MATHEMATICAL INVALIDITY OF RELATIVITY

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Abstract: In special relativity, the Lorentzian transformation equations inevitably force themselves to have zero as their denominators. The acceptance of the mathematical operation leading to such equations can also lead us to have infinite number of numerical relationships such as 0.2=1=0. In general relativity, the term homogeneous gravitational field must lead itself to be interpreted as homogeneous inhomogeneous field in mathematical terms. While the moving path of a free moving object in the gravitational field can be mathematically demonstrated to include some closed loci, which are proven by abundant facts in the heavens, no replica of the same can be produced in a mechanically accelerating field. This is of course a proof of failure of the so-called principle of equivalence.

On Special Relativity

The crucial role of the two equations *x=ct* and *x'=ct'* in the derivation of the Lorentzian transformation equations must evidence the indisputable presence of the following equation set in special relativity:

$$x' = \frac{x - vt}{\sqrt{1 - \left(\frac{v}{c}\right)^2}}$$

$$t' = \frac{t - x\left(\frac{v}{c^2}\right)}{\sqrt{1 - \left(\frac{v}{c}\right)^2}}$$

$$x^2 = (ct)^2$$

$$x'^2 = (ct')^2 \qquad (Eq.\ \ set\ \ A)$$

Given v and c as constants, and because of $x=ct$ from the third equation, the first Lorentzian equation in the set will lead to

$$x' = \frac{x - vt}{\sqrt{1 - \left(\frac{v}{c}\right)^2}} = \frac{cx - vct}{\sqrt{c^2 - v^2}} = \frac{cx - vx}{\sqrt{(c+v)(c-v)}} = \sqrt{\frac{(c-v)}{(c+v)}} \cdot x$$

In this new equation, *x'* is no longer a function of time but a function of spatial coordinates only. If we compare the coefficients of the *x* terms and the *t* terms between this new equation and the first Lorentzian equation, we must have the following equation set:

$$\frac{1}{\sqrt{1-\left(\frac{v}{c}\right)^2}}=\sqrt{\frac{(c-v)}{(c+v)}}$$

$$v=0 \qquad (Eq.set \quad B)$$

Both equations in equation set B require *v=0* for mathematical satisfaction. Therefore, if Lorentzian transformation equations can enjoy any credit in explaining phenomenon in mechanics, the case of *v=0* is the only case it is entitled to. However, if we must start the calculation with a speed of non zero value such as *v=0.2c*, we will find ourselves encountering even bigger difficulties with relativity.

Difficulty 1: The above reasoning can lead us to have two different equations for *x'* , which are written as

$$x'=\frac{1}{\sqrt{1-\left(\frac{0.2c}{c}\right)^2}}\cdot x-\frac{0.2c}{\sqrt{1-\left(\frac{0.2c}{c}\right)^2}}\cdot t$$

$$x'=\sqrt{\frac{c-0.2c}{c+0.2c}}\cdot x \qquad (Eq.\ set \quad C)$$

In order to accept the disappearance of the *t* term in the second equation we must accept *0.2=0* as the coefficient of the *t* term in the first equation of equation set C.

Difficulty 2: In comparing the coefficients of the *x* terms between the two equations in equation set C, we have

$$\frac{1}{\sqrt{1-\left(\frac{0.2c}{c}\right)^2}}=\sqrt{\frac{c-0.2c}{c+0.2c}}$$

This relationship must eventually lead to *c=c-0.2c* and thus, again, *0.2c=0***.**

Aren't all these enough to raise our suspicion concerning the mathematical validity of the Lorentzian transformation equations?

The conditions for the establishment of the two Lorentzian transformation equations are such that the origins of both the **x** and **x' axes** meet at the time instant $t_0=t_0'=0$ while the two axes are moving parallel and passing each other with constant speed v.

With $x'=0$, the first Lorentzian equation leads us to have $0=x-vt$, and of course, then, $x=vt$, or $v=x/t$. This is the equation describing the movement of the origin of the **x' axis** along the **x axis**. On the other hand, within the scope of relativity, it is easy to show that the movement of the origin of the **x axis** along the **x' axis** is necessarily and sufficiently described by the equation $x'=-vt'$, or $-v=x'/t'$. Indeed, for any point chosen from the **x axis**, its movement along the **x' axis** can be described by an equation that matches $-v=x'/t'$. With $-v=x'/t'$, the two Lorentzian transformation equations listed in equation set A inevitably warrant the following mathematical operation

$$-v=\frac{x'}{t'}=\frac{\dfrac{x-vt}{\sqrt{1-\left(v/c\right)^2}}}{\dfrac{t-x\left(v/c^2\right)}{\sqrt{1-\left(v/c\right)^2}}}=\frac{x-vt}{t-x\left(v/c^2\right)} \qquad (Eq.1-1)$$

Term rearrangement yields

$$-v=\frac{x-vt}{t-x\left(v/c^2\right)}$$

$$-v\left[t-x\left(v/c^2\right)\right]=x-vt$$

$$-vt+x\left(v^2/c^2\right)=x-vt$$

$$\left(v^2/c^2\right)=1$$

$$v=c$$

If the two Lorentzian equations must channel themselves to show $v=c$, these two equations must accept a zero as their denominators. No valid mathematical expression will allow its denominator to be zero. Special relativity can not be excused from this mathematical rule. Further, if *v* is designated with a numerical value such as *0.2c*, Eq.1-1 will give us

$$-0.2c = \frac{x - 0.2ct}{t - x\left(0.2c/c^2\right)}$$

$$-0.2c\left[t - x\left(0.2c/c^2\right)\right] = x - 0.2ct$$

$$x\left(0.2c/c\right)^2 = x$$

$$0.2 = 1$$

As shown previously, special relativity can also lead to 0.2=0. All these have made it apparent that special relativity is formulated by some mathematical operations that can lead to 0.2=1=0. The numerical system, the backbone as well as reason of mathematics, becomes nothing but merely a nonsensical chaos in relativity. This author strongly believe that the scientific world owes the future generations an explanation why and how a theory that is unacceptable in mathematics has been allowed to retain a dominant position in the realm of physical study. Based on the fact that special relativity has lost respect to mathematics, the scientific world must also re-evaluate the physical significance of some imaginary concepts that are brought up by special relativity, such as space-time, world line, and the equivalent conversion between mass and energy.

At this point, we may further be interested in the reason how those mathematical expressions like Lorentzain transformation equations that are unacceptable in mathematics have been formulated.

As we all know, in its mathematical derivation, special relativity assumes a constant speed for the traveling of light with respect to any inertial frame by introducing the relationship of *x=ct* and *x'=c't'*. So, the acquisition of Lorentzian equations must be conditioned by *x=ct* and *x'=c't'*. At the same time, relativity presents to us that the same Lorentzaian equations are expected to solve those kinematics problems in which *x* and *x'* are conditioned by *x=vt* and *x'=-vt'*, where *v* and *c* must be of different values, set by relativity. In other words, relativity has assumed itself a freedom of assigning the conditions of *ct* or *vt* at will to the spatial coordinators in deriving the Lorentzian equations. How can mathematics accept a "solution" that contains such a contradiction? Besides this contradicting belief in initiating its calculation, special relativity has left us with many questionable operations in algebra as well as in calculus. A reader who is interested in further detailed discussion on this matter is invited to visit the web page at <http://members.aol.com/crebigsol/awards.htm> .

On General Relativity

In one article [ON THE INFLUENCE OF GAVITATION ON THE PROPAGATION OF LIGHT, by *A. Einstein*], relativity states that "relatively to **K**, as well as relatively to **K'**, material points which are not subjected to the action of other material points, move in keeping with the equations"

$$\frac{d^2x}{dt^2} = 0, \ \frac{d^2y}{dt^2} = 0, \ \frac{d^2z}{dt^2} = -\gamma$$

where **K** represents a coordinate system that is at rest in a gravitational field, and **K**' represents a coordinate system that is (mechanically) accelerated. Since relativity has apparently compared accelerations in all 3 dimensions between the two systems, relativity must allow **X//X', Y//Y'** and **Z//Z'** as the only orientation between all the axes of the two systems.

In another article, relativity states that "Let **K**' be a second system of reference which is moving relatively to **K** in *uniformly accelerated* translation." [THE FOUNDATION OF THE GENERAL THEROY OF RELATIVITY, by *A. Einstein*] In this statement, **K** is referred to as an inertial system. In order for us not to confuse **K**, which represents an inertial system in this statement, with the **K**, which represents a system rest in the gravitational field in the previous paragraph, let us use $\mathbf{K}_0$ to represent the inertial system mentioned in this paragraph. The axes of $\mathbf{K}_0$ will then be named **Xo, Yo**, and **Zo**. In the movement comparison presented by this paragraph, relativity of course must have restricted the orientation of all axes between **K**' and $\mathbf{K}_0$ in such a way that **X'//Xo, Y'//Yo** and **Z'//Zo**.

Putting together all of the above restrictions regarding the orientation of axes, relativity must accept the overall relationship between all the axes in all three systems aforementioned as **X//X'//Xo, Y//Y'//Yo,** and **Z//Z'//Zo**. No other relationship, as far as orientation is concerned, should be allowed between these three systems.

With the geometrical orientation that is specified above, we immediately recognize that relativity has forced an impossibility upon the gravitational field. In the gravitational field, when **Z axis** is restricted to be parallel to **Zo axis** all the time, we cannot find any other coordinate point in the entire **X-Y-Z** coordinate system, except those along the **Z axis** where *(x,y)=0*, that can satisfy $\frac{d^2x}{dt^2} = 0, \ \frac{d^2y}{dt^2} = 0, \ \frac{d^2z}{dt^2} = -\gamma$ all at the same time. Instead, if we obey the restricted requirement of **Z//Z'//Zo**, at any point in the entire gravitational field except those on the **Z axes**, we must find at least one of the following:

$$\frac{d^2x}{dt^2} \neq 0, \ \frac{d^2y}{dt^2} \neq 0$$

More specifically, only the mechanically accelerating field can provide in its entire field any point at the same time to satisfy the mathematical relationship of $\frac{d^2x}{dt^2} = 0$, $\frac{d^2y}{dt^2} = 0$, $\frac{d^2z}{dt^2} = -\gamma$, but the gravitational field can not. For most corresponding points in the gravitational field except those along the **Z, X,** or **Y axis**, we must find at least two of the three terms of $\frac{d^2x}{dt^2}$, $\frac{d^2y}{dt^2}$, and $\frac{d^2z}{dt^2}$ to be non zero at the same time. What makes relativity believe that it can hide the distinction between zero and non zero in its course of presenting explanation to the physical world?

We all know that the value of acceleration in the entire mechanically accelerating field is coordinate independent, but it is absolutely not so in the gravitational field, not even along the **Z axis** alone.

If a field like the gravitational field whose strength can not be independent of coordinate even along a single axis, what is the significance of homogeneity termed by general relativity for this field? Relativity must respect the fact that the inhomogeneous characteristic is typical to the gravitational field which is produced by a mass that is, even by relativity itself, presumably concentrated at one single point in that field. In naming a homogeneous gravitational field, general relativity has actually created a term that in mathematics reads as a **homogenous inhomogeneous field**.

As a matter of fact, relativity has even failed itself in recognizing a homogeneous gravitational field in many of its important statements. Typically, it states that "The unit measuring-rod thus appears a little shortened in relation to the system of co-ordinates by the presence of the gravitational field, if the rod is laid along a radius, …With the tangential position, … the gravitational field of the point of mass has no influence on the length of a rod." [THE FOUNDATION OF THE GENERAL THEORY OF RELATIVITY, *by A Einstein*]

The words radius and tangential together tell people that relativity can not get itself away from a field that is inhomogeneous, because the words **radius** and **tangential** together totally reject the existence of a gravitational field that can only show $\frac{d^2x}{dt^2} = 0$, $\frac{d^2y}{dt^2} = 0$, $\frac{d^2z}{dt^2} = -\gamma$.

Let us choose a radius of a length that can result in a gravitational acceleration of $\frac{d^2z}{dt^2} = -\gamma$ at the tip of such a radius along the **Z** direction while maintaining the restriction of **Z'//Zo** all the time. After we rotate this radius by 90 degrees around the origin, one must find that $\frac{d^2z}{dt^2} = -\gamma$ is no longer true at the tip of the same radius. Assuming that the tip of this radius happens to locate in the **Z-Y** plane after the rotation, we now must have $\frac{d^2x}{dt^2} = 0$, $\frac{d^2y}{dt^2} = -\gamma$, $\frac{d^2z}{dt^2} = 0$. Can we realize this mathematical relationship in the mechanically accelerating field if we rotate some radius apart from the **Z'** axis? No!

If relativity believes that it has identified a field in which the mathematical properties such as $\frac{d^2x}{dt^2} = 0$, $\frac{d^2y}{dt^2} = 0$, $\frac{d^2z}{dt^2} = -\gamma$ is found valid along one, and only one, single line but fails anywhere else, what is its geometrical concept of "field"?

If special relativity and general relativity believe that they can be unified as one coherent theory, they must also overcome another difficulty. **If it is said that the measurements concluded by special relativity such as length contraction, time dilation, and mass escalation are observation dependent, the same measurements concluded by general relativity are no longer observation dependent, but absolute.** In other words, for example, special relativity tries to convince people that, in an environment free of gravity, the determination of the length of an object depends on how fast an observer is moving with respect to the object that he is measuring. The moving status of an observer, however, no longer plays any crucial role in general relativity when the same measurement is made. Once the mass quantity of the object that causes the gravitational field is determined, the other factor that governs the result of the measurement would be the location with respect to the massive object.

Why is the method in determining certain measurements in general relativity absolute, but, once acceleration is absent, as stressed by special relativity, must the method of making the same measurements be observation dependent? How can such a difference in determining the measurement fit into what Einstein said: **"The laws of physics must be of such a nature that they apply to systems of reference in any kind of motion"**? [THE FOUNDATION OF THE GENERAL THEORY OF RELATIVITY, *by A Einstein*]

The Paths of a Free Moving Object

In the following text we will review the validity of the equivalence assumed by relativity between the gravitational field and the mechanically accelerating field by examining the traveling path of a free moving objects in these two fields. For convenience, we will abbreviate the gravitational field as GF, the mechanically accelerated field as MF.

In the GF, we will name the coordinate system X-O-Z that is attached to the massive object that produces the gravitational field, with its origin O located at the mass center of the massive object.

Assume that at a certain time instant, in the GF we found a projectile B, whose mass is M_B, having a distance of R_{AB} from a massive object A whose mass is M_A. With respect to the inertial frame X-O-Z, this projectile is found moving with velocity v_B, which forms angle β with R_{AB} (Fig.1). This velocity can be resolved into two components: tangential component $v_{B/T}(=v_B \sin\beta)$, and radial component $v_{B/R}(=v_B \cos\beta)$.

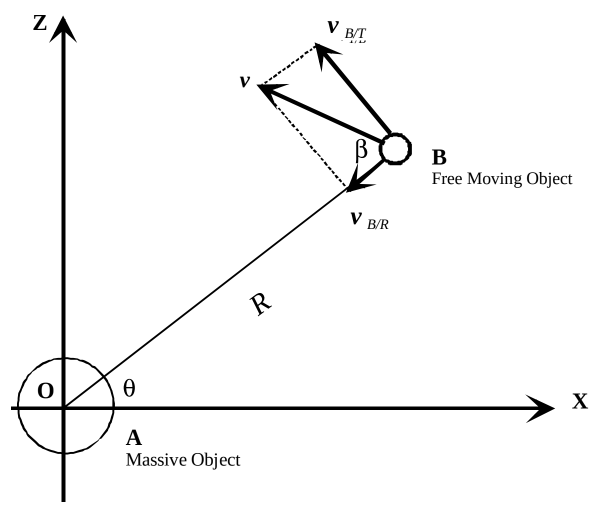

Fig. 1

We can always find the gravitational force F between object A and object B according to the following formula:

$$F = -\frac{GM_A M_B}{R^2} \qquad (Eq.3-1)$$

The total mechanical energy of B with respect to A is

$$E = \frac{1}{2} M_B v_{B/R}^2 + \frac{1}{2} M_B v_{B/T}^2 - \frac{GM_A M_B}{R_{AB}} \qquad (Eq.3-2)$$

If there is no foreign interference, E is a constant. We can divide both sides of Eq.3-2 by M_B to get

$$\frac{1}{2} v_{B/R}^2 + \frac{1}{2} v_{B/T}^2 - \frac{GM_A}{R_{AB}} = e \qquad (Eq.3-3)$$

where e represents the total mechanical energy per unit mass of projectile B; e is also obviously a conserved quantity.

When B carries a tangential velocity, it would simultaneously develop a centrifugal force, which points away from object A, and counteract the gravitational force between A and B. On the other hand, the existence of gravitational force tends to reduce the distance between A and B. As the distance reduces, according to principle of conservation of angular momentum, the tangential component of B's velocity will increase. This in turn increases the centrifugal force. Although the absolute magnitude of gravitational force also increases as the distance R_{AB} decreases, it is easy to show (omitted) that the centrifugal force increases at a much faster rate and in the opposite direction than the gravitational force. Eventually, B will reach a point where the centrifugal force and the gravitational force cancel each other out because of their equal magnitudes but opposite directions. We will call this point the **virtual equilibrium point**, abbreviated as VEP. All values at this point will bear a subscript of ve. For example, R_{ABve} means the distance between A and B at VEP; $v_{B/Tve}$ means the tangential component of the velocity possessed by B around A at VEP; and $v_{B/Rve}$ means the radial component of the same velocity at VEP. Because of the sideways movement of B, we can say that R_{AB} is rotating or sweeping. For each unit mass of B at VEP, we have from Eq.3-3:

$$\frac{1}{2}v_{B/Rve}^{2} + \frac{1}{2}v_{B/Tve}^{2} - \frac{GM_A}{R_{ABve}} = e \quad (Eq.3-4)$$

At VEP the magnitude of centrifugal force and gravitational force are equal, so

$$F_c + F_g = 0$$

$$\frac{M_B v_{B/Tve}^2}{R_{ABve}} + \left(-\frac{GM_A M_B}{R_{ABve}^2}\right) = 0$$

$$\frac{M_B v_{B/Tve}^2}{R_{ABve}} = \frac{GM_A M_B}{R_{ABve}^2}$$

$$\frac{R_{ABve}^2 M_B^2 v_{B/Tve}^2}{R_{ABve}^3} = \frac{GM_A M_B^2}{R_{ABve}^2}$$

$$\frac{J^2}{R_{ABve}^3} = \frac{GM_A M_B^2}{R_{ABve}^2}$$

$$R_{ABve} = \frac{J^2}{GM_A M_B^2} \qquad (Eq.3-5)$$

where $J = R_{ABve} M_B v_{B/Tve}$ is actually the angular momentum of B with respect to A.

Since J, the angular momentum, is a constant, Eq. 3-5 tells us that R_{ABve} must then also be a constant once all the initial moving status are defined, including the speed with which B was found. In the upcoming calculations, we are going to simplify our symbols by using m to replace M_B, R to replace R_{AB}, R_{ve} to replace R_{ABve}, and drop the subscript B from all other quantities regarding B. At a point other than VEP, we can set $R = \frac{1}{f} \cdot R_{ve}$, with f being any positive number. Then Eq.3-3 would become

$$\frac{1}{2}v_R^2 + \frac{1}{2}v_T^2 - \frac{GM_A}{\frac{R_{ve}}{f}} = e \qquad (Eq.3-6)$$

With $mv_T R = mv_{Tve} R_{ve}$, $v_T = \dfrac{v_{Tve} R_{ve}}{R} = f \cdot v_{Tve}$, Eq. 3-6 becomes

$$\frac{1}{2}v_R^2 + \frac{1}{2} f^2 v_{Tve}^2 - \frac{fGM_A}{R_{ve}} = e \qquad (Eq.3-7)$$

Substituting Eq.3-4 into Eq.3-7, and dropping the subscript B from all quantities regarding B in Eq.3-4, we have

$$\frac{1}{2}v_R^2 + \frac{1}{2} f^2 v_{Tve}^2 - \frac{fGM_A}{R_{ve}} = \frac{1}{2}v_{Rve}^2 + \frac{1}{2}v_{Tve}^2 - \frac{GM_A}{R_{ve}} \qquad (Eq.3-8)$$

Because centrifugal force at VEP= gravitational force at VEP, we have:

$$\frac{mv_{Tve}^2}{R_{ve}} = \frac{GM_A m}{R_{ve}^2}$$

$$v_{Tve}^2 = \frac{GM_A}{R_{ve}} \qquad (Eq.3-9)$$

Substituting Eq.3-9 into Eq.3-8, we have

$$\frac{1}{2}v_R^2 + \frac{1}{2} f^2 v_{Tve}^2 - fv_{Tve}^2 = \frac{1}{2}v_{Rve}^2 + \frac{1}{2}v_{Tve}^2 - v_{Tve}^2 \qquad (Eq.3-10)$$

Further calculation of Eq.3-10 shows

$$\begin{aligned}\frac{1}{2}v_R^2 &= \frac{1}{2}v_{Rve}^2 + \frac{1}{2}v_{Tve}^2 - v_{Tve}^2 - \frac{1}{2} f^2 v_{Tve}^2 + fv_{Tve}^2 \\ v_R^2 &= v_{Rve}^2 - v_{Tve}^2 - f^2 v_{Tve}^2 + 2fv_{Tve}^2 \\ &= v_{Rve}^2 - v_{Tve}^2\left(f^2 - 2f + 1\right) \\ v_R &= \pm\sqrt{v_{Rve}^2 - v_{Tve}^2 (f-1)^2} \qquad (Eq.3-11)\end{aligned}$$

The positive direction of R is assumed to be pointing away from A. v_R is along the radial line and in the direction of decreasing R, so we take the negative sign for v_R , i.e.,

$$v_R = -\sqrt{v_{Rve}^2 - v_{Tve}^2 (f-1)^2}$$

$$or$$

$$\frac{dR}{dt} = -\sqrt{v_{Rve}^2 - v_{Tve}^2 (f-1)^2} \qquad (Eq.3-12)$$

If we express B's sideways movement with angular speed $\omega = \frac{d\theta}{dt}$, then, because of conservation of angular momentum, we would have

$$mv_T R = mv_{Tve} R_{ve}$$

$$(\omega R)R = v_{Tve} R_{ve}$$

$$\omega = \frac{v_{Tve} R_{ve}}{R^2}$$

$$\frac{d\theta}{dt} = \frac{v_{Tve} R_{ve}}{R^2} \qquad (Eq.3-13)$$

Dividing both sides of Eq.3-13 by Eq.3-12, we have

$$\frac{d\theta}{dR} = \frac{-v_{Tve} R_{ve}}{R^2 \sqrt{v_{Rve}^2 - v_{Tve}^2 (f-1)^2}}$$

$$or$$

$$d\theta = \frac{-v_{Tve} R_{ve} \, dR}{R^2 \sqrt{v_{Rve}^2 - v_{Tve}^2 (f-1)^2}} \qquad (Eq.3-14)$$

Since $R = \frac{R_{ve}}{f}$, $\frac{dR}{df} = -\frac{R_{ve}}{f^2}$, $dR = -\frac{R_{ve}}{f^2} df$, Eq.3-14 becomes

$$d\theta = \frac{v_{Tve}\,df}{\sqrt{v_{Rve}^2 - v_{Tve}^2 (f-1)^2}}$$

$$\int \theta = \int \frac{v_{Tve}\,df}{\sqrt{v_{Rve}^2 - v_{Tve}^2 (f-1)^2}} + C$$

$$\theta = \sin^{-1} \frac{v_{Tve}}{v_{Rve}} (f-1) + C$$

$$\sin(\theta - C) = \frac{v_{Tve}}{v_{Rve}} (f-1) \qquad (Eq.3-15)$$

At VEP, if v_{Rve} takes the negative sign, the ratio of $\frac{v_{Tve}}{v_{Rve}}$ is a negative value. Besides, at VEP, $R = R_{ve}$, thus $f = 1$. The continues movement of B serves to further decrease R, or, to further increase f. These conditions enable us to assume an initial condition of 180^0 for C. So, Eq.3-15 gives us

$$\sin(\theta - 180^0) = \frac{v_{Tve}}{v_{Rve}} (f-1)$$

$$-\sin\theta = \frac{v_{Tve}}{v_{Rve}} (f-1)$$

$$-\sin\theta = \frac{v_{Tve}}{v_{Rve}} \left(\frac{R_{ve}}{R} - 1 \right)$$

$$R = \frac{R_{ve}}{1 - \frac{v_{Rve}}{v_{Tve}} \sin\theta} \qquad (Eq.3-16)$$

Eq.3-16 is a conic section formula. In this conic section formula, R_{ve} is a constant according to Eq.3-5. Once R_{ve} is obtained, v_{Tve} can be calculated from Eq.3-9. Then, v_{Rve} can be obtained from Eq.3-7 because of the fact that the total mechanical energy per unit mass of B is a measurable but conserved quantity at any point during B's movement.

At VEP, $f = 1$, $v_R = v_{Rve}$, Eq. 3-7 leads us to have

$$\frac{1}{2}v_{Rve}^2 + \frac{1}{2}f^2 v_{Tve}^2 - \frac{fGM_A}{R_{ve}} = e$$

$$\frac{1}{2}v_{Rve}^2 + \frac{1}{2}f^2 v_{Tve}^2 - fv_{Tve}^2 = e$$

$$v_{Rve}^2 + v_{Tve}^2 - 2v_{Tve}^2 = 2e$$

$$v_{Rve}^2 = 2e + v_{Tve}^2 \qquad (Eq.3-17)$$

Analytic geometry tells us that Eq.3-16 indicates:

1. Object B will move on a hyperbola path if $\left|\frac{v_{Rve}}{v_{Tve}}\right| > 1$, corresponding to $e > 0$ in Eq.3-17,
2. Object B will move on a parabola path if $\left|\frac{v_{Rve}}{v_{Tve}}\right| = 1$, corresponding to $e = 0$ in Eq.3-17,
3. Object B will move on an elliptical path if $\left|\frac{v_{Rve}}{v_{Tve}}\right| < 1$, corresponding to

$e < 0$ in Eq.3-17. In the case of $v_{Rve} = 0$, of course, $R \equiv R_{ve}$, the ellipse is actually a perfect circle. By the same token, if we vary the ratio of $\left|\frac{v_{Rve}}{v_{Tve}}\right|$ but keep it less than 1 all the time, we can have any close moving path for the movement of object B, from a perfect circle to a very elongated ellipse.

From these equations, we can easily tell that the VEP is always on the **X** axis.

In recent years, astronomical observations have found a number of other planet systems besides our solar one. In these newly found systems, planets are found moving in some very elongated orbits. It has been wondered how these elongated elliptical orbits could have been resulted. Eq. 3-16 tells us that the ratio of $\left|\frac{v_{Rve}}{v_{Tve}}\right|$ determines the shape of a free moving object's path around a massive object. If an object like our object B in the above analysis is ejected into the vicinity of a massive object with various combination of $\boldsymbol{v}_{Rve}$ and $\boldsymbol{v}_{Tve}$ while the ratio of $\left|\frac{v_{Rve}}{v_{Tve}}\right|$ being kept less than 1, all kinds of elliptical orbit can be possible.

A simple mathematical reasoning can be shown as following:

When $\theta = 90^{o}$, Eq. 3-16 gives us the radius between the pericenter of the elliptical path and the massive object. Let us call this radius R_{90}, then

$$R_{90} = \frac{R_{ve}}{1 - \frac{v_{Rve}}{v_{Tve}}}$$

Similarly, when $\theta = 270^{o}$, Eq. 3-16 gives us the radius R_{270} between the apocenter and the massive object as

$$R_{270} = \frac{R_{ve}}{1 + \frac{v_{Rve}}{v_{Tve}}}$$

Thus we obtain the following ratio:

$$\frac{R_{270}}{R_{90}} = \frac{v_{Tve} - v_{Rve}}{v_{Tve} + v_{Rve}}$$

Given that v_{Rve} is a negative value to begin our derivation of the conic section equation, i.e., Eq.3-16, the above ratio will approach a bigger value when the absolute values of v_{Rve} and v_{Tve} are getting more equal to each other, resulting in a more elongate ellipse.

Now we may further wonder where all these objects come from and how they have been ejected into those areas that are occupied by other massive objects so that various elliptical paths are established. These questions can be answered with a new cosmological model that is proposed in the book **Mathematical Demonstration of Hubble's Law**, by *Cameron Wong*.

In the MF, we can name a coordinate system **X'-O'-Z'** similar to the system **X-O-Z** in the GF, but there exists no massive object at the origin **O'** of this system. Without the restriction of a massive object upon the origin, **O'** can be designated anywhere with respect to an inertial field whose coordinate system has been named **Xo-Yo-Zo** . For the sake of convenience, let us assume that the line of force that is exerted on a certain frame by an engine is parallel to the **Z' axis**, and henceforth parallel to **Zo axis** of the inertial coordinate system as well.

The floor of this frame that is moving with acceleration ***a*** is coincided with the **X' axis**.

For any point we choose as the origin of the coordinate system, the free moving object can not have the same angular momentum at various locations with respect to this origin during its traveling. Suppose when the free moving object is found, with respect to the origin, its moving status are all the same as those of the free moving object found in the GF: the same initial distance of R_{AB} from the origin, the same initial velocity relative to the origin, and the velocity forms the same angle β with R_{AB}, and R_{AB} forms the same angle θ with the horizontal axis, i.e., **O'X'**. Furthermore, let us also call the free moving object as object B. (Fig.2)

Velocity of object B can be resolved into two components: one component is parallel to **O'X'**, the other is parallel to **O'Z'**. We will call the component parallel to **O'X'** the horizontal component, designated as v_h, and the component parallel to **O'Z'** the vertical component, designated as v_v. We can see that

$$v_h = v\cos(\beta - \theta)$$
$$v_v = v\sin(\beta - \theta)$$

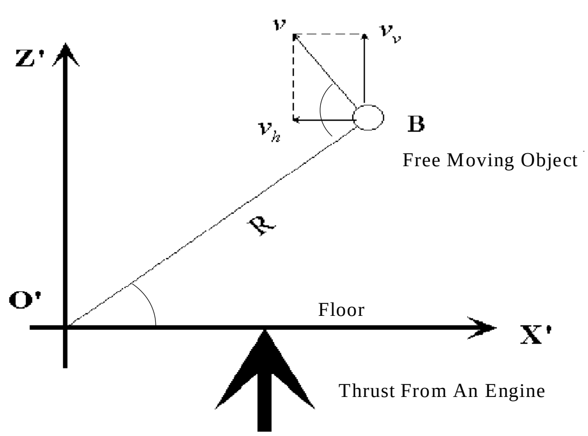

Fig. 2. **X'** is assumed to be coincided with the floor of a frame that is accelerated in the**Z'** direction by an engine, Therefore, X'-O'-Z' is regarded as accelerating with respect to an inertial frame.

Without any foreign interference, v_h remains as a constant while v_v changes with respect to X'-O'-Z' as time goes by. Simple differential equation operation on the above equations leads us to

$$X' = v_h \cdot t + R_{AB}\cos\theta = v\cos(\beta - \theta)\cdot t + R_{AB}\cos\theta$$
$$Z' = -\frac{1}{2}at^2 + v_v \cdot t + R_{AB}\sin\theta = -\frac{1}{2}at^2 + v\sin(\beta - \theta)\cdot t + R_{AB}\sin\theta$$

where t is time.

Eliminating t in both expressions will lead us to

$$Z' = -\frac{1}{2}a\left[\frac{X' - R_{AB}\cos\theta}{v\cos(\beta - \theta)}\right]^2 + v\sin(\beta - \theta)\cdot\frac{X' - R_{AB}\cos\theta}{v\cos(\beta - \theta)} + R_{AB}\sin\theta$$

Since we have the freedom of choosing any point in the field as the origin, we can choose a point in Fig.2 such that $\theta = 90^0$. Then we have

$$Z' = -\frac{1}{2}a\left[\frac{X'}{v\sin\beta}\right]^2 - X'\cot\beta + R_{AB}$$

Clearly, this equation describes nothing else but a parabola path for object B's movement with respect to an accelerating field.

The behaviors expressed by a free moving object in two different fields do not cooperate with the prediction made by the assumption of equivalence, which serves as the foundation for general relativity.

REFERENCES

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