sec. 5(9)3d, part c*.

5(2)1c – Gravitomagnetism from viewpoint of H particle-paths hypothesis

A) General aspect

Considering a mass-body m is free falling near a massive stationary mass-body *M*, *Fig. 5(1)*. Now supposing the latter is rotating along an axis normal to the reader page, which is passing through its center of gravity; therefore, we have additional single direction force-lines *CF* in the direction of its rotation on the reader page. These force-lines will induce the mass-body m during its falling to rotate in the same direction of mass-body *M*, i.e. a whirlpool mode of falling. According to [302], *Background*, "The main consequence of the gravimagnetic force, or acceleration, is that a free falling object near a massive rotating object will itself rotate". According to [320] "A gravitomagnetic field, according to Einstein's theory of general relativity arises from moving matter (matter current) just as an ordinary magnetic field arises from moving charges (electrical current)". Resuming based on H particle-paths hypothesis viewpoint, an argument similar to that of falling object in a massive rotating mass-body must be considered in the latter cases according to *part B*.

According to *Sec. 3(1)2, Fig. 3(5)b*, the *SN* configuration is equivalent to the preference of forwarding negapa respect to its background counter-current conjugate, i.e. posipa. It can be likened to the preferential motion of positive charge, *Sec. 4(3), Fig. 4(5)* relative to negative charge respect to an observer at rest (lab). According to [321], *part one, section 2*, *gravity and electromagnetism,* "Vacuum experimental results seem to point to a link between electro-magnetism and gravity. For instance, Erwin Saxl found that when a torsion pendulum was positively charged, it took longer to swing through its are than, when it was negatively charged". Moreover, "If an electrical capacitor using a heavy, high charge-accumulating dielectric material between its plates was charged with 75 000 to 300 000 volts, it would move in the direction of positive pole- this later became known as the Biefeld-Brown Effect" [321], *part 1, section 2, Briefeld-Brown Effect.* Therefore, the motion of positively charged particles that have SN_r configuration in co-direction of their motion, *Sec. 4(3), Fig. 4(5),* (*i.e.* the same as expanding gravitational spheres, *Sec. 5(16)1b*, *paragraph 15*.of SN_r configuration) are favored. As a result, the positive charge will be favored the motion respect to negative charge in the above experiment. It can be referred to some extent to the dominant correlation effect of negapa (respect to posipa) with these charges by analogy with that of masses as in *Sec. 5(9)3;* please refer also to *Sec. 5(16)1b, part A, Remark 5(16)b4*, and *Sec. 5(2)1c, part B*. According to *Sec. 5(16)9b*, this preferential motion of negapa respect to its conjugate posipa in *SN* configuration is accompanied by time arrow. i.e. algebraic sum of time arrow and its reversal related to SN_r, and SP_l configuration respectively with the slight preference of expanding SN_r configuration over contracting SP_l one in our type *R* Universe, *Sec. 5(16)9*. According to above discussion, and *Sec. 5(16)1d, Comment 5(16)1d1*, gravitomagnetism of single direction (or irreversible) modification of H particle-paths of a mass-body, while gravity is related to reversible counter-current motion of its H particle-paths. Note that a mass-body at rest has also gravitomagnetism effect due to spirally expanding H particle-paths of gravitational spheres (i.e. expandons), please refer to *part B, paragraph III.*

B) Discussion

Supposing the mass *M* is rotates counterclockwisely along an axis that is passing from the center of mass *M*, e.g., the Earth, and is perpendicular to reader page. Therefore, the H particle-paths of the mass *M* have a common motion around this axis counterclockwisely on a single direction path. On the basis of, this statement, we encounter with effects as following:

I) The H particle-paths of the mass *M* expanding gravitational spheres obeys such a motion. In other words, the field's H particle-paths of both SN_r, and SP_l configurations, *Sec. 5(16)1b, part A, paragraph 7B* undergoes a contraction in the direction of motion and a dilations in the opposite direction of mass *M* rotation. To have a right idea, please refer to *Sec. 4(3)1, part B*, in case of the field lines of electron (or positron), and extended it to gravitational field their of SN_r (or SP_l) configuration respectively that is based on *Fig. 5(8),* of *Sec. 5(16)1b, part A*, in this regards, *Comment 5(2)1c, B1*. Therefore, the path-length of gravitational field analogous to that of electron is equal in the both direction and counter-direction of the mass *M* rotational motion. As a result, the symmetry of the gravitational dome, *Sec. 5(2)1a*, of mass *M*, is broken according to the direction of its rotational motion. Factually, the geometrical arrangement of vacuum texture is distorted respect to the case of non rotating massif mass-bodies based on common (or external), *Sec. 1(3),* motion of the mass *M* that affects its gravitational expanding spheres constituted of counter-currents H particle-paths in the same direction of mass *M* rotational motion.

II) Noteworthy, in electromagnetism we can attribute two distinct contributions due to the right- and left-handed characteristics of H particle-paths of the related fields, *Sec. 4.* On the other hand, according to H particle-paths hypothesis, the gravitational spheres expand both radially, *Sec. 5(4)4a*, and right-handed spirally, *Sec. 5(16)5*, through vacuum medium as its intrinsic characteristics. As a result, according to *Sec. 3(1)2, Comment 3(1)2a*, in our right-handedly expanding Universe, *Sec. 5(16)9a*, there is a slight preference of SN_r configuration, (i.e. excess of negapa over posipa), over SP_l configuration, (i.e. excess of posipa over negapa) of the gravitational field, *Note 5(2)1c1*. This preference governs on all of the motion involving rest masses, e.g., electron, proton, mass-bodies, except photon of zero rest mass, and related interactions. Therefore, the positive results of *GP-B* can be regarded as confirmation in this domain. "New analysis of the data from *GP-B* has confirmed the geodetic Effect with an accuracy of than one percent. Although the same effect has already been measured by *NASA*'s Cassini Mission. The results indicate that the much subtle frame dragging effect should be confirmed data analysis by the end of this year" (i.e. 2007) [384]. "The latest data analysis that includes a model for the roll-pothole resonance torque yields a 15% statistical uncertainty for the Frame-Dragging effect, it has 15% uncertainty does not include all systematic effects".[500] Program status (Mission update, *Feb. 2009*)

III) Factually, electromagnetism that is the result of interaction based on right- or, left-handed H particle-paths as singlet, *Sec. 4(1), Note 4(1)1*. It leads to a similar effect entitled gravitomagnetism due to slight preference of SN_r configuration over SP_l one in case of gravitational fields of moving mass-bodies gravitational spheres, and SP_l over SN_r one in case of related main mass-body, *Sec. 5(2)1c, part c*, and *Comment 5(2)1c, B1*. Based on this statement and contrary to electromagnetism that deals with identical and opposite sign charges, in the gravitomagnetism we are confined merely to opposite sign charges of equal magnitude. According to *Sec. 4(3)2, Eq. 4(6),* the magnetic field vector $\vec{B}$ in electromagnetism has an equivalent $\overrightarrow{B_G}$ vector in gravitomagnetism.

Therefore, according to above discussions, we have:

$$\overrightarrow{B_G}=\alpha(\frac{\vec{v}}{|v|}\times E_G), \text{ or} \qquad 5(11)a$$

$$\overrightarrow{B_G}= k\alpha\frac{GM}{R^3}(\frac{\vec{v}}{|v|}\times\frac{\vec{R}}{|R|}), \textit{ Remark 5(2)1c2} \qquad 5(11)b$$

Where:

$\alpha -$ The deviation degree from reversibility, *Sec. 2(1)1, Eq. 2(7)*

$k -$ Proportionality factor that according to [391], *page 2*, is equal to $-\frac{3}{c}$

$E_G -$ Equivalent of electric field in gravitomagnetism, i.e. gravitoelectric field, $E_G = k\frac{GM}{R^2}$.

R – The distance between two masses *M* and m. Moreover, $\vec{R}$ is the related vector pointed from *M* to m, and $|R|$ is it's related magnitude. Therefore, $\frac{\vec{R}}{|R|}$ is the related unit vector in this regards.

v - is the corresponding velocity in comparison to electromagnetism. Therefore, $\vec{v}$, is the corresponding vector.

The vector $\overrightarrow{B_G}$ of a moving mass-body of v speed e.g. translational, rotational, due to partial charge δe, or, δq, *Comment 5(2)1c*2, will induce a magnetic field in spatial medium, *Sec. 7(4)3, part A*. "In the case of the Earth, the magnetic field is induced and constantly maintained by the convection of liquid iron in the outer core"[604] *Formal definition.* This convection is under spatial experiment in case of *geoflow* project [605].

In the low velocity, i.e. $v<<c$, as in case of the Earth, α will tends to $\frac{v}{c}$. In fact, according to the above discussion based on H particle-paths hypothesis, one can deduced, why gravitation is likened to electromagnetism; please refer also to *Sec. 5(16)1d*. "Gravitomagnetism refers to a set of formal analogies between Maxwell's field equation and an approximation of the Einstein field equations for general relativity, valid under certain conditions" [392], *Preface*. Therefore, the resemblance of electromagnetism to gravitation as an ad hoc assumption based on Maxwell equations leads to general relativity prediction of gravitomagnetism. However, H particle-paths hypothesis attributes this resemblance to slight preference of SN_r configuration of

counter-current H particle-paths of gravitational field of negative partial charge characteristics in our type *R* expanding matter Universe over SP_l one that is based on expanding gravitational sphere (or expandon, *Sec. 5(16)1c, part A3*) as discussed above. Please refer to [395A] the law of gravitomagnetism. In order to have an idea, in case of analogy Lorentz force, vector potential, Ampere law of electromagnetism to the related form in gravitomagnetism.

Resuming, in case of two masses, e.g. at rest state, there are additional to their gravitational attraction based on *Sec. 5(2)1a*, an attracting gravitomagnetic force. The latter is based on interaction of H particle-paths (of SN_r configuration) of right-handed spirally expanding gravitational sphere, *Sec. 5(16)5* of the gravitational field of one of the two masses on the main body's H particle-paths (of SP_l configuration) of the other one (or vice versa). Therefore, the rotational motion of one of the masses along its axis will affects the part of the force related to gravitomagnetism. Noteworthy, in case of antimatter Universe the gravitational spheres expand left-handedly with SP_l configuration, whereas the H particle-paths of main body has SN_r configuration. In the other words in the matter Universe, there is also attracting gravitomagnetical force analogous to the stated above example.

Comment 5(2)1c, B1- According to *Sec. 4(3)1, part B,* considering case of single direction H particle-paths of a moving electron main body of SP_l configuration in the direction of motion. Its reversible part is constituted of H particle-paths uniformly distributed at SP_l configuration. Noteworthy, the field of electron has SN_r configuration based on Mirror Image Effect, *Sec. 6(2)3*, respect to main electron's body of SP_l configuration. By analogy to the electron case, the single direction part of H particle-paths of a mass-body (that is constituted analogous to electron from fermions) similarly to its reversible part has SP_l configuration in the direction of motion, and at an excess magnitude respect uniformly distributed of reversible part in case of rest state. Thus, it has a lack of SP_l configuration in the counter-direction of motion. In other words, in a matter Universe the contraction in the direction of motion is always along with SP_l configuration and dilation (or expansion) in opposite direction of motion has an equal magnitude lack of SP_l configuration, i.e. an equivalent SN_r configuration Nevertheless, its gravitational field has SN_r configuration, i.e. Mirror Image of the mass-body at all of the above steps.

As a result, a mass-body respect to an observer at rest has an additional SP_l configuration in co-direction, and an equivalent SN_r configuration in counter-direction of motion respect to its stationary state. Moreover, the path-length in co-, and counter-direction of motion has equal magnitude, but at opposite sign, *Sec. 5(9)3d*. Noteworthy, according to Mirror Image Effect, the gravitational field of the mass-body has SN_r configuration, whenever the main mass-body has SP_l configuration and at the same magnitude. In other words, the expanding closed surfaces of gravitational field, i.e. expandons, *Sec. 5(16)1c, part A*, lost its symmetrical spherical shape (or geometry) in the motion direction respect to an observer at the *CMPRF* of the whole system, *Sec. 5(11)*. Factually, the expandon's non-homogeneity besides its geometrical shape covers the SN_r configuration population (or density) of its related H particle-paths. Nevertheless, the expandons of gravitational field of a mass-body conserve its spherical shape respect to its mass-body *CMPRF's* observer as a firm (or solid) correlated unique expandons-mass H system, *Sec. 5(2)1d, part B*. Please refer also to *Sec. 5(2)1d, part D*.

C) Contracton

C1) General aspect

In our type *R* Universe, *Sec. 5(16)9*, the rotation of mass *M* along its axis induces an additional mono-direction (or external or common, *Sec. 1(3)*) rotating H particle-paths in expanding gravitational sphere of SN_r configuration, i.e. slight preference of SN_r over SP_l configuration. Please refer to *Sec. 3(1)2, Fig. 3(5),* and *Sec. 5(16)2a, Consequence 5(16)2a*. On the other hand, due to Mirror Image Effect, *Sec. 6(2)3*, the mass *M* H particle-paths gained an equivalent SP_l configuration, i.e. slight SP_l over SN_r configuration due to its rotation. In other words, the rotation of mass *M* leads to an induce effect during its rotation as following:

The gravitational expanding spheres additional mono-direction motion of SN_r configuration, that is equivalent to $-\delta e$ partial charge

The mass *M* acquires an excess SP_l configuration over its own SN_r one that is equivalent to $+\delta e$ partial charge, *Comment 5(2)1c2*.

Please refer to *Consequence 5(2)1c1*.

According above discussion two poles of opposite signs and magnitude $|e|$ that depends on the speed of mass *M* rotation is stabilized. Noteworthy, the minus sign partial charge spreads on gravitational spheres surface, whereas positive one of equal magnitude on mass *M* main body surface. Similar discussion as above is also held on a rotating quartz ball of mass m. In other words, the interaction of the gravitomagnetism field of $\overrightarrow{B_G}$ value of mass *M* of SN_r configuration on axeon, *Sec. 10(8),* of mass m, i.e. the spin axis of ball gyroscope of SP_l one. This leads to a similar effect as in case of electromagnetism discussed in *Sec. 4(3)*. Please refer to *Sec. 4(3)1, part B*, *Figs. 4(5),* cases *c, F*, and *Sec. 4(3)3* in this regards. It induces a torque on the angular momentum of mass m, that leading to deviation of its axis from its initial direction. Considering the two cases *I, II*, the first one increase the right-handedness due to SN_r configuration of expanding gravitational sphere, i.e. expandon of spin-2, *Sec. 5(16)1c, part A3*. Therefore, the second one imparts the equal amount of left-handedness to the fermion related to normal mass that must be

reveal as particle's axeon, *Sec. 10(8),* of SP_l configuration, e.g., left-handed unknown particle. In other words, according to *Sec. 5(15)2b*, dark matter convert through normal matter to right-handed expandons, and left its remnant left-handed as another hypothetical particle nominate contracton, *Sec. 5(2)1c, part c2*. It can be regarded as axeon of consumed dark matter particle at the end of conversion, *Note 5(2)1c2*. Moreover, we must add theses particles to the right-hand side of *Eq. 5(45)4*. Thus, each generated expandons of type R_e path-length of $2\hbar$ value, *Sec. 2(4)4a*, along with right-handed H hall package, *Sec. 5(16)3a*, (or entropy) increment, *Sec. 5(16)9d*, *part A*, is associated with an appropriate fermion of type L_c path-length value of $2\hbar$ value, *Comment 5(2)1c1*. It is confined in related H hall package, *Remark 5(2)1c4*, but of left-handed SP_l, of $-2\hbar$ as Mirror Image Effect conjugate of expandon of $+2\hbar$ spin, *Sec. 5(16)9d, part B;* please refer also to *Sec. 5(16)2a, Consequence 5(2)1c1*. As an alternate interpretation, the exit of partial charge of negative sign, $-\delta e$ through gravitational spheres, or, expandons, accompanied by right-handedness increment, and increment of partial charge of positive sign of the same magnitude $+\delta e$ related to left-handedness augmentation of related mass-bodies. Therefore, the consumption of right- and left-handedness during this process can be attributed directly to mass loss. In other words, the *Eq. 5(67)15b* of *Sec. 5(16)2a*, that is based on *Eq. 5(7) of Sec. 5(1)1* can be written as following:

$$-\frac{dM}{M}=-\frac{d\alpha}{\alpha}=8\pi^2\frac{G}{c^3}\left(\frac{a_s}{b}\right)\cong 1.95\times 10^{-34}\left(\frac{a_s}{b}\right) \qquad 5(11)b1$$

According to *Sec. 4(6)2, Eq. 4(27)*, at the case of mass-body at rest the *Eq. 5(11)b1* can be written as following:

$$-\frac{d\alpha}{\alpha}=-\frac{\delta e}{e}=8\pi^2\frac{G}{c^3}\left(\frac{a_s}{b}\right) \qquad 5(11)b2$$

Where:

G – Gravitational constant

α – Deviation degree from reversibility, *Sec. 2(1)1, Eq. 2(7)*

$\frac{\delta e}{e}$ - Handedness variation per unit of charge variation

- $a_s=1s^{-1}$, *Note 1(2)1,* $b=1kg^{-1}, u=1m^{-1}$ of inverse dimensions based on units of dimensions in *SI* units.

According to *Note 7(5)3a1*, the contracton has a superluminal speed that transfers spontaneously through common H hall package, *Comment 5(16)2a1*, at the order *33* higher than light speed (or velocity of expandon propagation) in spatial medium; please refer also to *Sec. 5(7)8*.

Consequence 5(2)1c1:

In case of antimatter, the gravitational expanding spheres, item *1*, has SP_l configuration, i.e. equivalent to $+\delta e$ partial charge. While, the anti mass-body *M* acquires a slight excess of SN_r configuration over its SP_l ones, i.e. equivalent to $-\delta e$ partial charge, *Note 5(2)1c3*. Therefore, both E_G and B_G signs in *Eq. 5(11)a* is reversed accordingly. Thus, according to H particle-paths hypothesis, the gravitomagnetism is not an ad hoc assumption based on simply comparison of electromagnetism and gravitational effects, *Sec. 5(16)1d*.

Gravitomagnetism related to ultra weak interaction of attractive characteristic of the gravitational field of a mass-body of SN_r configuration with the main body of another mass-body of SP_l configuration (SN_r-SP_l interactions) in our matter Universe at long range. Similarly, it is predicted that, there is also an interaction of repulsive characteristic of two mass-bodies (or main bodies) of SP_l configuration (SP_l-SP_l interactions) at sub-millimeter level. Please refer to *Sec. 5(18),* and to references [464 to 470]. According to *Sec. 4(5), paragraph X*. It is also predicted beyond the latter level at thin micro distance there is an interaction related to Casimir Effect, *Sec. 9(2), Note 9(2)4*, due to contribution of H particle-paths of the two mass-bodies in a common reversible motion.

"In the static limit, exchange of natural parity bosons of mass m_b produces a spin-independent potential between two particles

$$V_{12(r)}=\pm\frac{g^2}{4\pi}\tilde{q}_1\tilde{q}_2\frac{e^{-r/\lambda}}{r} \qquad 5(11)b3$$

Where, $\tilde{q}$ represents a generalized charge of the particle, g is the corresponding coupling constant and $\lambda=\hbar/m_b c$. The basic character of this interaction depends on whether the boson spin is even or odd. For even spin bosons, the minus sign applies and the force between like charges is attractive and a particle has the same charge as its antiparticle. On the other hand, the positive sign applies to interactions arising from exchange of odd-spin bosons where the force between like charges is repulsive and the charge of a particle and its antiparticle are opposite. Interactions of the form given in *Eq. 5(11)b3* are best detected by the *EP*-violating accelerations imparted to unpolarized test bodies. The acceleration of a test body experiencing the potential of *Eq. 5(11)b3*.

$$a_1=-\frac{\partial V_{12}}{\partial r}\frac{1}{m}\alpha\left(\frac{q}{m}\right)_1 \qquad 5(11)b4$$

will violate the *EP* unless $\frac{\tilde{q}}{m}$ is identical for all test bodies . This is manifestly not the case for vector interactions where a particle and its antiparticle have opposite $\frac{\tilde{q}}{m}$'s and where binding energy has no charge but does effect the mass" [465] *Some properties of quantum exchange forces*.

Ultra weak interaction of two masse-bodies of SP_l configuration at small distance scale, e.g. $10^{-3}m$, is similar to like charges as discussed in *Sec. 5(2)1c, part c1*. Therefore, there is some analogies with discussion held in parts *I, II* of this Consequence. Moreover, the contracton generation during gravitational interactions of two mass-bodies, *Sec. 5(9)3d, part c, Eq. 5(38)7a* can be viewed as an analogy of interactions between particles through boson exchange on the basis of standard Model. Therefore, the interaction of kind SP_l - SP_l of like partial charges $+\delta e$ is to some extent analogous to Yukawa interaction stated above.

Note 5(2)1c1- "Consider a toroidal mass with two degree of rotation (both major axis and minor axis turning inside out and revolving). This represents special cases in which gravitomagnetic effects generate a chiral corkscrew-like gravitation field around the object" [302] *higher order effects*. This corkscrew-like field has right handed configuration; please refer to *Sec. 5(16)9a*.

Note 5(2)1c2 (proposal) – Noteworthy, the bosonic dark matter particles have an indistinguishable character, *Sec. 8(9),* axeon of *SM* configuration and zero spin, whereas expandon has an expanding axeon of SN_r configuration of $+2h$ spin up to universe size. Therefore, related contracton has a contracting axeon of SP_l configuration of $-2h$ spin down to Planck length, l_P, and mass M_P. Please refer to *Sec. 5(2)1c, parts, c1, c2*.

Note 5(2)1c3- "An article published in 2007 featuring a model-independent analysis [1] concluded that the neutron has a negatively charged exterior, a positively charged middle, and a negative core. The negatively charged exterior of the neutron gives an intuitive explanation for why more neutrons are required in atoms with large numbers of protons, as the neutrons' negatively charged surfaces attract the positively charged protons to stay clumped together in the atom"[542]*Geometry*. This is an example of a neutral particle of rest mass in this regards that have an alternate interpretation from viewpoint of *HPPH*.

Comment 5(2)1c1- The expandon, *Sec. 5(16)1c, A3*, and its contracton conjugate is related to irreversible path-length, *Sec. 2(4)1*, in an H system. The expandon has expanding type R_e path-length of $2\hbar$ value; while, contracton has contracting type L_c path-length of $2\hbar$ value of equal magnitude and opposite signs, *Sec. 5(16)11*. Moreover, if we assume the path-length value of expandon as positive, the path-length value of contracton must be regarded as negative at equal magnitude (or vice versa). In other words, the algebraic sum of path-length of an expandon and related contracton is zero. Noteworthy, the irreversible path-length in case of gravity (*Case A*) is depending on stationary matter wave counterpart, *Sec. 2(4)4b*, of related mass-bodies, or particles at rest state; while, in case of moving particle (*case B*) it is depending on their de Broglie matter wave counterparts, *Sec. 7(4)2e*. In addition, the contracton take its existence during photon detection (or measurement, *Sec. 8(7)2*), and gravitational field interaction, *Sec. 5(16)1a*, *Remark 5(16)1a5*. Therefore, in case *A*, the contracton (or a group of that) is transferred to the source through the correlated H hall package, *Secs 8(7), Sec. 8(9),* and *Note 5(16)7, g2,*. In the case *B*, the released contracton (or group of that) is transferred spontaneously, *Sec. 7(4)2f, part C*, through common H hall packages, *Comment 5(16)2a1*, between the interacting mass-bodies, *Sec. 5(9)3d, part c*. "The corresponding *SRT*-based approach to the gravitational field problem is suggested in agreement with observations. One of the prediction is an existence of superluminal particles in a gravitational field, the prediction can be experimentally verified"[495] *Conclusion*. Moreover, the expandon, contracton in the case *A* is nominating kind *G* (or *G*-expandon, and *G*-contracton) and in the case *B* kind *P* (or *P*-expandon, *P*-contracton) respectively. Moreover, the electromagnetical expandon, contracton are nominating kind *E* (or *E*-expandon, and *E*-contracton) respectively, *Sec. 4(3)1 part c*. However, all over this article for reason of simplicity, the *G*-expandon and *G*-contracton are nominating simply expandon and contracton respectively. Moreover, the expandon has two expanding types *R&L* expandons, e.g. nominating simply WR, and WL, *Simulation 7(4)2e1*, respectively. Noteworthy, there is a non-expanding expandon-like particle of SM configuration nominating pseudo-expandon, *Remark 7(4)2b2*, of reversible character (or reversible path-length, *Sec. 2(4)4b*).

Comment 5(2)1c2- The partial charge per unit of mass (or charge density), i.e. $\frac{\delta e}{m}$ (or $\frac{q}{m}$), has a constant value through the mass medium irrespective of the mass-body composition. Any deviation from this value, leading to Equivalence Principle, *Sec. 5(3)1*, violation, *Consequence 5(2)1c1 part III*. As a result, the left-handedness related to SP_l configuration through the mass medium is as its intrinsic characteristic in our matter Universe. It has a constant value (or rate) at a time, and at a location respect an observer at rest state of the investigating mass-body.

C2) Contracton and Geon comparison

During right-handed expandons generation, its left-handedness conjugate, i.e. contracton, acquires left-handed H particle-paths up to reach to Planck mass, M_P, *Sec. 5(8)2,* and *Sec. 5(8)1, Eq. 5(34)1,* through its axeon of SP_l configuration, *Comment 5(2)1c, B1*. In other words, the internal wavelength of these H particle-paths reach to Planck length, l_P, *Eq. 5(33),* at his final stage. Therefore, The Universe expansion that is due to expandon generation is accompanied by contracton formation. These compact high frequency contractons (or their aggregate, *Sec. 7(5)3d, part B*) liken ultimately to theoretical micro-black holes, *Sec. 5(7)7, Remark 5(7)7a*. By a far analogy, there is an equivalent to contracton based on theoretical general relativity nominated geon. "A geon is an electromagnetic or gravitational wave which is held together in a confined region by gravitational attraction of its own field energy. They were first investigated theoretically in *1955* by J. A. Wheeler, who coined the term as contraction of gravitational electromagnetic entity". "Wheeler speculated that there might be a relationship between microscopic geons and elementary particle". "Wheeler did not exhibit explicit geon solutions to the vacuum Einstein field equation" [405]. He suggested that geons could provide an intermediate stage in the creation of micro-black holes" [404] *the concept*. As a result, expandons, *Sec. 5(16)1c, part A3*, and contracton by some analogies are equivalent to graviton, and geon respectively from viewpoint of modern physics. Noteworthy, expandons and contractons are correlated together, *Secs. 8(7), 9,* through their related mass-body. Therefore, their evolutions lead to gravitomagnetic phenomena.

As a result, based on H particle-paths hypothesis and simply according to Mirror Image Effect, *Sec. 6(2)3*, similar result analogous to General relativity theory and string theory without invoking to laborious mathematical formalism can be obtained. There is a probable pair production as Hawkings' radiation through interaction of contracton with counter-current H particle-paths of expanding spheres' *CF-lines* at event horizon; please refer to *Proposal 5(16)3b, E1* in this regards. "Serious consideration should be given to the possibility mini-black holes may contribute to the dark matter in the Universe" [404] *Conclusion*. "A micro black hole, also called a quantum mechanical black hole and inevitably mini black hole, is simply a tiny black hole which quantum mechanical effects play an important role. The smallest mass it is believed a black hole description to still make any sense at all is probably of the order of the Planck mass". It has" a Compton wavelength equal to the black hole's Schwarzschild radius (this distance being equal to the Planck length", "Small black holes would look like elementary particles because they would be completely defined by their mass, charge and spin" [396] *Explanation*. Please refer also to *Sec. 5(8)1, Note 5(8)1a*.

Remark 5(2)1c2 – Factually, in case of Gravity Probe *B* Mission Experiment [391], there are three kinds of rotations a following:

I- The Earth rotation along its axis
II- The quartz ball rotation along its axis
III- The satellite rotation around the Earth.

Thus, there are three right-handed SN_r configuration in the single direction of motion of gravitational spheres the three above masses, i.e. $SN_{r(E)}, SN_{r(B)}, SN_{r(S)}$ related three above cases, *I, II, III*, respectively. To each of the three configuration relates a gravitomagnetic momentum, $\vec{\mu}_{G(E)}, \vec{\mu}_{G(B)}, \vec{\mu}_{G(S)}$, of SP_l configuration of related masses respectively. Noteworthy, each of gravitomagnetic is placed in a gravitomagnetic field $\overrightarrow{B_{G(E)}}, (or, \overrightarrow{B_{G(B)}}, \overrightarrow{B_{G(S)}})$ of other ones through comparison with that of electromagnetic field. Therefore, it experiences a torque τ, which can be expressed in the form of vector production as following:

$$\overrightarrow{\tau_{Ge}} = \frac{1}{2}\overrightarrow{\mu_{G(B)}} \times \overrightarrow{B_{G(S)}} \text{ related to Geodetic Effect} \qquad 5(11)c$$

$$\overrightarrow{\tau_{Fd}} = \frac{1}{2}\overrightarrow{\mu_{G(B)}} \times \overrightarrow{B_{G(E)}} \text{ related to Frame Dragging Effect} \qquad 5(11)d$$

In case of additional ½ factor in *Eqs. 5(11)c, d* respect to that of electromagnetism; please refer to *Remark 5(2)1c3*.

The angular momentum of the quartz ball variation of the two above cases, i.e. $\overrightarrow{\Delta L_{Ge}}, \overrightarrow{\Delta L_{Fd}}$ that is perpendicular to the angular momentum of quartz ball $\vec{L}$ through time interval Δt, e.g., a year, is obtained as following:

$$\overrightarrow{\Delta L_{Ge}} = \overrightarrow{\tau_{Ge}}.\Delta t, \quad \overrightarrow{\Omega_{Ge}} = -\frac{1}{2}\overrightarrow{B_{G(S)}} \qquad \overrightarrow{\Delta L_{Fd}} = \overrightarrow{\tau_{Fd}}.\Delta t, \quad \overrightarrow{\Omega_{Fd}} = -\frac{1}{2}\overrightarrow{B_{G(E)}} \qquad 5(11)e$$

Where, $\overrightarrow{\Delta L_{Ge}}, \overrightarrow{\Delta L_{Fd}}$, are related to Geodetic Effect, Frame dragging Effect respectively. This gives an angular velocity of precession of the spin axis, e.g., $\overrightarrow{\Omega_{Ge}}, \overrightarrow{\Omega_{Fd}}$ relative to the direction to distant star, e.g. guide star *IM Pegasi* in Gravity Probe Mission [391]. "This should be compared to the analogous precession of the intrinsic angular momentum (spin) of classical charged particles in an electromagnetic field, $\vec{\Omega}_{precession} = +1/2\frac{q}{m}\vec{B}$" [395A] *the law of gravitomagnetism*. According to *Sec. 4(5), Fig. 4(9)*, q, and m have a common characteristic, i.e. full reversibility of H particle-paths as singlet and counter-current respectively. "We stress that apart from formal analogies, gravitomagnetism and the Maxwell-Lorentz electromagnetic theory are fundamentally different" [438] Criterion. Therefore, this difference arises merely in the singlet and counter-current characteristic of H particle-paths of related fields. Moreover, refer to *Remark 5(2)1c3* for the minus sign explanation in case of gravitomagnetic field. Noteworthy, according to *Sec. 5(16)5*, the spirally expanding Universe that has a distinct axis of rotation similar to that of the Earth may influenced also on the quartz ball gyroscope axis of Gravity Probe *B* Mission. This gives a direct prove of rotational motion of our Universe through considering Mach's principle. "Our results demonstrate (in first order perturbation theory for *FRW* cosmologies with $k = 0$) the validity of Mach's principle hypothesis that axes of local non-rotating frames (i.e. gyroscope axis) precisely follow an average of the motion of cosmic matter" [395 B] *Abstract*. Please refer also to *Sec. 5(9)3b*.

Remark 5(2)1c3- "In the literature, all instances of $\vec{B}$ in the *GEM* (gravitomagnetism) equations are multiplied by ½, a factor absent from Maxwell's equation. The factors *2* and ½ arise because the effective gravitomagnetic charge is twice the state gravitational (gravitoelectric) charge, a remnant of the spin-2 character of the gravitational field" [302] Equations. According to *Sec. 5(16)1c, part A3, Eq. 5(67)10*, the spin of expandon (i.e. expanding gravitational sphere) is $2\hbar$. The two sets of equations (i.e. Maxwell and *GEM* equations) are identical, but for the minus sign preceding 4π in the *GEM* equations" [302] *Comparison*. According to *Sec. 5(2)1c, part B*, the gravitational field or expanding spheres has SN_r configuration of negative partial charge, but the related mass body has SP_l configuration of positive partial charge. In other words, the field and related mass has two - & + signs respectively that appears in the gravitomagnetic equations, as an example, $\nabla.E = 4\pi\rho$ in electromagnetism $\nabla.E_G = -4\pi G\rho$ in *GEM*. Noteworthy, in the special case a positive charge of SP_l configuration instead of producing a field of SP_l configuration, i.e. positon, it leading to its reversal handedness field, i.e. negaton, of SN_r configuration related to a negative charge; please refer also to *Sec. 4(6)4*. Therefore, the SN_r, and SP_l configurations in the rotational motion can be compared formally with the right-hand side of equations b & g of *Sec. 4(2)*, *Fig. 4(3)* respectively along with related gravitomagnetic field. By a far analogy, mass an its related gravitational spheres can be compared by proton nucleus and electron's shell in hydrogen atom each of them having its magnetic moment, i.e. a special kind of dipole. Because of this analogy, i.e. an expanding partially negatively charged expanding sphere of SN_r configuration, and approximately point-like stationary partially positively charged mass-body of SP_l configuration, a kind of gravitational wave through oscillating motion of the related mass-body based on *Sec. 4(3)1, part c, Fig. 4(6),* is not far from expectation.

Remark 5(2)1c4 –Any expandon generation is accompanied by right-handed H hall package of SN_r configuration or entropy increment. It has an expanding type R_e path-length, *Sec. 5(16)11*. Therefore, according to Mirror Image Effect, *Sec. 6(2)3*, contracton generation is along with initial H hall package decrement as left-handed of SP_l configuration, or, entropy decrement, i.e. negentropy (negative entropy). In other words, the initial total number of H hall packages is increased through its right-handed configurations, i.e. expandons, in spatial medium. Moreover, it is decreased (or overlapped) through left-handed ones as in case of contractons through mass media. Please refer to *Sec. 5(16)9d, part B* in this respect. Noteworthy, contracton has a contracting type L_c path-length at the same magnitude, and opposite sign of type R_e path-length of its expandon's conjugate.

C3) Kind of contractons

The contractons have different kinds as following:

1) Gravitational contracton (*G*-contracton) that is releasing towards the center of mass of a mass-body. It is normal to and in the direction of the curvature of *CF*-line, *Proposal 5(2)1a1,* or extremum of related expandon. It has two types *PR & PL* related to types *R & L* configuration, *Simulation 7(4)2e1*.
2) Contracton related to interaction as e.g. collision, measurement. This kind of contracton is emitted along the trajectory of related particle, e.g. photon as in *Sec. 8(9), Fig. 8(2).*
3) Electromagnetical contracton (or *E*-contracton). Its effect is similar to gravitational one in *item 1*. The *E*-contracton has two types nominating negactron & posictron, *Sec. 4(6)4*, that acts as singlet, *Note 4(1)1*, without accompanying other contracton singlet related to opposite sign charge. Moreover, according to *Simulation 7(4)2e1,* and *Sec. 4(4), Fig. 4(8),* The *PR & PL* contractons are equivalent to negactron & posictron respectively.

5(2)1d – Speed of gravity

A) General aspect

A1) Preliminary step

According to *Sec. 5(9)3*, a correlation of H particle-paths between the gravitation domes, *Sec. 5(2)1a*, to the both interacting mass-bodies *M* & m is established. In other words, the interaction of expandons, *Sec. 5(16)1c, part A3* of the object m on *M*, and *M* on m that travel at finite speed related to aberration on a distinct path leading to gravitation dome formation. This subsequently ended to a tunnel correlating the H particle-paths of mass-bodies m & *M* due to equilibrium stage, *Sec. 5(2)1b*, formation. It is analogous to that of entangled pair, *Sec. 8(7), Sec. 8(9)1, paragraph 3*; thus, any fluctuation of movement of a mass-body is transferred spontaneously to the other body through common tunnel of H hall package, *Sec. 5(16)3a*, on the same path, *Sec. 8(9)2*. It is interpreted analogous to Newtonian model as instantaneous action at a distance, i.e. infinite speed of gravity, *Remark 5(2)1d, A1a*. Noteworthy, there is expandons propagation through vacuum texture, *Sec. 5(16)3b*, at c (or less than c) speed until to reach a mass-body in order to gravity tunnel formation, nominating cavity reverson, *Sec. 5(2)1d, part D,* and *Comment 5(16)2a1*. It is followed with subsequent spontaneous propagation of interaction (or forces) within the tunnel that is formed between interacting bodies at locally successive equilibrium, *Sec. 5(9)3, Fig. 5(5)2*. The first one, can be regarded as potential fields around a mass as in *Sec. 5(16)1b, part A, Fig. 5(8),* that extends at finite speed less or equal to light speed through vacuum medium, but second one is instantaneous propagating speed of gravitational force inside tunnel of H hall package. "If gravity from the Sun propagated outward at the speed of light, transmission delay would progressively increase the angular momentum of bodies orbiting the sum so great a rate that orbital radii would double in 1000 revolutions" [103]. "The force is the instantaneous gradient of the retarded potential", "Potential cause force or force cause potential. The geometric interpretation of *GR* assumes the former" [439] *Third Round of Responses*" "Disturbances of this potential field or medium are called gravitational waves. According to *GR* such waves

propagate at the speed of light, as do all other phenomena, *Comment 5(2)1d, A1a,* associated with potential field that that propagate at all". "However, the name not withstanding gravitational waves have nothing to do with gravitational force. Binary pulsars (with masses and speeds) show that the speed of gravity must be at least *20* millions times the speed of light. A *1997* laboratory experiment by Walker & Dual showed gravitational signals propagated much faster that light signals". "Propagation delay is not important for gravitational potential because the potential field is already present near any source mass, and does not propagate to get there. Its shape is describe by Einstein's equations" [409] *the physical meaning*.

Resuming, according to H particle-paths hypothesis, if, the gravitational waves propagate through normal vacuum texture, its speed is the same of the light speed, i.e. c. However, if it travel within H hall package, *Sec. 5(16)3a*, tunnels its speed is infinite (spontaneous), please refer also to *Sec. 8(9)*. "The gravitational waves can be calculated from observation of the orbital decay rate of binary pulsars *PSR 1913+16* and *PSR BI 1534+12*. The orbits of these pulsars around each other are decaying due to loss energy in the form of gravitational radiation. The rate of this energy loss (gravitational damping) can be measured and since it depends on the speed of gravity, comparing the measured value to theory shows that the speed of gravity is equal to the speed of light to within *1%*" [415] *experimental measurements*. This experiment is an indirect confirmation of speed of gravitational waves. According to these experimental results, that is based on general relativity, the gravitational waves propagate through vacuum texture (instead within H hall package tunnels) at the light speed that is analogous to the case of electromagnetical waves propagation through vacuum texture. Please refer to *part c* of this section, and *Sec. 4(6)6*.

Comment 5(2)1d, A1a- In religious books, the speed of information transfer are also finite, e.g. "God orders and plans the affairs of the Earth and its habitants from the heaven. Then the result of his orders for mankind will ascend to him on a day (period) the duration of which is one thousand years according to your ordinary calendar and calculation." [110]B, *Surah 32, verse 5*. Moreover, In case of information volume "And were every tree that is in the Earth [made into] pens and the sea (to supply it with ink), with seven more seas to increase it, the words of God would not come to an end."[110]A, *Surah 31, verse 27*.

Remark 5(2)1d, A1a – According to the following articles, the results obtained according to article [440] is independent of velocity-dependent terms in the time delay, i.e. v/c correction on the speed of gravitational interactions, c_g. "Using a relativity simple method, I compute the v/c correction to the gravitational time delay for light passing by a massive object moving with speed v. It turns out that the v/c effects are two small to have been measured in the recent experiment involving Jupiter and quasar *JO 842+1845* that was used to measure the speed of gravity" [441] *Abstract*. "The altered propagation speed of gravitational signal has no effect whatsoever on the time delay to the first order in v/c beyond the leading terms, although it will have an effect to second and higher order" [444] *Abstract*. "We calculate the time delay in the limit of an instantaneous gravitational force; and find the velocity-dependent terms with no dependence on the speed of gravity. The speed of gravity cannot be determined by measuring these terms in the Shapiro time delay" [445] *Abstract*. "A truly impressive observational feat in radio astronomy, provided a measure of the speed of light only, not the speed of gravity as was claimed" [445] *Conclusions*. "We have taken account of the light cone effect but not the propagation of gravity. Hence, it has been clearly shown that the excess comes from nothing but the propagation of light" [447] *Conclusion*. As a result, the modification of general relativity in case of static object to the moving one based on aberration, or, finite speed of gravity has no sense.

A2) An H particle-paths hypothesis interpretation based on experimental Results

According to *Sec. 5(16)1b, part A, paragraphs 3, 4*, the total velocity c of gravitational expanding spheres (i.e. expandons, *Sec. 5(16)1c, part A3*) that is the sum of two radial v_r, and tangential v_t velocities. According to *Fig. 5(8)*, at the vicinity of a mass-body, the radial velocity is much higher than tangential one, i.e. $v_r \cong c >> v_t$ that is in accordance with indirect experimental results. According to these results, "The relativistic light deflection of the quasar *JO 842 + 1835* as Jupiter passed within *3'.7* on *2002 September 8*, by measuring the time delay using the Very Long Baseline Array (*VLBA*) and Effelsberg radio telescopes at *8.4 GHz*. A closest approach, general relativity (*GR*) predicts a radial (static) deflection of *1190* $\mu arc\sec$ and a tangential (retarded) deflection in the direction of Jupiter's motion of *51* $\mu arc\sec$"[440] *Abstract.* Please refer to *part A1*, *Remark 5(2)1d, A1a*. Noteworthy, in case of a static mass-body the tangential velocity v_t in the plane normal to radial one has a reversible characteristic, and its sum is equal to zero in this plane. Therefore, it affects only on the magnitude of single direction radial velocity v_r of the static main mass-body.

According to *Sec. 5(2)1d2*, in the above case, the whole H system, i.e. Jupiter and its correlated gravitational potential moving analogous to case of Sun-photon-target system, *Sec. 8(9)2*. In other words, the motion of Jupiter at v_{Ju} speed affects the potential field H particle-paths the same as Jupiter main mass-body respect to an observer at rest on the center of mass of center of mass of Sun-Jupiter (or *CMPRF's* observer, *Sec. 2(8)3*). Therefore, the radial velocity vector $\overrightarrow{v_{rs}}$ of gravitational potential field of a static object combines with the vector velocity $\overrightarrow{v_{Ju}}$ of the same object of motion in each point of potential field, i.e. $\overrightarrow{v_{rm}} = \overrightarrow{v_{rs}} + \overrightarrow{v_{Ju}} \le c$ at non-relativistic level. Please refer also to *Sec. 2(6)5c*. Where, $\overrightarrow{v_{rm}}$ is the speed of radial expansion of gravitational potential field of Jupiter at motion respect to an observer at rest on the Sun-Jupiter center of mass. Factually, according to *Sec. 5(2)1d, parts B*, there are common gravitational potential fields (or expandons) along the Sun-Jupiter axis centered on their center of mass.

B) Non aberrative gravitational potential field

According to *Sec. 5(16)1b, part A, Fig. 5(8), paragraph 18,* the gravitational spheres (i.e. expandons, *Sec. 5(16)1c, part A3*) during their expansion are correlated through their cells to the related mass. It is in accordance with correlation of an entangled pair of particle, *Sec. 8(9)1, paragraph* 6. In other words, there is an expansion at finite speed as in *paragraph 3* both radially and tangentially (or transversely) from the mass as the source through vacuum texture, *Sec. 5(16)3b, part A*, up to reach another mass-body (or target), *Sec. 8(9)2*. Therefore, during a measurement, *Sec. 8(7)2,* process due to gravitational domes formation, *Sec. 5(2)1a*, the non aberrated gravity forces induce spontaneously between two mass-bodies, *Sec. 5(2)1d*. At this stage, the two mass-bodies have unique (or common) gravitational spheres (or expandons) that expand through vacuum texture, *Sec. 5(16)3b, part A*. In other words, the strength and geometrical configuration of each expandon at the instant of its generation depends on the relative configuration of relating two orbiting mass-bodies configuration, *Sec. 5(9)3*. Noteworthy, the mass and its related expandons have a total path-length L_t, *Sec. 5(16)1a, Eq. 5(54).* Factually, the reversible counter-current H particle-paths of correlated mass-expandons as a unique H system of path-length value L_t similarly to the single direction photon that is confined in an H hall package induces no aberration during source-target interactions at least at a short distance such as solar system, and respect to its *CMPRF's* observer, *Sec. 8(9)2, paragraph III.* Please refer to *parts c, D* of this section. Noteworthy, according to *Sec. 2(1)3, Note 2(1)3b,* the mass is contracted form of the field, and field is expanded form of the mass. Therefore, according to *part A2* of this section, the whole mass and related field are moving through vacuum texture as a unique correlated H system, in such a way that the center of mass is coincide with that of the related main body mass. In other words, the *CF*-lines, *Sec. 5(2)1a*, of mass-body are in connection with the main mass-body through this correlation. In order to have an idea, case of a moving particle can be extended to macro-bodies, and comparing it with one of the cell in the *Fig. 4(4) of Sec. 4(3)1, part B*. In this figure, by analogy with correlated single-direction electromagnetical potential field-lines, the gravitational *CF*-lines constituted of reversible counter-current H particle-paths. “In general relativity, when the solutions to the Einstein equations (which govern the potential) are converted to equations of motions (which describe gravitational acceleration), the assumption of infinite speed of gravitational force is implicitly adopted by setting aberration in the gradient of the potential equal to zero” [439] *Summary*. Please refer also to *Remark 5(2)1d, B1*.

According to above discussion, there is a competition between H particle-paths of main mass-bodies and vacuum quantized texture with the main dominance of former respect of H particle-paths of expanding gravitational fields. In other words, in case of a moving mass-body by a rough analogy the whole *Fig. 5(8)* including mass and gravitational expanding spheres are moving with the same speed through vacuum texture, *Remark 5(2)1d, B1*. This paradox is solved as stated above through instantaneous, *Sec. 7(4)2f, part c*, transfer of gravitational interactions in the form of released contractons within the same path (or tunnel, *Sec. 5(9)3d, part c*) that H particle-paths of expandons traveled before at finite speed irrespective of the shape (or form) of this tunnel, *Note 5(16)7,g2*; while, the gravitational expanding spheres (expandons) are continued their expansion through vacuum texture. Factually, in practice, considering the reader as rest observer, i.e. lab, there is some disturbance in the geometrical configuration of forwarding H particle-paths respect to backwarding one by analogy with *Fig. 4(4)* that is based on path-length constancy, *Sec. 2(1)2*, and Delta Effect, *Sec. 2(1)1b*, in each of constituting cell. Please refer to *part D* of this section

According to *Sec. 5(16)3b, part B,* the track texture defines the path of a moving particle, e.g., photon, electron, through space. "The light bending in *GR* is not caused by gravitational force, but rather by gravitational potential, as is obvious by examining the formula for the effect (proportional to $1/r$)” [439], *first Round of Responses*. Factually, the gravitational potential is the vacuum gravitational texture around related mass-body. Analogous to the case of interacting charged particles of rest mass, e.g., electron, proton, that virtual photons, *Sec. 4(6)5b*, act as spontaneous, *Sec. 7(4)2f, part c*, force carrier through H hall package tunnels, the contracton, *Sec. 5(2)1c, part c*, as gravity force carrier transfer instantaneously through H hall package tunnel between two interacting mass-bodies, *Example 5(2)1d, B1*. Therefore, the instantaneous gravity force is intrinsic characteristic of particle and body of rest mass. Please refer to *Sec. 5(9)3c*, *d*, *Fig. 5(5)2*. “Light bending and signal propagation delay are related to potential strength only, not to force strength” [439] *third round of responses*.

Example 5(2)1d, B1- Referring to *Sec. 8(9)2, Fig. 8(2),* supposing mass *S* (Sun) and mass P (photon) are moving relatively. To each point of $P_1, P_2, \ldots P_8$ of photon trajectory is terminated a *SP* H hall package tunnel, *Sec. 5(9)3d, part c*, from the center of mass of object *S*. According to *Sec. 5(9)3d, part c, Fig. 5(5)2*, there are spontaneous mutual contractons exchange between objects *S* and *P*. In other words, in each point of object *P* trajectory there is an instantaneous gravitation force application by the mass *S*. Thus, there is no gravitation aberration in this case. In the photon-Sun system as in *Fig. 8(2),* this phenomenon is also valid except that photon measurement (or interaction) by target *T* is very stronger respect to the former *SP* gravitational interaction, i.e. the gravitational force is very weak respect to the other forces, e.g. electromagnetical. The gravitational force is due to beat occurred at each point $P_1, P_2, \ldots P_8$ on photon trajectory during contracton exchange within a cone-like cavity, *Sec. 5(2)1d, part D,* of mass *S* during stay time interval ΔT, *Sec. 7(4)2f, part A*. Moreover, the photon P has reversed spins in any two adjacent beats.

Note 5(2)1d, B1- According to *Sec. 5(2)1b*, the H particle-paths of gravitational potential through interaction with that of purely single direction H particle-paths of photon induce the geometry of the latter at the same form of the former one. In other words, the photon H particle-paths acquire the geometry of H particle-paths of the gravitation potential paths of interacting mass-body. Thus, obeys the gravitational potential track texture paths of related mass-body. Please refer also to *Sec. 5(16)3b, part B, item XI.*

Remark 5(2)1d, B1 – According to *GR*, the space-time curved around an isolated mass-body up to infinity along with an attenuation. Thus, if the center of mass of mass-body changes its position from *A* to *B*, at the latter position, i.e. *B*. the same idea of curvature up to infinity also holds. Therefore, the aberration in the gradient of gravitational potential field in this respect is an ad-hoc (or additional) condition that is introduced by another theory, i.e. *SR*, according to that no interaction or speed is faster than

light speed. In other words, the gravitational field aberration according to *GR* is zero. "Force field is obtained as derivative of metric tensor. If metric tensor has a retarded argument so will the force have. Force is derived from a retarded potential by taking a gradient. In the gradient (which just act of partial derivatives), one can choose to use instantaneous or retarded coordinates in those partial derivatives. If one chooses retarded coordinate, the gradient points toward the retarded source position, and angular momentum conservation is lost. So in *GR*, the choice is always to use instantaneous source mass, and conserves angular momentum, allowing the theory to agree with observations at the expense of its Lorentz invariance" [439] *Second round of Responses*. Please refer also to *Sec. 5(2)1, parts* c, D.

C) - Discussion

According to *Sec. 8(9), Figs. 8,* the photon emitted from the source has mono-dimensional (or lined shape) correlated trajectory that propagates through vacuum texture, *Sec. 5(16)3b, part A, as in Fig. 8(2).* However, in case of gravitational field, the expanding gravitational potential fields emitted from the source (i.e. mass) have a firm tri-dimensional (or spherical shape as defined in *part D*) correlated propagation through vacuum texture, *Fig. 5(8), Sec. 5(16)1b, part A, paragraphs 3, 4*. Therefore, it resist to deformation during motion of related mass-body. In other words, by a far analogy correlated photons can be compared with a flexible elongation of a rubber rod that its shape is the photon trajectory as shown in *Fig. 8(2)*. Whereas, the expanding gravitational potential field can be compared with a blowing balloon that its overall shape will not be altered during its motion (i.e. mass-body motion). In other words, the gravitational fields (i.e. body of the balloon) move with the same speed of the related mass (i.e. the center of balloon). Therefore, contrary to the case of photon, there is no aberration in case of gravitational field potential (or expandons), *Sec. 5(2)1d, part D*. Noteworthy, in the two above cases, the forwarding and backwarding motion of H particle-paths in each cell of photon structure, *Sec. 4(4), Fig. 4(8),* and gravitational fields, *Fig. 5(8),* obeys the forwarding and backwarding motion of H particle-paths as in *Fig. 4(4) of Sec. 4(3), part B*. It is based on counter-currency motion of H particle-paths, *Sec. 3(1)2, Figs. 3(4), 3(5)*. Please refer also to *Comment 5(2)1d,* $c1$.

As a result, there is a main difference between correlated and non-correlated H particle-paths of a gravitational potential expanding spheres (or expandons). In the first case, the expandons expand radially without deviation related to aberration. In other words, the radial direction of expansion that has an angle respect to the direction of motion of related mass-bodies preserves its direction and the magnitude of its angle respect to direction of motion up to infinity as in case of static mass-body. Whereas, in the second case this angle is varied proportional to the speed of the mass-body as the potential field extent up to infinity. Noteworthy, in the first case, any interaction induced on the main mass-body such as collision, *Sec. 6(2)1a*, external force, *Sec. 6(2)1b*, is propagated spontaneously in an abstract vacuum, *Sec. 5(16)3h,* through unique H hall package, *Sec. 5(16)3b, part A,* constructed of mass-body and its related field. Based on *Sec. 8(9),* this H hall package perforates the vacuum quantized texture.

Summarizing, the mass-mass, and mass-field interactions of mass-bodies at the instant of interaction [or measurement, *Secs. 8(7)2, 8(9)*] transferred instantaneously*, Sec. 7(4)2f, part c*. Whereas, according to *part A* of this section the field variations of a mass-body, and mutual field-field interactions of mass-bodies are transferred through vacuum texture at finite speed equal or less than light velocity c*, Example 5(2)1d,* $c1$. According to *part A* of this section, the gravitational waves analogous to photon must be confined in extending H hall package with path-length value h, *Sec. 5(16)3g*, that is elongated from the source, i.e. pulsars up to the measuring device, *Sec. 5(9)3*, at the light speed in an entangled manner. Therefore, after measurement, according to *Secs. 8(7)2, 8(9)1, Fig. 8(1),* this correlation is interrupted from emitting source instantaneously within H hall package's tunnel instead through vacuum texture. Noteworthy, in case of gravitational interaction the newly formed H hall package tunnel between source and detector will be overlapped with the old ones at the equilibrium stage, *Sec. 5(2)1b*, contrary to case of measured photon that the tunnel is dissipated. Therefore, as an alternate interpretation of ref. [415] that is consistent with H particle-paths hypothesis is the following one. "Dynamical studies of binary pulsars show that not only the position and velocity of a source of gravity are anticipated without light-time delay, but accelerations of the source are anticipated as well. Indeed Newton's universal law of gravity, to which general relativity is supposed to reduce in the low velocity, weak-field limit, requires infinite propagation speed for gravity". [103] *abstract*.

As a result, based on above discussion the interacting mass-bodies passing the following steps:

1- Any mass-body interacted according to *Sec. 5(2)1a*, through entrance and exit of *CF*-lines force, *CI*-lines impulsion lines respectively at overall c speed through vacuum texture to reach an equilibrium stage along with total path-length variations up to constant value.

2- At the equilibrium stage, *Sec. 5(2)1b*, that correspond to *GRT* principle, the H particle-paths of interacting mass-bodies transfer through H hall package tunnel as contracton, *Sec. 5(2)1c, part c*. Therefore, induce gravitational forces spontaneously, *Remark 5(2)1d,* $c1$. In this stage, the total path-length of the system is remained unchanged during the time. Please refer to *Sec. 5(9)3, Example 5(9)3*a.

3- The rate of regeneration of interacted expandons (or their H particle-paths), and contracton transfer within the common H hall package tunnels of interacting mass-bodies is spontaneous, *Note 5(2)1b2*. Please refer also to *Sec. 5(9)3, Fig. 5(5)2*.

According to items *1 & 2*, any interaction that leading to total path-length value variation, propagate at c speed through vacuum texture as a carrier of path-length variation is transferring through related H hall package spontaneously.

Resuming, "The statements that the speed of gravity equals the speed of light is manifestly false, and heard often only because of the confusion with the propagation speed of gravitational waves" [437] *part 5*. Factually, expandons (related to gravitational potential) propagates through vacuum texture at finite speed less than c , *part A2*. Whereas, the gravitational force between mass-bodies propagates spontaneously through their common H hall tunnels. Therefore, the expandons affect merely on the strength of gravitational forces due to its expanding spherical (or closed surface) character, *Sec. 5(2)1*, without affecting on the direction and speed of propagation of the latter.

Example 5(2)1d, c1- The orbiting pulsar, e.g. pulsar type *PSR 1913+16*, and its companion, can be regarded as a unique H system. Therefore, the variation of intensity of their related combined expandons of SN_r configuration moving through vacuum texture at finite speed can be considered as gravitational waves. In other words, the variation of the latter is due to the relative motion of pulsar system in vacuum space. As a result, the pulsar's expandons variation during an interaction with a mass-body (i.e. detector), *Sec. 5(2),* has instantaneous gravitomagnetical effect, *Sec. 5(2)1c*. Please refer to *Sec. 5(16)1b, part c* in this regards.

Comment 5(2)1d, c1- Factually, in our matter Universe according to *Sec. 5(2)1c,* in case of a static mass-body the SN_r, and SP_l configurations of H particle-paths in a cell of expanding gravitational sphere (or expandon) are equal in magnitude. It is along with slight preference of the former respect to the latter one that for the reason of simplicity (as former one) nominating SN_r configuration. This is due to spirally expanding character of expandons of the mass-body in our *type R* matter Universe, *Sec. 5(16)9a*. Moreover, in case of a moving mass-body, e.g., Jupiter, this preference becomes significant, proportional to the linear momentum of the latter in the direction of its motion respect to an observer at rest on the Earth, i.e. Lab, *Sec. 5(2)1c*, *part B, Eq. 5(11)a*. Therefore, the moving mass-body (or Jupiter) also induces a mono-direction gravitomagnetism effect. "We develop a general relativity framework which shows that measurement of the retardation of gravity in case of a uniformly moving light-ray deflection body is equivalent to measurement of gravitomagnetic (Lorentz type) force generated by the time derivatives of the metric tensor in the post-Newtonian expansion of the light geodesics equation" [446] *Abstract*. Contrary to this claim, the gravitomagnetic interactions propagate spontaneously because of mass-field interaction, *Sec. 5(2)1d, part c*.

Remark 5(2)1d, c1- "The speed of propagation of gravitational force is at least $2\times10^{10}c$. Examples are the locality dilemma of quantum mechanics and the quantum of the existence of singularities in nature (black hole)" [103] *Abstract*.

D) Gravitational cone-like cavities

The gravitational texture overcome the vacuum quantized texture *Sec. 5(16)3b*, or perforating the latter, and replacing with that during the motion of the generating mass-body as a rigid tri-dimensional H system including the related mass-body up to re-overcoming of vacuum texture medium (e.g. up to the solar system scale in case of gravitational fields of macro-bodies). According to *Sec. 5(16)1b, part A, paragraphs 19,* the cone-like cavities conserve their straight radial shaping as in *Fig. 5(8),* during the motion of center of mass of the related macro mass-body through vacuum quantized texture. In other words, these tunnels are not affected by vacuum medium texture. Noteworthy, the H particle-paths of the cells, *Comment 5(2)1d, D1*, that are confining in these tunnels merely are affected in the direction of the motion respect to an observer at rest state. The H hall package's tunnel of the photon that is correlated to the source, *Sec. 8(9),* is collapsed during the photon measurement by a measuring device. Therefore, conversely to the case of cone-like cavities that remained unaffected as stated above, photon undergoes aberration through its propagation within the vacuum medium texture. During the gravitational interaction of two-mass-bodies, their correlations are performed within their common H hall packages tunnels as in *part c, Note 5(2)1d, D1.* Factually, any of the n_s Planck areas of Schwarzschild surface acts as a particle confining in a cone-like cavity of path-length value $2\hbar$, *Note 5(2)1d, D1*. Therefore, according to *Sec. 7(4)2e*, two reversible countercurrent types $WR, WL,$ exit successively at a superimposed indistinguishable manner through the cone-like cavities at expanding type R_e, and L_e path-lengths with slight preference of the former one along with contracting types L_c, and R_c path-lengths at equal magnitude and opposite signs through the related mass-body medium, *Sec. 7(4)3, part D*, respectively; please refer also to *Comment 7(4)2f, E2*. According to above discussion and according to *Note 2(3)1a, Eq. 2(56),* the frequencies of emitting $WR, WL,$ (or frequencies of relates expanding spheres) η_0 are obtained as following:

$$\eta_0 = K_\Gamma n_0 \qquad 5(11)f$$

Therefore, according to *Sec. 2(1)3, Eq. 2(35):*

$$\eta_0 = a_1 K_\Gamma N_0 \qquad 5(11)g$$

Where:

- a_1, constant of media coefficient, *Note 1(2)1*.
- K_Γ, the proportionality factor of matter wave frequency (or here, the frequency of expanding spheres emission η_0) with that of frequency equivalent n_0 of related mass-bodies
- N_0, the total number of H particle-paths of mass-body at rest state.

Note 5(2)1d, D1- According to *Sec. 5(9)3d, Figs. 5(5)1 & 2*, any expandon in a diverging cone-like cavity, *Sec. 5(2)1d, part D*, of mass *M* has an expanding type R_e path-length, and during its interaction with a mass-body m leading to a contracton. The latter that has a contracting type L_c path-length of $2\hbar$ value, and opposite signs of the former, *Sec. 5(16)11*, ejecting towards the mass-body M in a reversed handedness through a common H hall package of converging cone-like characteristic. The propagation of expandons in a diverging cavity, *Sec. 5(2)1d, part D*, through spatial medium is at c speed up to an interaction. While, the emission of its contracton conjugate in a converging H hall package tunnel within abstract vacuum, *Sec. 5(16)3h*, is spontaneous. It is analogous to case of entangled pair of particle, e.g. photon, destructive interaction (or measurement, *Sec. 8(7)2*); please refer to *Sec. 8(9)* in this regards.

Note 5(2)1d, D1- In case of the gravity, this particle is nominated expandon, *Sec. 5(16)1c, part A3*, of path-length value $2\hbar$; please refer to *Sec. 5(16)1a, part B*.

Comment 5(2)1d, D1- A particle, e.g. photon, electron, is constituted merely of a cell (or an H hall package) of path-length value h; while, a mass-body, e.g. a coin, is constituted of polycell (or H hall packages) of the same number of n_s, *Sec. 5(1)1*, on its Schwarzschild surface of stored path-length value $n_s h$, *Sec. 7(4)1, item3*. Therefore, according to *Sec. 2(10)1, Eqs. 2(116), 2(117),* in case of a particle $K_m \cong 1$, *Consequences 2(10)1b, c*. In a mass-body, the H hall package units may be individual or overlapped in the apex of a cone-like cavity, *Sec. 5(2)1d, part D.* Therefore, n the total number of H hall package unit, *Consequence 2(10)1b*, may be equal or less than K_m, i.e. $K_m \geq n$.

5(2)1e- Curved space-time from viewpoint of H particle-paths hypothesis

According to *Sec. 5(16)3b*, a particle moving through a normal vacuum (or vacuum quantized texture) traces a track texture on its trajectory, *Sec. 5(16)3b, part B, item XI*. In fact, based on *Sec. 7(4)2e*, the particle's track is its matterwave counterpart that expand right-handedly due to *P*-expandons, *Comment 5(2)1c1,* generation on this track *Sec. 5(16)1a, part B*. Therefore, the *P*-expandon flows on the direction of curvature of space-time constitute the gravitational field of the particle. By analogy to the case of particle, the expanding matterwave of a mass-body creates its gravitational field texture through normal vacuum, *Sec. 5(16)1b, part A,* that its combination with the particle track texture constitute the combined track texture of particle (or test mass-body). As a result, based on H particle-paths hypothesis, the particle matterwave (or track texture), and gravitational field texture geometry have similar role that space-time have in *GRT*. Moreover, more expansion rating is related to more space-time curvature (or vice versa).

Factually, the General theory of Relativity deals with the equilibrium part of gravitational interaction, i.e. after passing the first stage related to *CF* force-lines interactions, *Sec. 5(2)1a*, and *Note 5(2)1e1*. In other words, excluding the part related to Mirror Image Effect (a modified form of Newton third law), *Sec. 6(2)3*, i.e. no acting force. "The problems with this curved space-time view are several. But, the most basic of them all is that a body at rest in a gravitational field has no cause to commence motion because curvature does not induce motion unless a force acts"[482]. According to *Sec. 5(2)1b*, gravitational interactions have two parts, the interacting part and equilibrium part. Therefore, at each instant of a mass-body motion in a gravitational field, its momentum is changed in order to reach equilibrium. "A second problem with curved space-time (or curved anything), causing motion by itself is that motion is momentum, and momentum cannot be created from nothing. Therefore, the curved space-time (or curved whatever) must still apply a force; i.e., it must have momentum of its own in the form of moving parts. Creating momentum or anything from nothing requires a miracle, and postulating that the curved space-time applies a force or has moving parts defeats the value of this "pure geometry" mechanism as an explanation for gravity."[482]. According to *Sec. 5(16)3b, parts B, F2*, a particle or a mass-body preferentially moves on a track texture. Therefore, the external gravitational field texture avails this track texture in the spatial medium, *Sec. 7(4)3, part A*. At each point of this track texture, there is interaction of expandons of external field with the H particle-paths of the main mass-body that is along with contractons generation, *Sec. 5(9)3d, part c, Fig. 5(5)2*, based on Mirror Image Effect. *Comment 5(2)1b1*. "The extra bending is most easily explained as a refraction effect in the space-time or light-carrying medium *(5, 6).*This again illustrates that *curved space-time* geodesic paths do not involve any curvature of space. The contrary viewpoint in many textbooks has been a source of confusion for physics students for the last generation. For an extreme expression of this contrary viewpoint, see any relativity books by Robert Wald; e.g., *(7)*.This is an important concept. If the curved path of a body through space, *Note 5(9)3d, A1,* is not caused by a curvature of space, then clearly an external force is still required to produce and explain the deviation from straight-line motion. Moreover, some explanation other than curved space is needed to understand the equivalence-principle-like property of gravity. Fortunately, another explanation of the equivalence principle and of gravitation itself, consistent with general relativity, is available. It is based on the *Le Sage* model, in which space is filled with a flux of extremely tiny, extremely fast particles called *gravitons (8)*. The apple falls from the tree because it is struck by more gravitons from above than from below because Earth blocks some gravitons from getting through from below. And any two bodies in space shadow one another from some graviton impacts, resulting in a net push toward one another" [482]. Please refer also to *Sec. 5(16)1c, part A3*. According to this discussion, the H particle-paths hypothesis leading to a reasonable explanation of gravity based on expandons and contractons formation because of Mirror Image Effect excluding discrepancies as state above, and discussed in *Sec. 5(4)5*. Please refer also to *Sec. 5(2)1c, part c; Sec. 5(9)3d, part c, Fig. 5(5)2*, and *Note 7(4)2f, E1*.

Note 5(2)1e1- The force *CF*-lines, *Comment 5(2)1b1,* plays the analogous role as curved space-time geodesic in *GRT* from viewpoint of H particle-paths hypothesis, *Sec. 5(16)1b, part G*. According to *Comment 5(16)3b, B1*, by analogy to case of wave formation in Huygens Principle, all point on a *CF*-line can be considered as point sources of expandon generation. After a time t, the new position of wave front is the surface tangent to these secondary wavelets. The force *CF*-lines and impulsion *CI*-lines can be designed in the framework of *4*-space as in case of space-time for more simplicity of analyzing the function of expandons. Moreover, according to Huygens principle, the secondary wavelets can be viewed as expanding sub-track textures, *Sec. 5(16)3b, part B*. "Huygens[1] proposed that every point to which a luminous disturbance reaches becomes a source of a spherical wave, and the sum of these secondary waves determines the form of the wave at any subsequent time. He assumed that the secondary waves traveled only in the "forward" direction and it is not explained in the theory why this is the case" [637] *History*.

5(2)2-Mass levitation in an external gravitational field

Considering an isolated moving mass m at v speed, the inner path of H particle-paths bended respect to that of an observer at rest calibrated as straight lines according to *Delta Effect, Sec. 2(1)1b*, *Fig. 2(3).* Now we can suppose, the mass m is exerted by

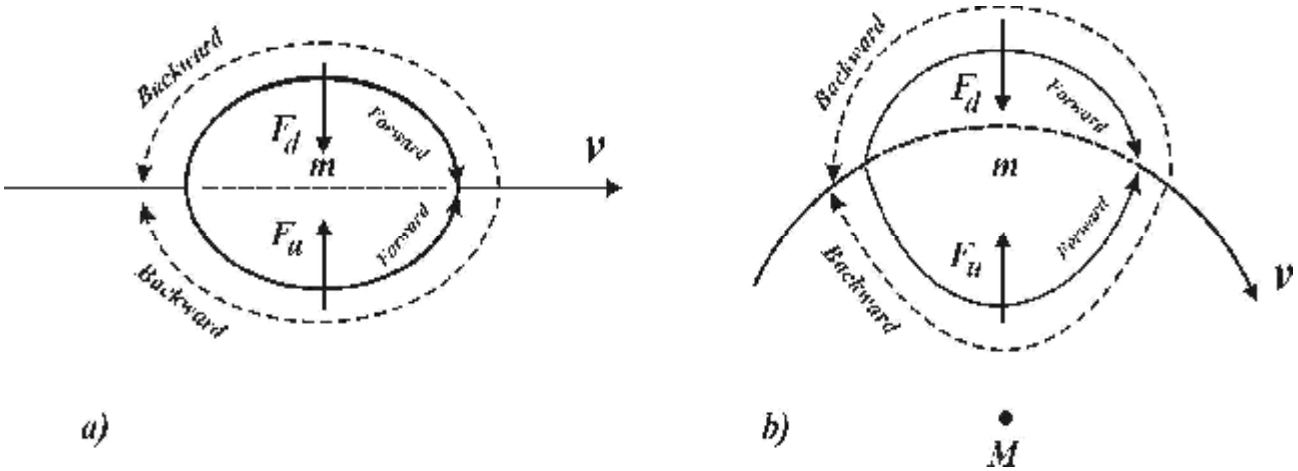
two forces induced by its right or left-handed spiral of H particle-paths *Fd* (down) and *Fu* (up), at equal magnitude, *Fig. 5(2)1a,* but at opposite directions, *Note 2(1)3a,* thus it is moving in a straight or rectilinear path. Please refer also to *Note 5(2)2a*.

$$Fd = Fu \qquad 5(12)$$

Supposing the moving mass m is in a gravitational field of mass *M* at equilibrium state *Fig. 5(2), Eq. 5(10).* Thus, at the case of a closed uniform circular motion about the mass *M* we can assume according to *Eq. 5(12),* two equal forces, the *Fd* related to the gravitational attraction of mass *M* and *Fu* related to centrifugal (repulsion) of mass m at v speed. In other words, at equilibrium state, *Eq. 5(10); i.e.* weightless state in which the gravity centripetal force must be equal to centrifugal force, *Fig. 5(2)1b.*

Gravipetal force *(Fd)* = Gravifugal force *(Fu)* 5(13)
(Directed inwards) (Directed outwards)

According to the above statement, and referring to *Fig. 5(2)1*, similarly to spatial medium, *Sec. 7(4)3, parts A, B*, that the geometry of its path-lengths is defined by gravitational field, the geometry of internal motion of H particle-paths (or path-lengths) in mass medium, *Sec. 7(4)3, part D*, is also defined by external gravitational fields.



a)- m, as an isolated H system *b)* -m, in the gravitational field of mass *M*

Fig. 5(2)1- Mass m moving at v speed (The forward and backward H particle-paths related to Delta Effect, Sec. 2(1)1b, Fig. 2(3), are shown).

At the equilibrium state a, or b of *Fig. 5(2)1*, the path-length of H particle-paths forwarding motion is equal in magnitude to that of backwarding direction, but at opposite sign. In other words, the algebraic sum of the two stated above path-lengths is zero; please refer to *Sec. 5(16)11*. Moreover, similarly to the above case, the path-length of two parts F_d, F_u, are equal in magnitude, but at opposite sign related to handedness reversal. Please refer also to *Sec. 5(9)3*, in case of mutual gravitational interaction of two orbiting mass-bodies.

The *Fig. 5(2)1b*, is an example of internal motion of H particle-paths path deformation of mass m (symmetry breaking) respect to the velocity axis comparing with its stable *Fig. 5(2)1a* configuration. "Consider a bead on a circular hoop that is rotated about a vertical diameter. As the rotational velocity is increased gradually from rest, the bead will initially stay at its initial equilibrium point at the bottom of the hoop (intuitively stable, lowest gravitational potential). At a certain critical rotational velocity, this point will become unstable and the bead will jump to one of two other newly created equilibria, equidistant from the center. Initially, the system is symmetric with respect to the diameter, yet after passing the critical velocity, the bead ends up in one of the two new equilibrium points, thus breaking the symmetry"[632] *Other examples.* In this example, "why the bead sudden departs from O goes away. From a physical point of view, the ascending of the bead on the wire ring is caused by the centrifugal tendency of the bead; but how does the bead acquires such a tendency while remaining motionless at the lowest point of the rotating rings?" [633] *part 4.2*. Based on *HPPH*, and *Fig. 5(2)1*, we can find the answer. "When we rotate the vertically suspended wire ring faster and faster, the bead would eventually depart from its symmetrical ground state and settle into an asymmetrical one" [633] *part 4.3*. Please refer also to [417], and *Simulation 8(7)2, E5a, item 9(B).*

Note 5(2)2a - Instead of two up and down forces [on the basis of counter-currency mode, *Sec. 3(1)2, Fig. 3(4)*], it is better to say two opposite handedness, i.e. left- and right-handed force-lines, that for the purpose of discussion on gravity supposed as up and down respect to the center of gravity. Thus, the mass m in case of *Eq. 5(12)* is comparable with the case *Eq. 5(13)*, i.e. the sum of exerted forces is equal to zero (weightless state).

5(2)3- Falling of a mass in the external gravitational field

Supposing, mass m is at rest respect to mass *M, M>>m*. According to *Secs. 5(1), 5(2),* the interaction of force-line *CF* of the gravitational field of mass *M* on the whole H-system m and exit of H particle-paths of the latter as impulsion *CI* is the main reason of falling of the mass m toward the mass *M Fig. 5(3)* .

In this Figure, the internal forward paths A_2, and backward A_1 of m are parallel to x -axis respectively and similarly A_5 and A_6 are parallel to *Z*- axis with the same curvature as force-lines *CF* of mass *M*. The radiuses of potential spheres of H system *M* at m location are in the direction of y-axis is equal to r.

As the impulsions (IA_1, IA_2) and (IA_5 and IA_6) path curvature are toward y - axis, thus a gravity force $\vec{F}_g$ applies in the apposite direction of y -axis, i.e. toward the gravity center *M* at the gravity center of m . The paths A_3 and A_4 parallel to *y-axis* for the reason of symmetry has no effect on gravity force $\vec{F}_g$ formation.

The inner H particle-paths of a falling mass m taking the combined shape as in, *Fig. 5(3), (x, z*-axe's plane) during its forward and backward motions.

As a result, during interaction (according to third law of Newton) of mass m in the gravitational field of mass *M*; the inner shapes, *Comment 5(16)2c, part B*, of H particle-paths mass m varies, *Comment 5(15)1a*, regarding the *Delta effect, Sec. 2(1)1b, Fig. 2(3).* It is based on equilibrium principle*, Fig. 5(2),* rather than merely the geometry of space-time, *Sec. 2(3)2b*, related to field *M*. Thus, space-time is used in order to explain the H particle-paths bending characteristic regarding Delta Effect due to constancy of the light speed, i.e. paths constancy. "In fact, there is a direct quote from Einstein, that "Space-time does not claim existence in its own right, but only as a structural quality of the (gravitational) field "[77], *Q&A, No.162.*
Considering *Fig 5(4)* the force-lines with variable potential sphere radii, r , i.e. variable number of *CF* H particle-paths of field mass *M*, interact with mass m . Moreover, according to *Fig. 5(5)* at local time intervals ΔT , *Note 5(2)3a*, due to constancy of light speed only those segments of potential spheres, which located between axis radius r and curve *C* interact with mass m.
As the result, the gravity attraction reaches its maximum at the case of two bodies at rest, i.e. $F_u = 0$ respect to each other; therefore according to the stated above discussion, the mutually attraction of mass m an *M* will decrease with increasing their relative tangential velocity.

Note 5(2)3a - The local time intervals obey the, *Sec. 10, Eq. 2(121),* i.e. by decreasing ΔT , the energy ΔE increase accordingly, or, better to say according to *Sec. 2(1)1b, Delta Effect, Fig. 2(3),* more H particle-path's path-length, *Sec. 2(1)2,* and vice versa. This phenomenon can be compared to space-time curvature concept in *GRT*; please refer to *Sec. 5(4)2, cases I & II* and *Sec. 5(16)1b, part A, Explanation of Figure 5(8).* By the difference, that in the latter we encounter with the case of frozen aspect of a static field related to a fixed gravitational source. Whereas, in the former a steady gravitational field generation on the form of expanding gravitational closed surfaces (or spheres) constituted of H particle-paths moving at c speed, *Sec. 5(4)5;* please refer to [103], part related to *Does gravitation field continuously regenerate or is frozen?".*

5(3) - Inertial mass - Gravitational mass
5(3)1- Preliminary step

The H particle–paths shape, *Note 5(3)1a,* or, in other words, the inner geometry of an H system in the presence of an external uniform gravitational field is the same as that, in an appropriate acceleration of its motion *Fig. 2(3)* in the absence of this field in a limited time interval, *Sec. 5(2)3*. Therefore it is confined to a small region of space (Equivalence, *Sec. 7(4)2e, part c*), respect to an observer at rest in a non-accelerating reference frame *Note 5(3)1b*. In other words, the field-mass interaction in the former is equivalent to mass-mass interaction of the latter due to a mutual interaction (e.g. force application, collision, *Sec.6*…etc.) with other H system masses, *Comment 5(9)1a*. Therefore, in a reference frame undergoing, uniform acceleration as above, the indistinguishably related to the path's shape of the H particle-paths occurred with that in an equivalent gravitational field inner the same H system respect to an observer at rest in a small location, if it is supposed isolated or far from other external interactions. As a result, the H particle-paths behavior of an H system can be interpreted as indistinguishable both in the presence of a uniform gravitational field and during an appropriate uniform acceleration in the absence of this field.
Moreover, it is summarized based on the action-reaction principle, *Note 5(3)1a*, of the Newton's third law, *Sec. 6(2)3*, for the both cases in a small location as following:

$$\left[\begin{array}{c}\textit{Inertial mass}\\ \textit{H particle-paths behavior + its geometrical}\\ \textit{shape during an uniform acceleration}\end{array}\right] = \left[\begin{array}{c}\textit{Gravitational mass}\\ \textit{H particle-paths behavior + its geometrical}\\ \textit{shape in an uniform gravitational field}\end{array}\right] \quad \textit{Sec. 5(3)2,} \qquad 5(14)$$

"The general theory of relativity owes its existence in the first place to the empirical fact of the numerical equality of the inertial and gravitational mass of bodies" [469].
In fact, the virtual gravitational field, *Consequence 2(8)3a*, that has for its equivalence the accelerating reference frame disappears when transferring to the appropriate reference frame. In contrary the real gravitational field based on the reversible H particle-paths moving in counter-currency mode of motion at c speed, can not be disappear with any choice of reference frame. Moreover, the latter is vanished at infinity in contrary to the former one that is constant until infinity. Please refer to *Sec. 5(16)1b, Fig. 5(8).*
In fact, the total potential energy of a field around the particle (e.g. gravitational) is equal to the energy of the total number of H particle-paths of that particle at its surrounding field state. Moreover, as the field is expanded form of its related matter, *Note 2(1)3b,* the total potential energy related to the field must be considered in the total energy of matter at rest state, i.e. total number

of reversible H particle-paths in the matter state. In other words, the total energy of a body or particle is equal to the sum of the total energy of the matter and its fields, i.e. the sum of their related H particle-paths energies at the two states; please refer also to *Sec. 4(6)3.*

Finally, according to interactions such as acting force, collision, *Sec. 6,* mass has dual characteristic, *Note 2(6)1a,* inertial and gravitational, *Eq. 5(14),* that has an unique source, i.e. two different aspects of H particle-paths behavior during an interaction *Sec. 5(16)2c, part c*. The inertial aspect of the mass is along with reversible path-length, *Sec. 2(1)2*, in a single medium, e.g. mass medium; while, its gravitational one is accompanied by irreversible path-length, *Sec. 2(4)4*, in two different media, e.g. spatial, and mass media, Sec. 7(4)3. Therefore, according to *Sec. 7(4)2f, part D*, the indistinguishability of two different aspect of mass (or equivalence) is violated; please refer also to *Sec. 6(2)2* in this regards.

Note 5(3)1a - Generally all of the entering H particle-paths (or force *CF* field – lines) are along *CF* paths. Similarly, all of the impulsions *I* leave the H-system m in a tangential *CI* impulsion-lines or paths. Therefore, we cannot separate the force or impulsion from its line or path, or, in the other words, we encountered with force -path *(CF*) and impulsion-path (*CI)*, in this respect all their path lengths may be the same as that of photons, i.e. equal to h and path-limit Γ, E_q. *1(3).* Moreover, according to *Sec. 5(4), Eqs. 5(15)* to *5(18),* to each point of curved force-path *(CF),* is related an equivalent force, or, in other words the geometry of geodesic space-time, *Sec. 2(3)2b*, (or path-length) of H particle-paths lines is equivalent to the applied force. Generally, the H particle-path may be compared with expected graviton (or its contractons equivalent, *Sec. 5(2)1c, part c*) that is predicted by physicists i.e. zero rest mass and spin 2 units as carrier of the gravitational forces propagating through space-time, that is presents in all physical interactions; please refer to *Sec. 5(16)1c, part A3.* In fact, each force-line (or impulsion-line) is consequence of interaction of field H particle-paths moving at c speed according to a counter-currency mode, *Sec. 3(1)2,* with that of interacted mass; please refer to *Sec. 5(16)1, Fig. 5(8),* and its explanation. Moreover, the exit of H particle-paths in the form of impulsion-lines (or better to say along its contractons front-line) during an interaction of mass body in an external gravitational field that leading to its acceleration can be simulated as gravitational radiation in *GRT*.

Note 5(3)1b - In fact, we must consider the similarity of the shape variation instead of merely shape of H particle-paths, in high speed; but this shape variation is regarded as shape only, to take into account the reliability of equivalence at zero initial speed or low speed.

5(3)2 – An interpretation of identity of inertial and gravitational masses based on H particle-paths hypothesis

"General Relativity is based on the Equivalence Principle: All bodies fall in a gravitational field with the same acceleration regardless of their mass or internal structure. Einstein realized that, a uniform gravitational field is the same as an accelerated reference frame."[467]. "Within the framework of Newtonian gravity, the equivalence principle is a complete mystery"[52]. The equality, *Eq. 5(14),* states that mass as inertial or gravitational has a unique base "H particle-paths" please refer to *Sec. 2(4), last paragraph*. In fact, inertial mass related to mass-mass interaction (contracted form of the field) and gravitational mass related to mass-field interaction of H particle-paths. As a result, the force applied to a mass-body at rest respect to an observer at rest can be considered as a deviation degree of its H particle-paths from initial reversibility, *Sec. 1(3),* during force application. On the other hand, the attractive force applied to a mass-body at rest by a gravitational field can also be regarded as deviation degree of its H particle-paths from initial reversibility. This deviation degree will be defined by α, *Sec. 2(1)1a, Eq. 2(7).*

The internal shape of H particle-paths of an object at rest respect to an observer, *Sec. 2(1)1a, Fig. 2(1),* can be supposed in the form of forwarding and backwarding H particle-paths as indistinguishable straight-lines moving at c speed. Now, referring to *Sec. 4(3)1, part B, Fig. 4(4),* the co-direction H particle-paths (i.e. moving in the motion direction are contracted, whereas the H particle-paths in counter-direction are dilate; please refer also to *Fig. 5(2)1a* of *Sec. 5(2)2*. Now, supposing the electron instead of uniform motion is accelerated linearly in the motion direction. Thus, the co- and counter-direction H particle-paths contracted and dilated proportional to electron's velocity at each instant respectively. In a gravitational field, according to equality of inertial and gravitational masses, the H particle-paths of electron dilated and contracted of identical shapes and form at the same speed as in first case.

As a result, there are no difference of H particle-paths shape and configuration of a mass-body accelerating by an external effect without the gravitational field with that of the case of mass-body in a gravitational field at an equal acceleration of the previous case, *Sec. 6(2)2*. Please refer also to *Sec. 7(5)2b*, *part II*. Factually, if mass-mass interaction by an external effect is based on Newton's third law, the mass-field interaction also must be obeyed from this law as in *Sec. 5(2)1a, Fig. 5(1).* According to *Sec. 5(2)1d*, a correlation through interchanging of H particle-paths of both electron and mass-body is established between the gravitational domes, *Sec. 5(2)1a*, of electron and mass-body; please refer also to *Sec. 5(9)3d, part c*.

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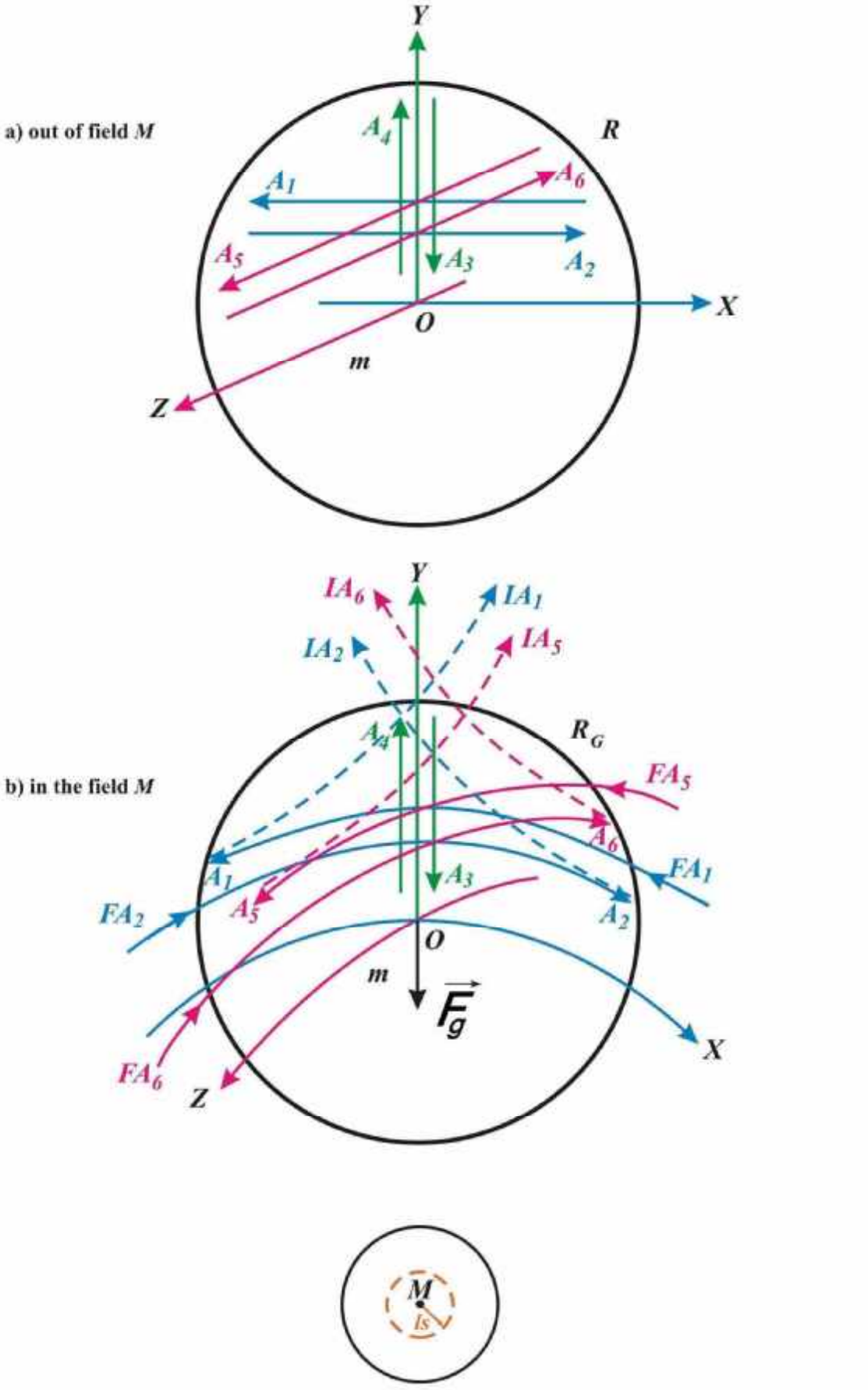

Fig 5(3) - schema of curvature of reversible internal motion particle-paths H - system *m* along curved *x* and *z* axes in the gravitational field of *M* ; I_s is the Schwartzschlid radius

5(4) - Expanding spheres (or closed surfaces)
5(4)1- General aspect

In view point of H particle-path behavior, falling of a mass m on the mass M (e.g. the Earth) is accomplished as follow:
1) the field (expanded form of mass) and mass (the compacted form of the field), *Sec. 2(1)3, Note 2(1)3b,* interaction of two objects take place by entrance force-lines that is accompanied by exit impulsion-lines of the H particle-paths of theirs, *Sec. 5(1), Fig. 5(1),* and *Note 5(4)1a.*
2) Mass-mass interaction of the two objects that is performed by entrance of collision force-lines that are accompanied by exit of H particle-paths impulsion-line of theirs, *Sec. 6(2), Fig. 6(1).*

According to the above statements, we encountered with concentric expanding spheres, *Note 5(16)1a2,* as gravitational field rather than static equipotential, *Note 5(4)1b,* concentric spheres; please refer also to *Secs. 5(1), 5(2); Sec. 4(6)1, Figs. 4(11) - 4(13)*. Moreover, the H particle-paths rotate on the surface of spheres, *Fig. 5(8),* according to counter-currency mode of posipa and negapa motions, *Sec. 3(1)2*. Moreover, the exit of each gravitational sphere (expansion) is accompanied by contraction of an internal gravitational sphere (in-flow) according to Newton's third law at inverse equal momentum, *Sec. 6(2),* toward the center of mass (event zone, *Sec. 5(16)2a*). Also, this process continues successively to supply the momentum of next gravitational sphere accompanied by Schwarzschild radius diminution, *Sec. 5(16)2a, Eq. 5(67)15a.,* i.e. radially pulsing,; factually, the total momentum of a gravitational sphere and related mass are zero separately contrary to single direction interaction that we encountered with momentum increasing during such a process.

The H particle-paths equivalent number in an expanding spheres, n_G, *Eq. 5(1),* is independent of the related atomic, molecular structure, and specific gravity .This number, n_G, is proportional to the total number, n_o, of the H particle-paths of the related mass, m, in a back and forth motions; for more information please refer to *Secs. 5(16)1*, *5(16)5.*
A gravitational closed surface (or sphere) regarding, *Sec. 5(16)1, part A,Fig. 5(8),* during its expansion obeys, *Sec. 2(10), Eq. 2(116) - 2(118),* considering time's arrow and space expansion, *Sec. 5(16)7a,* at an irreversible phenomenon.

Note 5(4)1a -In fact an electromagnetic (field in a vacuum) or a gravitational field may be regarded as a mechanical system (e.g. H system) it posses Lagrangian function, action, and so on, similar to mass body. Thus, the assumptions of distant interaction, *Sec. 5(4)5*, in case of gravitational laws of Newton, or, merely space-time curvature equality with stress-energy tensors in case of general relativity have a metaphysical and sophistical conception in this respect.

Note 5(4)1b - In fact, the total potential energy of a field around the particle, e.g. gravitational, is equal to the energy of the total number of H particle-paths of the particle at its field state. Moreover, as the field is expanded form of the related matter, *Note 2(1)3b*, the total energy of a body or particles are equal to the sum of the total energy of the matter and its fields, i.e. sum of their related H particle-paths at the two above states.

5(4)2- H particle-paths motion on gravitational sphere

According to *Sec. 2(1), Eq. 2(76), Fig. 2(3),* the total path-length, *Sec. 2(1)1b*, related to n_G , *Sec. 5(1), Eq. 5(1); Sec. 5(16)1, Eq. 5(55),* H particle-paths on each of the gravitational sphere geodesic remain unchanged, *Sec. 5(7)1,* in limited time interval. In other words, the total paths of H particle-paths on gravitational spheres are independent of their curvature (sphere radius); please refer to *Sec. 5(16)1b, part A*. Moreover, according to *Eq. 2(15)* the speed of H particle-paths on each sphere's geodesic is equal to c with its own time interval, $\delta t'$, and length, $\delta l'$. Considering the Frenet-Serret equations [34] for unit speed space curves and extend it, *Note 5(4)2a*, for c speed ones; thus:

$T'=KN$, recall that we have $K>0$, i.e. positive curvature. 5(15)

$N' = (-KT + \tau B)$ 5(16)

$B' = -\tau N$ 5(17)

Where:
1) T, N, B are mutually perpendicular unit vectors arise at each points as following:
The velocity vector *T*, i.e. tangent vector of the geodesic, is perpendicular to the acceleration vector *T'* which is proportional to gravitational attraction. Thus, if we take their cross product, we get a vector, *B, i.e.* bi-normal vector, perpendicular to both; we have only three space dimensions and so the derivative of the new vector *B'* must be expressible in terms of the others. In this way, three mutually perpendicular unit vectors *{T, N, B}* arise at each point on the gravitational surface:

$$\vec{B} = \vec{T} \times \vec{N} \qquad 5(18)$$

Here, *N* is principal normal vector.
Supposing a geodesic (circular at the case of sphere), *Fig. 4(13),* perpendicular to the stated above geodesic with its related velocity vector *T*; thus, vector *N* will be normal at the sphere surface at the point of intersection of these two geodesics.
2) K, τ are the curvature of geodesic circle (or curve) on the sphere surface (or closed surface) and the related surface torsion respectively.

As a result, the gravitational expanding spheres, or, in the general concept; the closed gravitational expanding surfaces can be compared with the space-time geometry or curvature in the general theory of relativity. Moreover, the paths closed curve of H particle-paths that moving on the on the geodesic of sphere at $T= c$ tangential speed can be assumed under an appropriate acceleration vector *T',* (at the same direction as *N*). Thus, according to *Sec. 5(2), Fig. 5(1)*, to each curved force-paths related to c speed, we can attributed an equivalent acceleration *T'* (momentum or force equivalent) that can interacted with H particle-paths of external mass-bodies.

The frequency of emission of expanding gravitational spheres of an isolated mass-body, *M* is obtained according to *Eq. 5(53).*Thus, the frequency Δn , remains unchanged respect to the observer *O'* at the location of measurement, i.e. independent of expanding sphere radius, r.

Now, supposing mass M is moving at v speed, as the H particle-paths on the gravitational closed surface moving at c speed, the following cases arise as follows,

Note 5(4)2b, Fig. 5(8):

I) Microstructure state- The H particle-paths moving according to counter-currency mode in a combination of the two configurations states as in *Figs. 3(4),3(5) a,b.*

II) Macrostructure state, (i.e. case that is investigated in the general theory of relativity) - As H particle-paths on the closed surfaces moving at $T = C$ speed. Therefore, the geodesics of the closed surface (that are in the same plane as tangential speed direction vector) contract according to *Delta Effect*, *Sec. 2(1)1b, Fig. 2(3),* in the speed direction of the moving mass-body. Now, instead of sphere, we have an ellipsoid so that all geodesics of which through speed vector axis are ellipses.

As the result, according to *Sec. 5(2), Figs. 5(1), 5(2),* a combination of H particle-paths shape, based on their combined geodesics from viewpoint of n_G H particle-paths on gravitational surface of mass *M* related to the two above states *I, II* can be curved. Moreover, a combined interaction of H particle-paths of mass *M* field as force-lines on te basis of, *Mirror Image Effect, Sec. 6(2)3*, takes place during its interaction with that of mass m body and vice versa. In other words, each gravitational sphere individually has its own time-space metric or coordinates on its surface, *Fig. 5(4).*

Supposing now, the center gravity of the mass *M* instead of moving at constant speed v, moving rectilinear at accelerating mode or on a curved paths at an accelerated motion, *Eq. 5(15) to 5(17)*, we can divided the path of motion into little portions at a constant rectilinear speed according to the cases of *Fig. 2(3).* Thus, regarding the cases, *I, II*, the shape of the geodesics of gravitational closed surfaces vary accordingly based on speed vector.

Generally, an expanding sphere is the surface of constant action, *Sec. 2(4)* that displaced in space orthogonal to the radial direction of expansion. In other words, action varies at the expense of inner path-length in the favor of the external or common one, i.e. time contraction, or dilation, *Sec. 2(1)1, Eq. 2(15); Sec. 2(1)1b, Delta Effect, Fig. 2(3).*

Remarkably, comparing the H particle-paths moving on gravitational sphere or closed surface, *Sec. 5(4),* in a counter-currency mode of motion, *Sec. 5(16)1b, part A,* and H particle-paths singlet, i.e. posipa or negapa, moving on potential closed surfaces in electromagnetism, *Sec.4(6),* through a single direction mode of motion. Thus, the stated above result is also valid for electromagnetic field by analogy with the gravitational field; please refer also to *Sec. 5(16)1d.*

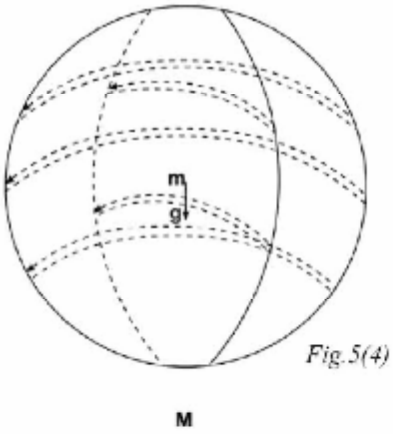

Fig.5(4)

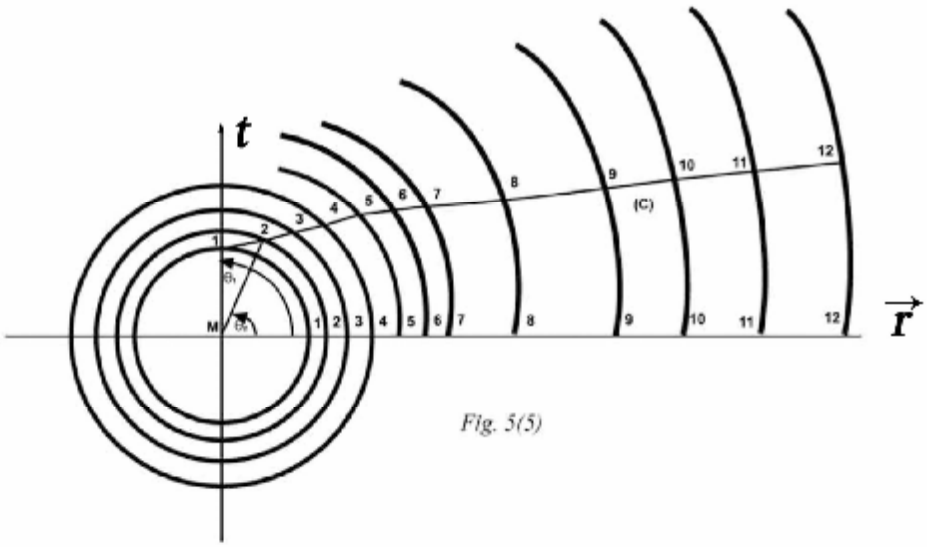

Fig. 5(5)

Note 5(4)2a - For the reason of simplicity, we take unit of speed $\vec{T} = c = \vec{i}$ ($\vec{i}$ is unit vector) in *Eqs. 5(15)* to *5(17)*; otherwise, the right side of equalities *5(15)* to *5(17)* must be multiplied by c.

Note 5(4)2b - Remarkably, H particle-paths moving on gravitational spheres or closed surfaces can be regarded as gravitational potential; and the gravitational closed surfaces can be considered as gravitational potential closed surfaces accordingly. Similarly, in case of the electric field of an isolated point charge q in the reference frame in which it is stationary, the H particle-paths singlet, *Sec. 1(14),* (i.e. Posipa or negapa according to the charge sign) moving on potential surface can be regarded as scalar potential; please refer to *Secs. 4(6)3, 8(1)3.*

5(4)3-Aether drag [90, 186]

To each single direction H particle-path one can attribute an equivalent mass h / c^2, of reversible H particle-paths, *Sec. 2(2)2*. Thus, at each point on gravitational field there will be a mass density equivalent (H particle-paths population) with its maximum density on the surface of the mass-body. Moreover, according to *Sec. 5(4)4*, there is a fully reversible H particle-path counterparts of the external gravitational field in mass m (taken as transparent medium respect to this external field) along with halo of dark matter, *Sec. 5(1)2*, that surrounding the mass m nominated field counterpart, *Remark 5(4)3a*. This field counterpart (or fraction) can be viewed as a non-separable aether drag, *Sec. 5(4)4*, related to mass m. The concept of Aether drift in 19th century may be appropriate to the stated above assumption of H particle-paths behavior (along with quantized H hall quantized packages, *Sec.*

5(16)3a), on a mass body. During moving of a mass body this H particle-paths fraction entrained by the former during an interaction that can be compared with Aether entrainment; therefore the absolute motion of a mass body, *Sec. 2(6)2f,* can be replaced by the relative motion of the latter in gravitational H particle-paths medium of an enormous mass body H system. Each mass body is the sink of H particle-paths of the other one that leads to mutual gravitational attracting of their, *Sec. 5(9)3*. The reversible H particle-paths of the field counterpart of the latter in the former body is dragged as in *Fresnel aether drag* [194, 196], *Sec. 5(4)4,* based on null result of Arago's experiment [195, 196]; Arago though that refraction of light ray by a prism depended on the velocity of the prism [196]*;* please refer also to *Secs. 5(1), 5(2).*
Remarkably according to [186] aether drag defined as "An explanation of the null result of the Michelson interferometer which supposed that the Earth dragged aether along with it as it moved".

Remark 5(4)3a- "There really is an aether, in which electromagnetic waves travel, but it is not the all compassing, uniform aether proposed by Maxwell. Instead, it corresponds to gravitational field that all celestial bodies carry about with them. Close to the surface (of sun, planet, or star) the field, or aether, is relatively more dense. As you move out in space, it becomes more attenuated. I believe that all the facts that seem to require special or general relativity can be more simply explained by assuming an aether that corresponds to the local gravitational field. Michelson found no aether wind or fringe shift. Because of course, the Earth's gravitational field moves forward with the Earth. As for the bending of starlight near the Sun, it is easily explained given a non-uniform light medium. "The wave fronts do change direction when they enter a denser medium" [435]. The aether discussed as above correspond both to vacuum quantized texture, *Sec. 5(16)3b, part A*, as in the case field counterpart. Please refer also to *Sec. 5(16)2c*, in case of gravitation refraction.

5(4)4- H particle-paths of a field in a moving medium (Fresnel drag)

Supposing ρ_0, is the density of an external field counterpart single direction (e.g. electromagnetical or gravitational) H particle-paths population density in the vacuum medium, *Secs. 5(4)6*, *5(16)3;* thus, the related energy density in vacuum, *Sec. 2(2)2,* will be:

$$E_0 = \rho_0 c^2 \qquad 5(18)1$$

A medium of refractive index η means that H particle-paths of the external field counterpart instead of moving at c speed in a single direction manner it moves at a combination of single direction and reversible motion, *Sec. 1(1),* one at apparent external common speed V (group velocity) in the transparent matter moving at v speed. However, according to the principle that true speed and total energy of H particle-paths does not drop; thus, it's external energy, *Sec. 2(2),* in transparent medium, i.e. $E_{ex} = E_m$, according to *Eq. 2(41),* must be equal to that of vacuum, i.e. $E_{ex} = E_0$, without internal motion. In other words, the kinetic energy of the field in vacuum medium is equal to that of transparent medium due to length contraction. Therefore:

$$E_{ex} = E_0 = E_m = \rho_0 c^2 = \rho_m V^2, \qquad P_m = mV = \text{momentum}$$

Where, ρ_m, is apparent combined density of external field counterpart H particle-paths in the medium, as if we are encountered with a virtual mass-body at V speed, and moving mass, *Eq. 2(32),* density ρ_m (equivalent to energy E_m), and rest mass density, ρ_r:

$$\rho_m = \frac{\rho_r}{\sqrt{1 - v_{cm}^2 / c^2}} \qquad 5(18)2$$

Please refer to *Sec. 2(6)5b*; *Sec. 2(10)3*.
Moreover, considering, *Eq. 5(18)2,* according to length contraction and density definition the total number of H particle-paths in related volume doesn't change during this length contraction.
On the other hand:

$$\delta\rho = \rho_m - \rho_0 = \left(\eta^2 - 1\right)\rho_0 = \left(1 - \eta^{-2}\right)\rho_m = f\,\rho_m \qquad 5(18)3$$

Where,

η - *Eq. 5(18)6,* the refractive index coefficient that is equal to *c/v* ratio, *Eq. 5(18)6.*

f- Fresnel drags coefficient [185], part related to *The Fresnel coefficient.*

$\delta\rho$ - the hidden fraction of density related to H particle-paths of the external field in the medium, that is supposed in a purely reversible motion related to internal energy, E_{in}, *Sec. 2(2)1, Eq. 2(41).* It is in direct relation with that of the entered external field (beam), and moving at v_{cm} speed. In other words, the H system m (a combination of internal H particle-paths of the field with that of the matter) can be regarded as field traveling in the medium at a group velocity V, *Comment 5(4)4a.*

Now supposing instead of external field a light beam entered in the transparent medium; thus, the similar case as above will be occurred. Factually, index of refraction, η as a character of a transparent matter, is the extent at which that matter can affects on the single direction H particle-paths of an external field toward a reversible motion.
When the matter wave moves at v speed the center of mass of $\delta\rho$ move at v_{cm} speed as following [109] *Part16-2*:

$$v_{cm} = \left(1 - \eta^2\right)v = fv \qquad 5(18)4$$

That is equal to the difference, ΔV of the light speed in moving transparent medium respect to the light speed in that medium at rest, that is a fraction of the transparent medium velocity with Fresnel coefficient, i.e. fv. Thus:

$$\Delta V = v_{cm} = V - c/\eta \qquad 5(18)5$$

That is based on the Lorentz transformation of relativistic velocity addition rule.

Factually, Fresnel drag is a direct result of reversible motion of H particle-paths of single direction external field or light beam during their multiple reflection by H particle-paths of a freely moving of a not bounded medium such as a bulk of gas molecules in a double way. In other means, a round trip, gas mode Michelson interferometer, gravitational field, *Sec. 5(16)2c*. Thus, in the cases of chemically bounded such as solid medium [105] this effect is compensated completely through *Mirror Image Effect, Sec. 6(2)3,* (based on Newton third law) of macroscopic mass body due to backward motion respect to preferred reference frame, *Secs. 2(6)2b, f, 2(5);* refer also to *Note 2(1)4a*, last paragraph. In an one-way non interferometer method, e.g., De Witte solid coaxial cable [601], we have positive result, i.e. the time interval in a forward or backward motion through path-limit Γ, *Note 2(6)2,* respect to a preferred reference frame. In other words, a path-length analogous to co-direction or counter-direction motions as in Sagnac Effect, *Sec. 2(6)4*; moreover the H particle-paths of the related H system bend according to *Sec. 2(1)1b*, *Fig. 2(3)*, i.e. Delta Effect, as in case of moving electron structure, *Fig. 4(4),* that is extended in a Γ range.

Finally, the drag coefficient of Fresnel was confirmed by the Fizeau experiment, *Sec. 2(6)3.*

Comment 5(4)4a - Remarkably, when an external field of density ρ_0, at vacuum, (e.g., electromagnetic waves, light) is moving in transparent medium. It can be regarded as a combined single direction and reversible mode of motion at density, ρ_m of its H particle-paths through that medium. Therefore, that part of its H particle-paths assumed at purely reversible motion, *Sec. 2(10), Comment 2(10)1b*, (i.e. hidden mass density, $\delta\rho$, related to fraction counterpart) can be assumed as dragged counterpart. This fraction counterpart can be visualized as a substitution of Aether dragged, *Sec. 5(4)3,* moving along with moving transparent medium. Moreover, the extent of its contribution respect to the moving part, ρ_m in transparent medium is equal to the fraction, f, *the Fresnel Coefficient*. Therefore, in case of a moving transparent medium this fraction is appeared through the entrance of the external field, e.g., light, as if, the latter pick up some fraction f, of the velocity of the transparent medium. In fact, the moving transparent medium at rest state can be considered as H particle-paths moving at fully reversible motion. Thus, during the motion of transparent medium this degree of reversibility is reduced by a fraction of f. In other words, the light speed v in transparent medium increment by ΔV, *Eq. 5(18)5*, due to this loss of reversibility. Since there is strictly no separation between the transparent medium and the fraction counterpart; please refer to [185] part related to *stellar aberration.* Similar result may be considered by taking into account the single direction H particle-paths of external gravitational field of a mass M through another mass m as transparent medium for H particle-paths of gravitational field of mass M; please refer to *Sec. 5(16)2a, Sec. 5(16)2c.* According to [187], "Fresnel supposed that the aether passes through a body, and that it is denser inside the body than outside. According to Fresnel ρ_0 is the density of an aether in vacuum and ρ_m is its density in the body so:

$$\frac{c}{V} = \sqrt{\frac{\rho_m}{\rho_0}} = \eta \qquad 5(18)6$$

Where, c, V, are speed of light in vacuum and transparent medium". In fact, according to *Eq. 5(18)6,* and above statement, the fraction counterpart density, $\delta\rho = \rho_m - \rho_0$ can be considered in this respect regardless of ρ_m, ρ_0 individually. On the other hand, one material can have different light refraction indexes, for different light wavelengths. According to all above statements the fraction counterpart is depended strictly on both the transparent matter and entered external field. Remarkably, by the above assumptions aether drag can be replaced by fraction counterpart hypothesis in the favor of *SRT*.

5(4)5- Some results due to expanding spheres and H particle-paths behavior in vacuum space

According to H particle-paths hypothesis by assumption of expanding gravitational surface along with its other aspects, we conclude that:

I) - No spooky action at a distance [219, 220, 360], (contrary to Newton's gravitational law).

II) - No need to existence of an intermediary medium with its unknown texture, e.g., Aether, *Sec. 5(16)3a,* Factually, the particles and mass-bodies move in a vacuum medium texture, i.e. through a track texture, *Sec. 5(16)3, part B*. Therefore, the normal vacuum is no longer considered as a point medium, *Secs. 5(16)3c, d*. According to [222], *part 2.1,* "Without the concept of an aether special relativity only describe but not explain why electric and magnetic fields oscillate in propagating waves". "Even within the framework of general relativity electromagnetic wave do not propagate through luminoferous aether" [292}, *part 2.2*; please refer to *Sec. 4(4); Sec. 5(16)3f.*

III) - Continuously gravitational field regeneration as an alternative to the criticized curved space-time concept in *GRT,* in case of frozen aspect of a static field related to a fixed gravitation source[103], *Remark 5(4)5.*

IV) - Local actions due to H particle-paths or gravitational sphere that propagate progressively, i.e. expand across space through the vacuum.

V) - No mass increase in a free fall, *Sec. 5(2)1.*

VI) - The process of expanding spheres linked with generation of space and time, *Sec. 5(16)3a,* i.e. H hall quantized package concept. Thus, it has an arrow of time, *Sec. 5(16)7a,* that is accompanied by mass conversion to energy or better to say, "Mass (contracted form of H particle-paths) conversion to that of gravitational field". This led to the source of dark energy on the expense of cold dark matter, *Sec. 5(1)2*, and normal matter in an accelerating Universe, *Sec. 5(15)2b*.

VII) - The mass lost in the form of expanding gravitational sphere, (or *CI* impulsion-line, *Sec. 5(2)1a*) via counter-current H particle-paths; please refer also to *Sec. 5(16)1b, part B*.

VIII) –According to *Sec. 5(2)1a*, the following bodies near to the Earth fall straight downward through the gravitational dome formation in the former contrary to *GRT, Sec. 5(2)1a, Comment 5(2)1a1*.

IX) – The time coordinate in an inertial reference frame is background time due to expansion of vacuum space far enough from gravitational field; please refer to *Sec. 5(16)1c, part c*.

X) – The proper distance, *Sec. 2(1)1a*, between two points during accelerating space expansion in a Minkowskian reference frame must be considered as an improvement in *SRT, Sec. 5(16)3e*. Moreover, specifying the time's arrow as fourth dimension in an inertial frame according to *SRT*; due to hypothetical exclusion of gravitational field from the mass in order to regarded it as inertial, we must considering mainly the background time's arrow, *Sec. 5(16)1c part c* due to space expansion , i.e. a time dimension improvement in *SRT*. Please refer also to *Sec. 5(16)7c*.

XI) – According to *Sec. 5(2)1,* entrance of *CF* force-lines are accompanied by exit of related *CI* impulsion-line that is based on Mirror Image effect, *Sec. 6(2)3,* (based on Newton third law); whereas, *GRT* is on the basis of space-time curvature, or, in other word, there is no force similar to that of Newton gravity. Evidently, there are no impulsion-lines accordingly.

XII) Some incompability that rose based on *SRT* and *GRT* are listed as following:

A) According to [269], "Hobill and his co-worker interest in the non-linear aspect of general relativity occasionally obtained unexpected result when trying to solve simplified forms of Einstein's equations numerically using a super computer. Moreover, Choptuik says, the system's non-linear behavior has some of the features of chaos".

B) Alternative to *GR* are highly constrained by tests in the solar system and in binary pulsars; however, if we are contemplating the space of all conceivable alternatives rather than examining one specific proposal, we are free to imagine theories which deviate on cosmological scales while being indistinguishable from *GR* in small stellar systems"[273], *part 2.3.* Please refer also to *Note 5(4)5a,* and *Comment 5(15)2a1*.

C) According to [324] *abstract*, "The cosmic censorship hypothesis is still one of most important open question in classical general relativity, it is intrinsically a quantum gravity phenomenon and violated within purely classical framework of general relativity. We prove that quantum effects restore the validity of the conjecture".

D) None of the theories based on quantum mechanics, e.g., spontaneous localization decoherence, *Sec. 8(7)1d*, is Lorentz invariant. “The intrinsic non locality of quantum theory presents formidable difficulties for the development of a Lorentz invariant formulation that avoids the vagueness”[355]. Please refer also to *Secs. 8(4), 8(7)4*. Moreover, “Theories of quantum gravity based on assumptions that general relativity theory fails to hold for infinitesimal volumes” [434] *part 4c, infinite time.*

XIII) – There are some differences between electromagnetism and gravity in respect of other accepted theories, *Sec. 5(16)1d*.

XIV) – “It is not clear how to determine the gravitational field of a particle, if under the Heisenberg uncertainty principle of quantum mechanics its location and velocity cannot be known with certainty” [425] *the incompability*. The H hall package, *Sec. 5(16)3a*, of a particle can solves the inconsistency problem in this regards from viewpoint of H particle-paths hypothesis.

XV)- Einstein introduce spontaneity and superluminality in an hidden fashion in its *GRT*. In other means, if a mass-body is moving at slightly lower than light speed from point A to B in spatial medium, according to *GRT*, the space-time is curved from A (or B) up to infinity at superluminal speed.

XVI)- The time dilation in a satellite moving around the Earth and prove by experiments; while according the *SRT* the time on the Earth must be dilated respect to satellite the same extent that latter respect to the Earth. There is no time dilation of the former case. According to *HPPH*, this paradoxical enigma is solved by introducing the *CMPRF* concept in the system of Earth-satellite. Scientists at CERN, the world’s largest physics lab, announced a startling finding yesterday that would be enough to make Albert Einstein roll over in his grave: Subatomic particles, called neutrinos, have been found to be traveling faster than the speed of light. If true, this development would break a fundamental pillar of physics. Einstein’s special theory of relativity has always told us nothing is supposed to move faster than the speed of light” [626]. Post science writer Joel Achenbach says that he’s sticking with Einstein, at least for now, because: Einstein’s theory... isn’t based primarily on measurements. Einstein’s theory emerged from thought experiments. It was a deep insight into the nature of the universe. Subsequent experiments for more than a century have verified that he was right”[626].

XVII)- “General relativity is time symmetric. It does not know about the second law of thermodynamics, and it does not know about which way cause and effect go” [611]. The *HPPH* deals with two kinds of path-lengths, type R_e of expanding and type L_c of contracting characteristics of equal magnitude and opposite signs, *Sec. 2(4)4a,* relating to entropy and negentropy, *Sec. 5(16)9d,* and *Sec. 5(16)11*, respectively.

XVIII) In case of particles entanglement, *Sec. 8(7),* the spooky action at a distance similarly to Newton gravity action at a distance exists. In Einstein’s *GRT* the action at a distance also exist in a different manner, i.e. a mass-body curved the space-time spontaneously. If this mass moves to another place, i.e. place *A* to *B* this curved space-time spontaneously taken place for *B* location. The entanglement or correlation of particles is confirmed by Aspect experiment. While, a photon pair emitted by a source is traveling in vacuum medium at c speed, the measurement of spin of photon of the pair by a measuring device, e.g. its spin up, has an instantaneous effect on the spin of other photon pair e.g. spin down. Therefore, an interaction is transferred at super-luminal speed. According to H particle-paths hypothesis in site Hparticle.com/, the correlation is down by contracton releasing, a particle that can be traveled spontaneously within abstract vacuum of a tunnel (an alternate to wormhole) that link the photon pair. As the result, there is two ways of signal transfer:

1) In spatial medium at maximum speed c .

2) Within abstract vacuum of a tunnel (alternate to wormhole) in spatial medium instantaneously, i.e. the famous spooky action at a distance.

3) In case of gravitational interaction the same scenario as in case *2* is taken place via contracton transfer within the abstract vacuum tunnel.
XIX)- SRT is challenged by experiment down in *CERN* concerning faster than the light speed of neutrinos, ***Sec. 7(4)4***.
XX)- GRT cannot provide an exact description of any rotating object; please refer to *Sec. 5(16)1b, part A, item 32*.

Note 5(4)5a- "Some theorists think that dark energy and cosmic acceleration are a failure of general relativity on very large scales, larger than super clusters. It is a tremendous extrapolation to think that our law of gravity, which works so well in the solar system, should work without correction on the scale of the Universe"[489] *alternative ideas*. "There is no way to even define relative speed in a curved space-time. Relative speed and velocity can only meaningfully defined in flat space-time or in sufficiently small (infinitesimal) regions of curved space-time"[489] *implications for the fate of the Universe*.

Remark 5(4)5a – "General relativity gives no theoretical cause for gravity. There is no explanation of why space is curved by mass, or, a derivation of the propagation speed of space-time curvature (postulated as c), or, a derivation of why objects follow the shortest geodesic without any external force". "*GR* can't tell you why it works it is still empirical". "No one has succeeded in unifying gravity with other force yet" [407]. Moreover, space-time must be regarded quantized, *Sec. 2(3)2b, Remark 2(3)2b1*.