- Implementation of the Assertion C based on an ad hoc nature of the *emission*.

Consider a material detector associated at all epochs with a rectilinear reference frame (in which by definition all the aetherinos move in straight lines at constant speeds). An "effective radiation speed" can be assigned to the radiation detected by the detector:

"Effective radiation speed" : Let T_M be the epoch at which the aetherinical force suffered by a detector of radiation R reaches its maximum. The force suffered by R is supposed to be the effect of a brief activity of an emitter E occurred at t=0 when its separation from R was equal to D. The *effective radiation speed* (relative to the detector R) is defined as D/T_M.

What will be shown next is that the effective speed (relative to the reference frame of the detector) does not need to suppose that there is a medium in which the detector is at rest to predict that the effective speed is independent of the speed of the source relative to the detector.

NOTE 1: For the phenomena described here it will be assumed that the time elapsed between the emission and the detection of light is small enough so that the speed of the aetherinos can be considered constant not only for the Ideal observer but also for the Official observer OO.

As was said in other papers of this work (e.g. see Eve9.pdf), from a strict point of view, the aetherinos move at constant speeds for the ideal observers IO. The official observers instead, whose real clocks increase gradually their tick rate relative to the ideal clocks, see the aetherinos increase their speed according to:

$$v(t) = v(0)\, e^{\mu t} \qquad [A6\text{-}1]$$

The small value of μ defended in a next section suggests that, for the present purposes, the OO speed of the aetherinos can be treated as constant during time intervals of the order of years.

To introduce the calculus of such "effective radiation speed", with the minimum mathematical complications, a simplistic experiment will be analysed first based on the (unphysical) idea of an "instantaneous" emission event (i.e. whose duration is infinitesimal):

- Consider first the simple case of a material detector R placed at distance D and *at rest* relative to an emitter E. There is vacuum between E and R. Let the reference system associated with R (and hence with E) be a rectilinear one (i.e. the aetherinos move in it in straight lines and at constant speeds for the IO observer).

Imagine the following explosion-type emission event:

At epoch t = 0 is emitted in the direction of R an instantaneous extra bunch (or lot) of aetherinos at a plurality speeds. At epochs t<0 and t>0 there is no activity at the emitter. Such extra lot of aetherinos can be described by its speed distribution:

r(v).dv = number of extra aetherinos with speeds in {v, v+dv} departing E in the direction of R, at the explosive event, by unit solid angle.

The aetherinos of a given speed v emitted at t = 0 will reach the detector at t = D/v. (i.e. at t = D/v the detector will receive an excess of aetherinos of speed v). The aetherinical impulse suffered by the detector (due only to the explosive event occurred at E) during the time interval dt elapsed between the arrival at R of the aetherinos of speed v+dv and those of speed v is: [number of selected aetherinos] * [impulse of an aetherino] = [number of selected aetherinos] * q v =

$$di = \frac{\sigma_R}{D^2} q\, v\, r(v)\, dv \qquad [A6\text{-}2]$$

where σ_R is the cross section of the detector to aetherino collisions. But the time interval between the arrival of the aetherinos of speed v + dv and those of speed v is:

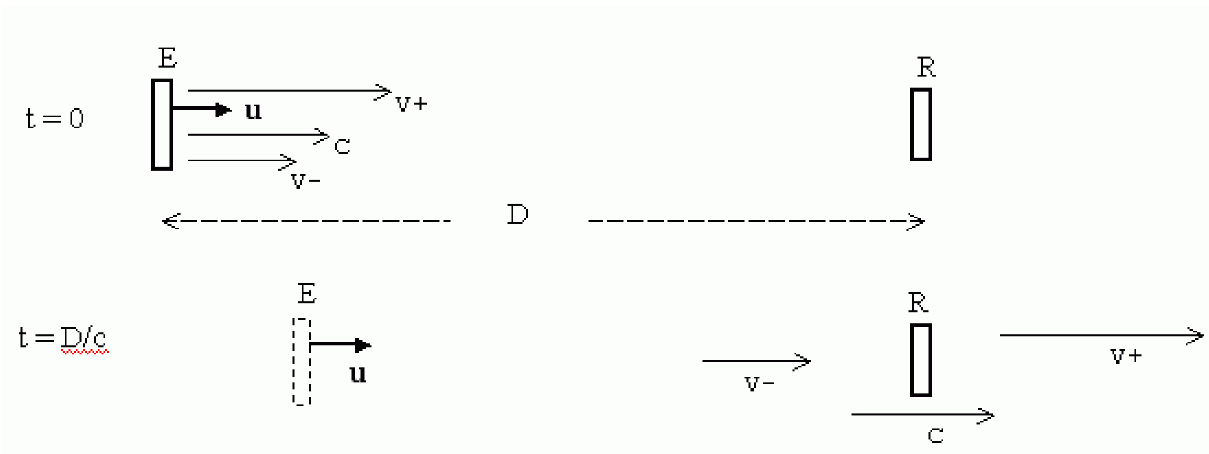
$$dt = -\frac{D}{v^2} dv \qquad [A6\text{-}3]$$

(as can be deduced by derivation of v = D/t). The impulse received by the detector in unit time (i.e. the force) at the epoch of arrival of the speed v aetherinos (epoch t = D/v) is therefore:

$$\frac{di}{dt} \equiv F(v) = \frac{\sigma_R}{D^3} q\, v^3\, r(v) \qquad [A6\text{-}4]$$

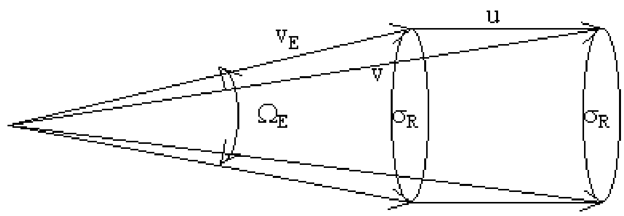
It is natural to define, in this case, the *effective speed* of the emitted disturbance as "the speed c for which the force F(v) reaches its absolute maximum".

- Consider now the case in which the emitter E is at t = 0 (instant of the explosive emission) *moving at speed* u relative to the detector. This detector R is supposed to be at rest at all times in some rectilinear reference frame. Let D be the separation between E and R at t = 0 (hence the radiation travels a distance D in the reference frame of the detector R).



Fig[A6-5]

Suppose that $D >> \sigma_R^{1/2}$. Considering the aetherinos departing the emitter and reaching the detector, those of speed v_E *relative to the emitter* E, will have approximately a speed $v = v_E + u$ *relative to the detector*. The solid angle as seen by the emitter by which emerge the speed-v aetherinos that are able to reach the detector is now:



$$\Omega_E = \frac{\sigma_R}{(D\frac{v_E}{v})^2} \cong \frac{\sigma_R}{D^2}\frac{v^2}{(v-u)^2} \qquad [A6\text{-}6]$$

Suppose that the emission is described by the following *special (ad hoc)* speed distribution:

$$r(v_E)\, dv_E = N_E\, v_E^{\,2}\, e^{-\alpha v_E}\, dv_E \qquad [A6\text{-}7]$$

that gives the number of aetherinos that, at the emission event, emerge E with speeds in the interval $\{v_E, v_E + dv_E\}$ by unit solid angle.

The sub index E in v_E is to remark that the aetherino speeds are relative to the emitter E.

Considering that an aetherino emitted at speed v_E relative to E has a speed v relative to R given by:

$$v = v_E + u \qquad [A6\text{-}8]$$

the emission distribution of Eq [A6-7] can be rewritten as a function of the speeds v relative to R:

$$R(v)\,dv \equiv N_E\,(v-u)^2\, e^{-\alpha(v-u)}\, dv \qquad [A6\text{-}9]$$

The net aetherinical impulse received by R during the arrival of the aetherinos with speeds in {v, v+dv} is now (see A6-6):

$$di = \Omega_E\, q\, v\, R(v)\, dv = \frac{\sigma_R}{D^2}\frac{v^2}{(v-u)^2}\, q\, v\, R(v)\, dv \qquad [A6\text{-}10]$$

where, as usual, it has been taken into account that an aetherino of speed v relative to a detector gives to it an "aetherinical impulse" equal to q v.

The impulse received in unit time (at the epoch of arrival of the speed v aetherinos) is using Eq [A6-3]:

$$\left|\frac{di}{dt}\right| \equiv F(v) = \frac{\sigma_R\, v^2}{D^2\,(v-u)^2}\, q\, v\, R(v)\, \frac{v^2}{D} =$$

[A6-11]

$$= \frac{q\,\sigma_R N_E}{D^3} v^5\, e^{-\alpha(v-u)} = \frac{q\,\sigma_R N_E}{D^3} e^{\alpha u}\; v^5\, e^{-\alpha v}$$

Defining as above: *effective speed of the emitted "radiation*" as the speed c for which F(v) reaches its absolute maximum, it is evident from [A6-11] that such speed c does not depend on the speed u of the emitter. In fact:

The speed c for which F(v) reaches its maximum is $5/\alpha$ for this particular explosive emission event since:

$$\left[\frac{dF(v)}{dv}\right]_c = 0 \;\Rightarrow\; \frac{q\,\sigma_R N_E\, e^{\alpha u}}{D^3}\,\frac{d\left(v^5 e^{-\alpha v}\right)}{dv} = 0 \;\Leftrightarrow$$

$$\Leftrightarrow\; (5-\alpha v)_c = 0 \;\Rightarrow\; (v=)\; c = \frac{5}{\alpha}$$ [A6-12]

In the more realistic case in which the activity of the emitter lasts a finite nonzero time interval Δt (and not just an “instant” as in the explosion considered above) it will happen that the detector R is receiving at the same time slow aetherinos emitted at the beginning of Δt together with faster ones that departed the emitter at the end of the activity interval Δt. In this case a possible mathematical treatment concerning the effective speed of the disturbance in vacuum could proceed as follows. Calling:

$r(v_E, t)\, dv_E\, dt$ = excess (/deficit) of aetherinos emerging E in the direction of R with speeds relative to E in $\{v_E , v_E + dv_E\}$ during the time interval {t, t+dt} by unit solid angle.
(the excess or deficit is relative to the average number of aetherinos of the corresponding speed “emerging” the emitter when it has no activity).

Let:

$r(v_E, t) = 0$ if $t < 0$ or $t > \Delta t$ [A6-14]

$r(v_E, t)$ = finite non zero function for t in { 0, Δt }

Let E be moving towards R with a constant speed *u* during its period of activity (i.e. between t = 0 and t = Δt) and let R be at rest at all times in some rectilinear reference system (which will be used as the description frame to refer the speeds of the aetherinos).

Let D be the separation between E and R at epoch t = 0. Hence their separation at epochs between t = 0 and t = Δt is given by:

$$D(t) = D - u\,t \qquad [A6\text{-}15]$$

The residual distribution [A6-14] emerging from E can also be expressed as a function of the aetherino speeds *relative to* R:

$$r(v_E, t)\, dv_E\, dt = r(v-u, t)\, dv\, dt = R(v, t)\, dv\, dt \qquad [A6\text{-}16]$$

and although its speeds v are referred to the reference frame of the detector, the distribution R(v, t) still represents a number of aetherinos emerging *the emitter* in unit time. But if the aetherinos of speed v able to reach the detector are emitted by E at a rate Ω R(v, t), then since E is moving at speed u towards R, the aetherinos of speed v emerging from E that reach the detector do not arrive at the rate Ω R(v, t) but at a rate v/(v-u) Ω R(v, t). This Doppler-type factor v/(v-u) was not pertinent in the above calculus of the force produced by an *instantaneous* emission of aetherinos (explosion). This has the consequence that now the ad hoc residual distribution $r(v_E, t)$, that allows for an effective speed of the disturbance independent of u, has to contain an extra factor v_E. Therefore, instead of having like [A6-7] a factor v_E^2, it can be guessed that the ad hoc distribution needed for the prediction must be of the type:

$$r(v_E, t)\; dv_E\, dt = f(t)\, N_E\, v_E^3\, e^{-\alpha v_E}\; dv_E\, dt \qquad [A6\text{-}16b]$$

or, when expressed as a function of $v = v_E + u$ it takes the form:

$$R(v, t)\, dv\, dt \equiv f(t)\, N_E\, (v-u)^3\, e^{-\alpha (v-u)}\, dv\, dt \qquad [A6\text{-}16c]$$

(This "guess" is adequate is because, in analogy with [A6-11], an extra factor (v-u) is needed in the numerator to cancel the (v-u) of the Doppler-type factor v/(v-u) that appears in this calculus).

Note: The residual distribution R(v, t) represents a number of aetherinos per unit speed interval and per unit time interval and has therefore the dimensions $[v^{-1}\, T^{-1}] = [L^{-1}]$. (Though R(v, t) is also a number of aetherinos "per unit solid angle", following mainstream Physics practice, this "dimension" is not made explicit).

Let T represent the time of observation of the force suffered by the detector.
The aetherinos departing E at the epoch *t* and arriving at R at the epoch T must be those whose speed relative to R is given by:

$$v = \frac{D(t)}{T-t} = \frac{D - u\,t}{T-t} \qquad [A6\text{-}17]$$

The aetherinos departing the emitter E at the epoch *t* and arriving at R during the time interval {T, T+dT} are those of speeds (relative to R) in the interval {v, v+dv} where v is given by [A6-17] and dv can be obtained by derivation of [A6-17] respect to T (considering t a constant):

$$dv = -\frac{D - u\,t}{(T - t)^2} dT = -\frac{v^2}{D - u\,t} dT \qquad [A6\text{-}18]$$

The minus sign reflects the fact that *increasing* dT allows for the arrival of aetherinos of *smaller* speeds. In the calculus of the force, when substituting dv by its function of dT such minus sign will be ignored because otherwise it changes incorrectly the sign of the force.

Notice that at a given epoch T, the detector R is simultaneously receiving a plurality of radiation "flows" emitted at different epochs at the emitter E. (The different "flows" received at T have different speeds ant hence they must have been emitted at different epochs).

The total aetherinical impulse suffered by R during the time interval of observation {T, T+dT} due to the emission event taking place during the time interval {t, t+dt} may be expressed by the integral:

$$di = \int q\, v \frac{v}{v - u} \Omega(t)\, R(v,t)\, dv\, dt$$

$$= dT \int_0^{\Delta t} q\, v \frac{v}{v - u} \Omega(t)\, R(v,t) \frac{v^2}{D - u\,t} dt \qquad [A6\text{-}19]$$

where v, a function of t and T, is given at Eq [A6-17]. (Notice that the definition i = q v of the *elementary impulse of an aetherino* has been used).

Let $D(t) >> \sigma_R^{1/2}$ for all t in {0, Δt } [A6-20]

At the epoch t, the emergent aetherinos of speed v_E (relative to E) that will be able to reach the "surface" σ_R of the detector separated (at that epoch) by D(t) are those that emerge by a solid angle relative to the emitter given by (see A6-6):

$$\Omega(v,t) \cong \frac{\sigma_R}{\left[D(t) \frac{v_E}{v_E + u}\right]^2} = \frac{\sigma_R}{D^2(t)} \frac{v^2}{(v - u)^2} \qquad [A6\text{-}21]$$

Therefore from [A6-19] and [A6-21] :

$$\frac{di}{dT} = F(T) = q\,\sigma_R \int_{t=0}^{t=\Delta t} \frac{1}{(D - u\,t)^3} \frac{v^6}{(v - u)^3} R(v,t)\, dt \qquad [A6\text{-}22]$$

where it must not be forgotten (when integrating for the emission epochs t) that v is actually a function of t given by [A6-17].

The expression [A6-22] may be considered valid for T > Δt and D >> u Δt

Eq [A6-22] can also be applied to observation epochs T such that 0<T< Δt but in this case to be consistent with the description postulate of causality, the upper limit of the integral must be changed to T. So, for the general case T>0, the upper limit of the integral should be the smaller between T and Δt that will be called min[T, Δt].

For T<0 it seems evident that F(T)=0.

A computation of Eq [A6-22] has been made choosing for the residual emissive function (see [A6-16]) the following example pulse:

$$r(v_E,t) \equiv P(t)\, N_E\, v_E^{\,3}\, e^{-\alpha v_E} \quad \Leftrightarrow$$
$$\Leftrightarrow R(v,t) \equiv P(t)\, N_E\, (v-u)^3\, e^{-\alpha (v-u)} \qquad \text{[A6-25]}$$

with: $P(t)=1$ for $0 < t < \Delta t$ [A6-26]
$P(t)=0$ for $t < 0$ or $t > \Delta t$

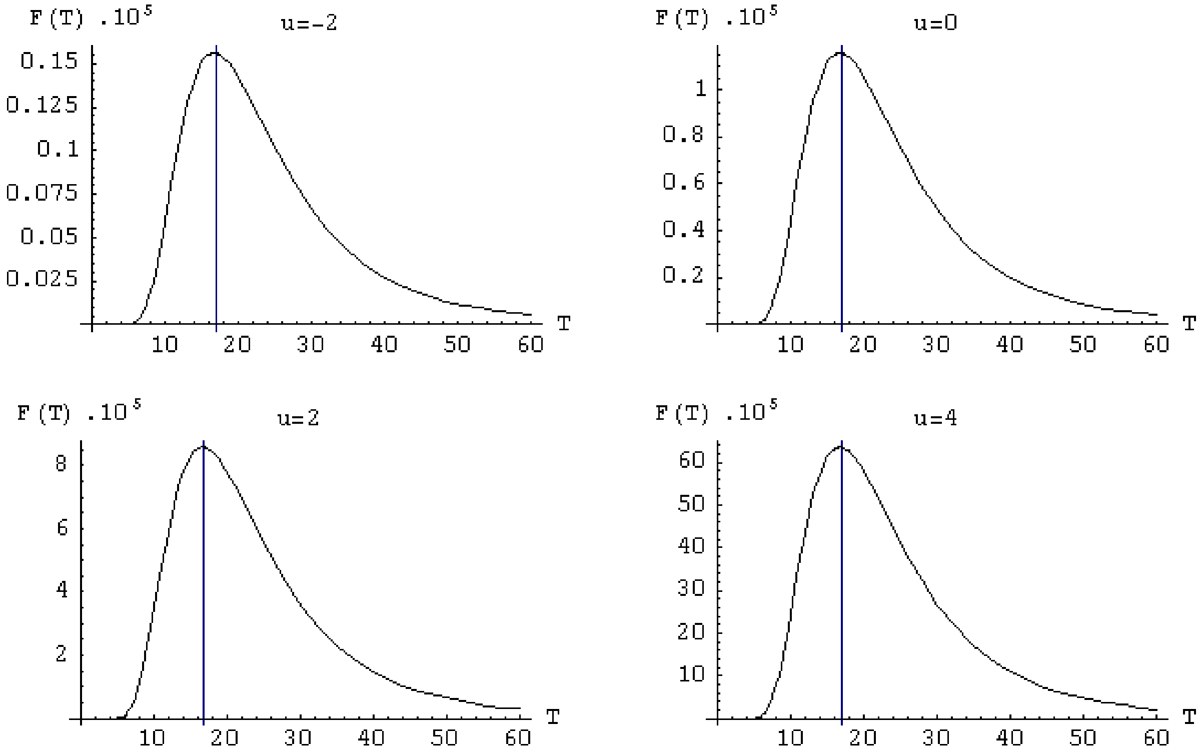
Therefore doing the pertinent substitutions v=(D -u t)/(T-t) the predicted force on the detector is:

$$F_R(T) = q\,\sigma_R\, N_E\, e^{\alpha u} \int_0^{\min(\Delta t, T)} \frac{(D-u\,t)^3}{(T-t)^6}\, e^{-\alpha \frac{D-u\,t}{T-t}}\, dt \qquad \text{[A6-27]}$$

The results obtained (see Note 2 below), are consistent with the proposed idea that it is possible to implement a disturbance whose (effective) speed relative to the frame associated with the detector is independent of the speed of the source relative to such frame.

It is realized that for these ideas to have any significance in the issue of the constancy of the speed of light it must be shown that the residual emissive function does not depend significantly on the speed of the emitter relative to its aether's local rest frame. This dependence, related to a more general discussion about the range of validity of a "principle of relativity" in reference frames of different speeds relative to the local aether has been shown to be negligible (see an example in the paper https://www.eterinica.net/redistribs_eterinicas_en.pdf) for speeds of the emitter not much bigger than the speed of light c if it is supposed an aether in which the average speed of the aetherinos (in the reference frame in which the aether can be considered at rest) is several orders of magnitude bigger than c.

The "constancy of light interpretation" presented in this paper is of course just a simplification that ignores the rich nature of light and of its possible ways to interact with matter. In particular the detector R has been described as a rigid surface of geometrical section σ_R with no inner moving parts. But it is believed that only with a resonant model of detector can the wave features of light be understood and described within the model. But a "resonant detector" implies that it is made of moving particles that therefore vary their speeds relative to the aetherino's radiation flows and this affects on its turn the intensity of the aetherinical force that they suffer at any time. The analysis of this section can therefore only be considered a gross interpretation of the constancy of light for negligible internal speeds of the resonant elementary particles that make the detector.



NOTE 2

The above graphics show the force F(T) suffered by a receiver R as a function of time (see Eq[A6-27]. The emitter E, during the short time interval $\Delta t = \{t=0, t=0.1\}$ emits an excess of aetherinos with a speed distribution given by [A6-25] and [A6-26]. It has been supposed that at the beginning of the emission (t=0) the emitter is at a position distant d=100 from R. The constants have been chosen $N_E = 1$, $\alpha = 1$, $q = 1$, $\sigma_R = 1$ ($\alpha = 1$ implies that the function v_E^3 Exp[- α v_E] has its maximum for $v_M=3$)
The graphics correspond respectively to the emitter speeds u = -2, u = 0, u = 2 and u = 4; (a negative u means that E is moving away from R). In the four cases it can be seen that the maximum of the disturbance reaches R at $T \cong 16.9$ which implies an "effective propagation speed" $c = 100/16.9 \cong 5.9$

From this and other examples it can also be seen that the strength of F(T) depends on *u*. The width of the disturbance detected by R depends on D but not sensibly on Δt. The features of F(T) depend also on the type of pulse P(t) emitted. But this Appendix is just a sketch of a qualitative model and, as said above, the features of the detected force F(T) do not pretend, at this stage, to incorporate the features (frequency, modulation, ...) of the emitted light.

NOTE 3

It can also be seen (doing some computations) that, if the emitter aetherino distribution $r(v_E, t)$, instead of including a simple exponential like in Eq[A6-25], is of the following (Maxwell - Boltzmann) type:

$$r(v_E, t) \equiv P(t)\, N_E\, v_E^2\, e^{-\alpha v_E^2} \qquad \text{[A6-30]}$$

then the speed of the disturbance relative to the detector shows a strong dependence on the speed *u* of the detector (at the time of emission of the pulse). I.e. in this case the constancy of light paradigm analysed in this paper does no longer work.

It seems difficult within the model to implement radiation emissions of the "simple exponential type" (Eq[A6-25]) based on the aetherino's redistributions exerted by some matter bathed by an aether of the Maxwell - Boltzmann type. It seems simpler to suppose that the aether's canonical distribution is not of the Maxwell - Boltzmann type that has been proposed in sections 1 to 4 but is instead of the simple exponential type:

$$\rho_0(v) = N_0 v^3 e^{-\alpha v} \qquad [A6\text{-}31]$$

Adopting Eq[A6-31] as the aether's canonical distribution (instead of Eq[1-47]) has no qualitative influence on the results obtained in previous sections. In particular, with this Eq[A6-31] canonical distribution it can be seen that the model's deduction of Newton's second law is not affected. The precise quantitative influence that a revised canonical distribution may have on the constants of the equations of the previous sections has not been studied yet.
