

## The three bodies problem in the general theory of relativity

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### Summary

In this study is proved :

IA) The movement of two bodies of a mass  $M_A, M_B$ , being moved under the influence of their mutual field of gravity, is expressed by the Exterior solution of Schwarzschild (1) through the equivalent mass  $m$  of the classic Mechanics and in accordance with the Principles of the Physic maintenance : of the Energy, and of the momentum (angular or not)

$$g_{11} dx^2 + r^2 d\theta^2 - g_{44} c^2 dt^2 = -c^2 d\tau^2 \quad (1)$$

$$g_{44} = \frac{i}{g_{11}} = 1 - \frac{2GM}{c^2 r} - \frac{GM}{c^2 \alpha^2} r^2$$

$$M = M_A + M_B, \quad m = \frac{M_A (M - M_A)}{M} = \frac{M_A M_B}{M} \quad (1a)$$

Where :  $t$  = the movement time (forth dimension)

$\tau$  = absolute time (scalar quantity)

$\alpha$  = Universal constant =  $2,3 \cdot 10^{24} \text{cm.}$

Especially, the (1) gives :

1) The force (2) of the gravity field, between the masses of

$$\frac{dD^1}{dr} = -\frac{GmM}{r^2} + m r \omega^2 - \frac{3GmM}{c^2} \omega^2 + \frac{GmM}{\alpha^2} r \quad (2)$$

$D^1 = g^{11} D_1$  = movement quantity (antievariant)

$$= m \frac{dr}{dr}$$

$$\omega = \text{angular velocity} = \frac{d\theta}{dr}$$

distance  $r$ , which includes aside the known forces of the field of gravity (attracting Newton's force, centrifugal force, force of advancing of the Perihelium, and the repulsing force a force proportional to the distance of the masses : that is, it is existing when  $\omega = 0$ , for  $r < a$  a attracting force, for  $r = a$  annuled, for  $r > a$  a repulsing force.

2) The force (2) gives the possibility of application of the centre of gravity theory of the classic Mechanics, which the (1) on the other hand can give by replacement of the distance  $r$  through the distances  $r_A, r_B$  of the masses from their gravity center (3).

$$m r = M_A r_A = M_B r_B, \quad r_A = \frac{M - M_A}{M} r \quad (3)$$

That is the principle of the maintenance of the momentum (antievariant) exists. And when the relation of the movement is made as to the gravity center, in such a case the constant momentum of the gravity centre is annuled (4).

$$\bar{D}_A^1 + \bar{D}_B^1 = \text{Const.} = 0 \quad (4)$$

3) My repulsing force determines the maximum of the distance, which possibly exists between the masses through the equation :  $g_{44} = 0$ . And so, when  $\omega = 0$  this distance, determining the Universe limit of the mass  $M$ , is (5)

$$R \cong \alpha \sqrt{\frac{\alpha c^2}{GM}} = R_M \quad (5)$$

When  $r = R$ , in such a case the smaller mass is transformed into light reversing its momentum, with a simultaneous changement of the equal momentum of the mass  $M_A$ , as result of the principle of the momentum maintenance (4)

Equally, the repulsing force gives for  $\alpha < r < R$  the phaenomenon of Red Shift (proportional to the distance of masses), for  $r = R$  except the transformation of the  $M_B$  into light, the «Earth-quotes» of the  $M_A$ , as a result of the changement of its momentum (4)

The existance of this repulsing force or the same of my Universal constant  $\alpha$ , which creates and engages the limitation of the Universe, of the  $M$  is indispensable to escape the madness of Infinity, which determines a without any limits, universe, that is an indeterminable universe which consequently is not susceptible of measurement.

4) The (1) gives the maintenance principles :

a) of the Energy,  $E$ , which, when  $D_k^1 = 0$ ,  $\omega = 0$  is equivalent to the (6)\*)

(\*) See Appendix in Greek.

$$iE = cD_4 = cg_{44} D^4 = c^2 g_{44} m \frac{idt}{d\tau} = \\ = imc^2 \sqrt{g_{44}^0} = \text{Const.} \quad (6)$$

b) Of the angular momentum  $D_2$  (7)

$$D_2 = g_{22} D^2 = g_{22} m \frac{d\Theta}{d\tau} = r^2 m \omega = \text{Const.} \quad (7)$$

5) The Geometry (1) gives the movement, on the same always surface, of each mass, to another one, being considered as stable, that is it contains the relativity concern, which the special theory of relativity gives. And the time  $t$  of (1) is a figurative time, being referred to figurative characteristics of the movement: of the equivalent mass  $m$  or of the gravity centre of the System,

Being given that as a result of the Principle of the Equivalence the «Falling» of bodies neutralizes the gravity force of the mass  $M$ , which causes their free falling, the real time for each mass must be the one being, determined by the Special Relativity theory. So, when  $\omega = 0$  the absolute falling velocity is the  $V^0$  (8), then the relative velocity between the masses is the  $V^0$  (9) which gives the time of each observer, ( $t_A, t_B$ )

$$V^0 = \frac{dr}{d\tau} = c \sqrt{g_{44}^0 - g_{44}} \quad (8)$$

$g_{44}^0$  = the metric tension at the starting time when the distance of masses is the  $r^0$ .

$$v = v^0 : \sqrt{1 + \frac{v_0^2}{c^2}} = \frac{dr}{dt}, dt_A = \frac{dt_B}{\beta} \\ \beta = 1 : \sqrt{1 + \frac{v_0^2}{c^2}} = \sqrt{1 - \frac{v^2}{c^2}} \quad (9)$$

correspondingly, according to the special relativity theory.

B) The Geometry (10) gives the characteristics of the field of gravity of each Mass and more especially

$$g_{11} dr^2 + r^2 d\Theta^2 - g_{44} c^2 dt^2 = -c^2 d\tau^2 \quad (10)$$

$$g_{44}^A = \frac{1}{g_{11}^A} = 1 - \frac{2GM_A}{c^2 r} - \frac{GM_A}{c^2 \alpha^2} r^2 \quad (10a)$$

$$g_{44}^B = \frac{1}{g_{11}^B} = 1 - \frac{2GM_B}{c^2 r} - \frac{GM_B}{c^2 \alpha^2} r^2 \quad (10b)$$

1) The (10) follows the Exterior solution ( $T_{\mu\nu} = 0$ ) of Schwarzschild, but diversifies to the General relativity Theory, as it is used today, at the equation (11), that is

$$\frac{\Lambda}{3} = \frac{GM_\lambda}{c^2 \alpha^2} = \frac{1}{R_\lambda}, \quad \lambda = A, B \quad (11)$$

the cosmological constante Einstein is replaced by the universal  $\alpha$  constante of mine, as a result of the fact that does not follow the principle of action and reaction of the forces, as it is ease to be proved, between the masses  $M_A, M_B$  when  $\omega = 0$ .

2) The principle of the maintenance of the momentum (4) and (7), imposes that the (10) is in valid only in the case of the stability of the masses ( $\omega = v = 0$ ) when we have:

a) The force between the masses  $M_A, M_B$  (12), which the immobile observers as to the field of each mass feel, and which is equal to the (2)

$$F_{AB} = - \frac{GM_A M_B}{r^2} + \frac{GM_A M_B}{\alpha^2} r \quad (12)$$

b) The space-time differences of the measurement instruments from the observer standing in a stable distance  $r_0$  from the centre of gravity of the mass  $M_\lambda$ , and the observer of the Special relativity theory (13)

$$dr_{\Delta\Delta} = \sqrt{g_{44}^{0A}} dr_A, dt_{\Delta\Delta} = \sqrt{g_{11}^{0A}} dt_A \quad (13)$$

Where is:  $g_{44}^0$  the metric tensor of the (10) for a distance  $r_0$ ,  $dr_A, dt_A$  the sizes of the space and time of the observer of the Mass  $M_\lambda$  without field of gravity, that is of the Special relativity theory (9).

c) The light velocity, regardless its position, as to the observer  $M_A$  (14)

$$c_A = g_{44}^{0A} c = \frac{dr_{\Delta\Delta}}{dt_{\Delta\Delta}} \quad (14)$$

d) The correction of the relative velocity (9) by the observer of  $M_A$  (15) as a result of the influence of its measurements (13) by its own gravity field, which and the observer  $M_A$  feels

$$U_{\Delta\Delta} = \frac{dr_{\Delta\Delta}}{dt_{\Delta\Delta}} = U \cdot g_{44}^{0A} \quad (15)$$

3) The Geometry (10) can generally indicate the light movement as to the mass  $M_A$ , when:  $d\tau = 0$ ; or more especially when:

a) It gives the energy  $E$  and the momentum  $D^1$  of the light (16)

$$iD^1 = D_4 = \frac{iE}{c} = \text{Const.}, \\ D_4 = i \frac{E}{c} \frac{dt}{dt_4} g_{44} = \text{Const.} \quad (16)$$

$dt_4$  = covariant time (scalar here, quantity)

b) The light velocity in a distance  $r$  as to the observer of the same distance from the gravity centre of the  $M_A$  (14a) that, is it gives the (14), which is independent of the light position, as to the observer, as a result of the (13)

$$c_A = g_{44}^A \cdot c \quad (14\alpha)$$

c) When the light is found in the distance  $R$  from the mass  $M_\lambda$ , is such a case it reverses its direction with a simultaneous change of the mass momentum  $D^1$  (from  $D^1 t_0 - D^1$ ) and in such way that the mass  $M_\lambda$  and the one hand undergoes a «Earthquake» and on the other hand to be possible the mass  $M_\lambda$  to absorb the photon giving its characteristics (momentum, energy) according to the Wave-mechanics principle.

C) It is proved that the Geometries (1) and (10) following the exterior solution, give the movement of two bodies moving under the influence of their mutual field of gravity, the forces of the field of gravity, the theory concerning the gravity centre, the relativity of movement in combination with the space time transformations of the proper field gravity of each observer, according to the Physics Maintenance principles, and against madness of Infinity.

IIA) The three bodies' movement (considered as Points) under the influence of their mutual field of gravity, as a result of the «centric» nature of the forces of gravity field between the masses, evidently they must follow the following conditions:

1) Of the Maintenance principles: Energy and momentum (angular or not)

2) Of the centre of gravity movement of the masses under a constant velocity motion.

3) Of the conversion of the problem to one of two bodies, when the influence of one mass will be considered as negligible.

4) Of the Exterior solution ( $T_{\mu\nu} = 0$ ) since as the Interior solution ( $T_{\mu\nu} \neq 0$ ), corresponding to a full-light space, as well as the previous conditions impose it.

B) The keeping of the previous conditions leads to the result, that the three bodies' movement is analysed to movements of two bodies which, in agreement to the above-said, keep the above conditions.

1) The movement of each mass  $M_\lambda$  towards the gravity centre of the system is the average movement of:

a) Two movements of the Mass  $M_\lambda$  as to the centre of gravity of the remainder masses, through the constant corrective terms of the mass  $M_\lambda$ ,  $\delta_\lambda$ .

b) The movement of this mass, owing to the two independent movements of its to the remainder masses, to the centre of gravity of the System.

2) That is, the movement of mass  $M_\lambda$  will be the consequent of the following movements:

a) The movement of the  $M_\lambda$  as to the centre of gravity of the remainder masses, according to the Geometry (17) this geometry

$$g_{44}^\lambda = \frac{1}{g_{11}^\lambda} = 1 - \frac{2GM}{c^2 r_\lambda} \quad \delta_\lambda = \frac{GM}{c^2 \alpha^2} r_\lambda'^2 \quad (17)$$

$$\delta_\lambda = \frac{1}{M - M_\lambda} \sum_\mu M_\mu \cos \rho_{\lambda\mu}^{\lambda K} \left( \frac{r_\lambda^K}{r_{\lambda\mu}^K} \right)^2,$$

$$M = \sum_\mu M_\mu, \quad M_{\mu\lambda} = M_\lambda + M_\mu \quad (17a)$$

$$g_{44}^{\lambda\mu} = \frac{1}{g_{11}^{\lambda\mu}} = 1 - \frac{2GM_{\mu\lambda}}{c^2 r_{\lambda\mu}} + \frac{GM}{c^2 \alpha^2} r_{\lambda\mu}^2, \quad \lambda \neq \mu = A, B, \Gamma \quad (17b)$$

Where is:  $r_\lambda^K, r_{\lambda\mu}^K$  the starting distances of Mass  $M_\lambda$  as to the centre of gravity of the other masses, or as to the other masses  $M_\mu$ .

$\rho_{\lambda\mu}^{\lambda K}$  The angle at the starting of the previous distances

gives to the mass  $M_\lambda$  an absolute velocity  $\bar{v}_{\lambda\delta}^0$  as to the centre of gravity of the system when there is no angular velocity ( $\omega=0$ )

b) The movement of  $M_\lambda$  as to  $M_\mu$  according to the Geometry (17b) which gives the ways of determining of the velocity of the M as to the centre of gravity of the system through the (18), when there is no angular velocity ( $\omega=0$ ):

$$\bar{v}_{\lambda-\mu}^0 = \frac{1}{M} \sum_\mu M_\mu \bar{v}_{\lambda\mu}^0, \quad \lambda \neq \mu = A, B, \Gamma \quad (18)$$

Where is:  $\bar{v}_{\lambda\mu}^0$  = the absolute velocity between the masses M determined by means of Geometry (17b)

c) Therefore the absolute velocity  $\bar{v}^0$  of the  $M_\lambda$  as to the centre of gravity of the System will be given through the (19)

$$\bar{v}_\lambda^0 = \frac{1}{3} \left[ 2 \bar{v}_{\lambda\delta}^0 + \bar{v}_{\lambda-\mu}^0 \right] \quad (19)$$

3) And the absolute velocity  $\bar{v}_{\lambda\delta}^0$  between two masses will be the Geometrical difference of the absolute velocity of those masses, as to the centre of gravity of the system that is the (20)

$$\bar{v}_\lambda^0 - \bar{v}_\mu^0 = \bar{v}_{\lambda\mu}^0 \quad (20)$$

As regard the relative velocity between them, its correction as a result of the propre field of gravity of each observer, is found, in the same way, to the case of the two masses (9), (14)

4) If the distance  $r = R_M$  becomes equal to the limit  $R_M$  of the Universe of the mass M, then the smaller mass is transformed into light imposing the phenomena of the reversal of the light movement, and of the «Earthquake» of the other masses, as a result of the principle of the momentum maintenance.

It is obvious, that on distance  $r > \alpha$  of the masses, the attractive force is negligible and subsequently only my repulsing force predominates and exists: that is appears again the phenomena of DER SHIFT between the masses

C) By analysing of the three Bodies Problem into the two bodies movement, there is possible on the one hand to determine the movement, if the starting constants are known, and on the other hand to determine the inverse problem, according to the Maintenance Principles, to the theory of gravity's centre, to the forces of field of gravity, and in connection with the relativity of motions and the influence of its own field of gravity of each observes.

As it obvious, the problem's report as to the centre of gravity of the bodies is obtainable by means of a resultant Geometry, following the Exterior solution ( $T_{\mu\nu} = 0$ ) since the component Geometries are refered to movements of two bodies, which movements follows the Exterior solution It is notable that these pulsing forces facilitate or rather they impose the movement's report as to the centre of gravity of the System, because of their size: It is always possible to replace the difference masses by their sum, laid at their centre of gravity.

III) The effects and the the consequences of the suggested solution are the following:

A) The possibility of the solution in the General theory of Relativity of one problem whose the complete solution, has not as yet been obtained in the simplest classical Newton's Mechanics, to the Relativity general theory, is owing to the very fact alone that the field of gravity and the General Relativity theory are just the same phenomenon. And so there is pointed out that:

1) The Exterior solution (according to which the per volume Einstein's  $T_{\mu\nu}$  tensors of Momentum - Energy are null) of Schwarzschild, with the correction given of replacement of the Cosmologic constant  $\Lambda$  of Einstein by my own universal constance  $\alpha$ , gives as the attracting forces which rule the planets' movements, as well as the repulsing forces of the long distant nebulas which forces justify their Red Shift.

2) The existence of the repulsing force in the gravity field is necessary in order to avoid the madness of Infinity, and on the other hand to permit the report of movement as the gravity centre of Universe.

3) The Exterior solution gives results which follow the Principles of Physics Maintenance, the theory of gravity centre of masses without rejecting the sense relativity of movement and the space-time transformation of each observer, as a result of his own propre gravity field.

4) It gives the way for the problem's solution of the N bodies by respective analysing of their movement into movement of two Bodies.

B) The Interior solution  $T_{\mu\nu} \neq 0$  concerning a space full of Electromagnetic wave, or the same of photons, cannot serve for the explanation of the Cosmological phenomena in such an Universe as containing masses. On the contrary, the Exterior solution  $T_{\mu\nu} = 0$  gives, besides the forces of the gravity field and the explanations of phenomena, such as the «Earth quakes», the eruptions of stars, or the creation of news ones, through a limited Universe [with a centre of gravity which is in immobility, which imposes and in connection with the Quantum phenomena (which later generally, rule the nature's phenomena)].

C) My geometry - physics conceptions according to which each force field of Physics is expressed and represented at bound together way by a specific Geometry: the gravity field by a Geometry of Riemann of Einstein' four dimensions, the Electromagnetic field by my Quantum Geometries of the type (A) and (B) of previous four dimensions and the thermonuclear field (referred to the phenomena of the Thermodynamics and of the Nuclear physics), by my Quantum Geometries (A) and (B) of the five dimensions, of which the fifth one is a real degenerated dimension.