Corrections Jan-2018, Sep-2019

6 - Speed of light.

Many experimental facts related to the speed of light can be explained assuming that:

1) The disturbance created in the aether by a “standard” emitter of light does not travel at a specific unique speed but is instead *spread* in a continuum of speeds. It could be said that a standard source of radiation emits ‘*many lights*’ of different speeds.

2) When many light-type disturbances of different speeds enter a material detector, only that of speed *c relative to the detector itself* manifests itself as “light”.

Supposition #1 is what can be expected to happen when oscillating charged particles (emitter) are interacting with the aetherinos (of the local aether) that have a plurality of speeds. The model of aether proposed in this work suggests in fact that the emission of radiation can be understood as a time oscillating redistribution of the speeds of the aetherinos that collide with the pertinent matter of the emitter. As a result, a “modulation” (of the aetherino’s number density) is introduced into all the emergent flows of aetherinos that leave the emitter at the different speeds. (Note: As explained in other sections of this work (e.g. at redistribs_eterinicas_en.pdf), the charged elementary particles create an anisotropous redistribution of the aetherinos that collide with them. In most cases such “modulation of the aether” emerging from the source of radiation is simply caused by the rotations of electrons).

The assertion #2 is actually a *prediction* of the model under an additional simple hypothesis as will be shown below. It means that the disturbances created by the emitter in the aetherinos of different speeds, exert their impulses on a material detector in such a way that the modulation emitted at an epoch t is only rebuilt in the detector at an epoch T and destroyed at all other epochs, and it means that T is such that D/(T-t) = c whatever the speed of the source relative to the detector (where D is the separation*, in the reference frame defined by the detector at the epoch T*, between the position of the emitter at the epoch t and that of the detector at the epoch T). The speed *c* is therefore a *constant relative to the material detector* and not necessarily relative to the source neither to the reference frame of description. Insisting on this feature the assertion #2 can be restated as:

<u>Assertion C</u>:
The speed of light in vacuum is c ***relative to the material detector*** *with which it interacts* (where c is the constant that in mainstream physics is called “speed of light in vacuum”).

NOTE: The "*detector*" (or receiver) is understood to be the *matter* ultimately detecting (or absorbing) the light (normally electrons of low speed relative to the detecting apparatus). It is important to distinguish whether the detector is at rest or whether it is moving relative to the reference frame S of the description. If the detector, at the epoch of its reception of the light, is moving relative to S then the speed of "the" light that it detects will no longer be c relative to S (because the model is assuming the Galileo transformation of velocities). But any two reference frames S and S' moving relative to each other will assign the same speed c to the light emitted at any given source, *if* their detectors R and R' are at rest in their respective frames (i.e. R does not move relative to S and R' does not move relative to S'). It is this second case that is normally taken for granted when acknowledging the “constancy of the speed of light” in any inertial reference frame.

Many Special Relativity textbooks and papers use a terminology that is considered confusing specially in this context. They write ‘the observer’, ‘frame of reference of the observer’, ‘observation frame’ … instead of ‘*description frame*’, which is what is usually meant. The confusion appears when the scenario includes detectors that move relative to the ‘description frame’ and those moving detectors are also called “observers”. No objection is raised to use *moving* detectors in any given description as long as it is remembered that light travels at speed c relative to the detectors and not necessarily to the reference frame of description.

"**Radiation flow**" will be the name given to a group of aetherinos of a *given speed* v that depart the emitter during a given time interval of emitting activity. An “infinite” number (a continuum) of radiation flows (characterised by their speed) can be abstracted in the group of aetherinos that carry out the emitted disturbance. During any standard radiative process an “infinite” number of radiation flows is being modulated at the source at every instant. All the “flows” carry the information of the disturbance produced by the emitter in form of a specific distribution of the density of their aetherinos along the flow.

In other words, the emitted disturbance does not travel at a well defined unique speed but can instead be considered to be spread in a continuum of speeds.

NOTE: The paradigm that a continuum of "light-type disturbances" of "all" speeds is simultaneously emitted (by a standard emitter) has raised the question: "Doesn't that hypothesis contradict the conservation of energy?" and it has been argued that the emitters should release an infinite amount of energy to account for the experimental fact that the light from a source can be absorbed by any detector whatever its speed relative to the emitter. A rigorous analysis of the energy features of light in the proposed model's description has not been attempted yet but, with some generic arguments (see below), it can be argued that the 'many flows' emitted by a light source (during a finite time interval) *do not* imply an infinite energy to account for the experimental observations of the radiation energy received by detectors moving towards or away from a light source. Furthermore there are hints that the many lights paradigm does not globally contradict the conservation of energy.

The so called Assertion C admits a priori two alternative interpretations. (1) The "*observed light*" interpretation would consist in supposing that all the flows, whatever their speed, interact with the matter of the detectors and are affected by this matter. But, when a standard radiation (made of many flows of different speeds) enters a detector, the radiation appears to be travelling at speed c because the flows of that speed (relative to the detector) are the most efficient in interacting with the detector's matter (e.g. due to a sharp resonance of the electrons to aetherinos of relative speed c). (2) The "*strong*" interpretation of the Assertion C would consist in supposing that only the flows of speed c (or very close to it) relative to the detector interact with matter while the other flows just cross through, unaffected by matter.

Presently the model favors "the observed light" interpretation, but even assuming the "strong" version of the Assertion C it must be admitted that a *physical* detector must be supposed to interact with ‘radiation flows’ not only of speed 'strictly' c relative to it but with all the flows of speeds in a narrow but finite (non zero) interval {c-Δc, c+Δc} where Δc<<c is some speed that should depend on the nature of the detector.

In the case of a *brief emission event* the model can argue that the total energy emitted can be evaluated by a standard integration of the energies of all the flows (in the flow's continuum) emitted by the source. (Again, for a flow to have physical meaning and carry energy it cannot be made by aetherinos of a strictly defined speed v but by aetherinos of speeds in an interval {v, v+Δv}. The individual flows can be singled out from the flow's continuum by choosing the speed interval Δv adequate for the problem being treated). The sum of the energies of all the flows emitted by the source during a brief emission event will have a *finite* value if it is supposed that the energy carried by each flow is finite (which is a reasonable physical assumption compatible with the model) and if it is supposed that the energy per flow tends "firmly" to zero as the flow speeds tend to infinity. An energy distribution such that it reaches its maximum at the speed “c” relative to the emitter, tending to zero not only as the flow speeds tend to infinity but also as the flow speeds relative to the emitter tend to zero, seems a good guess. This type of distribution implies of course some predictions about the intensity of the light received from fast moving sources of brief activity. No experiments or astronomical observations are known by the author to contradict such predictions.

In this case of a *brief* (short lasting) *emission*, although it is straightforward for the model to predict that the total energy emitted is finite, it seems at first sight that the sum of the energies of the flows that can be independently collected by a set of adequate detectors, is much bigger than the energy that is known (by other independent means like its temperature decrease in the case of blackbody radiation) to have been released by the emitter. But a further look suggests that the collectable energy will not be bigger than the emitted energy when taking into account (see Option 1 below) that the *amplitude* of the oscillating force detected by a detector (of a given speed relative to the emitter) decreases with the distance D (between the emitter and the detector) as $1/D^4$. (See the Intensity and Amplitude section below).

NOTE: for a "light type" disturbance of a given frequency and duration, the model considers, classically, that the energy that can be absorbed by a detector is proportional to the square of the amplitude of such force wave. In fact, suppose that the absorber consists of bound electrons. The displacement y suffered by an electron from its equilibrium position due to the aetherinical force F will be proportional to the force (Hooke's Law) and it can be written $F = k\, y$ and consequently $a_F = k\, a_y$ (where a_y is the amplitude of the electron's *displacement* oscillation and a_F is the amplitude of the aetherinical oscillating force). But the total energy (kinetic plus potential) of an harmonic oscillator (that of the bound electron) is classically $E = 1/2\ m\ a_y^2\ \omega^2$ and therefore also proportional to the square of the amplitude a_F of the applied oscillating aetherinical force.

Consider now the case of a *continuous stable emission*. The analysis of the energy that a set of adequate detectors can collect from a continuous emitter does neither seem to present any crucial energy problems if it is acknowledged that "the matter of a detector destroys the ‘energy release potentiality’ in *all* ‘the flows’ incident simultaneously on the detector (and not only of those flows of relative speed close to c)". When flows of a plurality of speeds are arriving simultaneously at a detector, the target electrons move in reaction to the global force of all the flows. A given emission of frequency ν implements the same frequency in all the flows. That frequency will be ν when viewed in the reference frame of the source whatever the speed of the flows. It will also have the same Doppler shifted value ν' at all the flows when viewed in a reference frame that moves relative to the source. Like in the mainstream description of absorption, when the electrons of the detector are bound in the adequate way, they reemit a secondary radiation in the same direction of the incoming radiation but since the secondary radiation has the same frequency but opposite phase it cancels gradually the intensity of the incoming radiation. According to the model, such reemission of radiation and cancellation occurs not only for the flows of speed close to c (whose intensity is dominant once inside the local matter of the detector) but for the flows of all speeds. And once a flow is "destroyed" by matter interposed in its trajectory it will no longer affect other detectors in the same line of sight.

This feature presents some similarity with that of ordinary waves that neither have a fixed indestructible energy associated with *each* of its fragments but at most with the whole wave; for each fragment, it can perhaps be defined a ‘potentiality to release energy’, that comes into existence (as measurable energy) only during absorption and only at detectors placed where there is no destructive interference with other waves (or with other fragments of the original wave). To ‘destroy the energy release potentiality of a radiation flow’ would simply mean that the detector produces a destructive interference in such flow in such a way that the flow ceases to propagate behind the detector.

Note: it is inadequate to talk *in abstract* of the energy of *a* radiation flow of a given speed interval. The energy is not only a frame dependent concept but furthermore, in this model, the contribution of the aetherinos of a given speed to the energy collected at a specific detector depends on several factors like the speed of those aetherinos relative to the detector, the simultaneous arrival at the detector of other radiation flows in different phase relationships with the first, the instantaneous sensitivity of the detector due to the fluctuations of its local aether, etc... The model should be happy enough if it could predict that, when adding all the energies able to be collected (in any given description reference frame) at the different speed detectors, its sum is, not only finite but, equal to the energy that is known (by other independent means like its temperature decrease in the case of blackbody radiation) to have been released by the emitter.

Some experiments could be done to test these ‘many lights’ features of the proposed aether model.

For example: using a detector of fast speed relative to the description reference frame, the ‘many lights’ paradigm predicts that a brief pulse of light emitted at t=0 will be detected at an epoch *different* from t=d/c (where t is the epoch of detection of the light pulse and d is the separation in the description frame between 'the emitter at the epoch t=0 of emission' and 'the detector at the epoch of detection'). Therefore since d is the distance travelled by the light in the description frame and since t is the time elapsed between the emission event and the detection event, it will happen that the speed of light measured in the description frame by a moving detector is *not* c.

Or, using the Earth as the detector of the effective “light” (that of speed c relative to the Earth) of the many lights emitted by a distant star, the different speed of the Earth relative to the star in two opposite epochs of the year should show some illustrative effects if the star does not emit a constant radiation. See more in the analysis of the “Temporal Aberration” of Section 8 (http://www.eterinica.net/EVE8/Eve8.pdf).

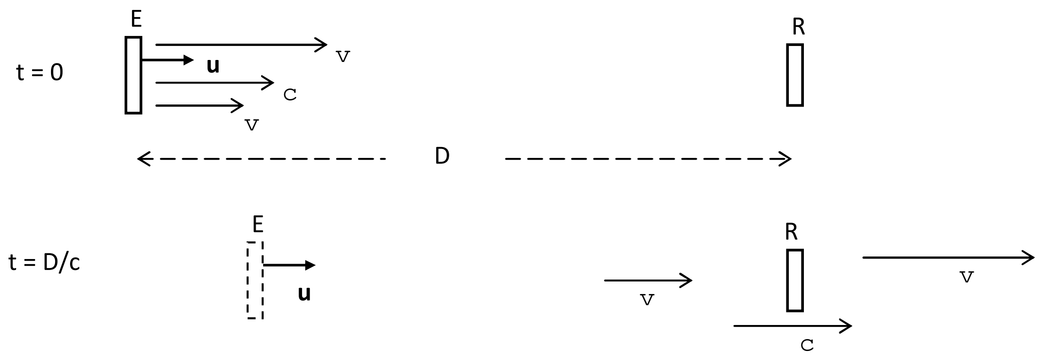
Force suffered by a detector due to standard radiation.

The force suffered by an elementary detector (e.g. an electron) due to the *aetherinical disturbance* that it receives from an emitter of radiation can be calculated as follows:

Let an emitter of light E be moving at constant speed u directly towards a detector (receiver) R and let R be at rest at all times in some rectilinear reference system which is used as the description frame.

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

[6-2] $$D[t] = D - u\,t$$

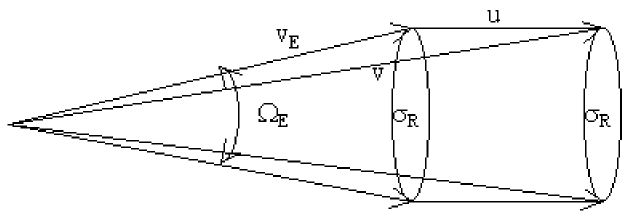


Fig[6-3]

Let σ_R be the area of the detector exposed to the light. It will be supposed by the time being that the detector is made by electrons that are *at rest* relative to the macroscopic detector as a whole (and are therefore at rest in the reference frame of description). Therefore, more precisely, σ_R should here be understood to represent the total geometrical cross section (to aetherino collisions) of those detecting electrons. The following calculus evaluates the total "aetherinical force" suffered by those detecting electrons when they are receiving light. Since those electrons are at rest in R, and since the emitter E is supposed to be moving along the straight line E-R, the force exerted by the pertinent aetherinos on any detecting electron is longitudinal, i.e. its component along any direction perpendicular to E-R is negligible (especially when the emitter and the detector are small compared with the distance D between them. See in Section 7 an analysis of the "transversal forces" predicted by the model).

Suppose that, at all the epochs t of activity at the emitter, the distance $D[t] >> \sigma_R^{1/2}$.
The sub index $_E$ will be used to denote aetherino speeds relative to the emitter E.
For aetherinos emerging the emitter and reaching the detector, the aetherinos of speed v_E (relative to the emitter E), will have a speed (relative to the detector) given approximately by:

[6-4] $$v = v_E + u$$



Fig(6-5)

At the epoch t, the emergent aetherinos of speed v_E (relative to E) that will be able to reach the area of the detector separated (in that epoch) by D[t] are those that emerge by a solid angle relative to the emitter given by:

[6-7] $$\Omega_E[v, t] \cong \frac{\sigma_R}{\left(D[t]\ \frac{v_E}{v}\right)^2} = \frac{\sigma_R\ v^2}{D[t]^2\ (v-u)^2}$$

Let
$r[v_E, t]\, dv_E\, dt$ = 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). The function $r[v_E, t]$ is what all along this work is being called a "redistribution" or a residual distribution.

Suppose that the emitter is active (emits light) only during the time interval $\{t_i, t_f\}$.
Therefore it will be supposed:
[6-8] $$r[v_E, t] = 0 \quad \text{for} \quad t < t_i \quad \text{or} \quad t > t_f$$

The residual distribution emerging E can also be expressed as a function of the aetherino speeds v *relative to* R:

[6-9] $$r[v_E, t]\, dv_E\, dt = r[v-u, t]\, dv\, dt$$

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

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

[6-10] $$v = \frac{D[t]}{T - t}$$

The aetherinos that depart E at the epoch t and arrive at R during the time interval {T, T+dT} are those with speeds (in the reference frame of description) in the speed interval {v, v+dv} where v is given by [6-10] and dv can be obtained by derivation of [6-10] respect to T (considering t a constant):

[6-11] $$dv = -\frac{D[t]}{(T - t)^2}\, dT$$

The number of aetherinos departed from E (by unit time) at the epoch t that collide with the target (of cross section σ_R) during the time interval {T, T+dT} is therefore:

$$n[T]\, dT = \Omega_E[v, t]\, r[v - u, t]\, dv =$$

where dv must be replaced by [6-11] (but neglecting its minus sign, see below)

[6-12] $$= \frac{\sigma_R\ v^2}{D[t]^2\ (v - u)^2}\, r[v - u, t]\, \frac{D[t]}{(T - t)^2}\, dT$$

and where v must be replaced by [6-10]. Substituting also D[t] by (D-u t) and simplifying:

[6-14] $$n[T]\, dT = \frac{\sigma_R\ (D - u\,t)}{(T - t)^2\ (D - u\,T)^2}\, r\left[\frac{D - u\,t}{T - t} - u,\ t\right] dT$$

Note: The minus sign of [6-11] reflects the fact that *increasing* dT allows for the arrival of aetherinos of *smaller* speeds emerged nevertheless at the same epoch t. When substituting dv by its function of dT (like has been done in [6-14]) such minus sign must be ignored because otherwise it changes incorrectly the sign of the expression.

Supposing (see Section 1) that an aetherino of relative speed v gives to the detector an *elementary aetherinical impulse* $h_1.v$ then the net aetherinical impulse given to the detector by those n[T] dT aetherinos emerged from E at the epoch t is:

[6-15] $$\delta i_t = h_1\, v\, n[T]\, dT = h_1 \frac{D - u\,t}{T - t}\, n[T]\, dT$$

The net aetherinical impulse received by R in the time interval {T, T+dT} due to all the aetherinos departed from E during all its interval $\{t_i, t_f\}$ of activity is therefore:

$$[6\text{-}16] \qquad di = \int_{ti}^{tf} h_1 \frac{D - u\,t}{T - t} n[T]\, dT\ dt$$

because at any given epoch T, the detector is simultaneously receiving a plurality of “radiation flows" emitted at different epochs at the emitter. (The different “flows” received at the epoch T have by definition different speeds ant hence they must have been emitted at different epochs).

The *aetherinical force* (defined as the net aetherinical impulse by unit time) suffered by R at the epoch T due to the activity of the emitter is:

$$F[T] = \frac{di}{dT} = h_1 \int_{ti}^{tf} \frac{D - u\,t}{T - t} n[T]\ dt =$$

[6-20]

$$= h_1 \int_{ti}^{tf} \sigma_R \frac{(D - u\,t)^2}{(T - t)^3\,(D - u\,T)^2}\ r\left[\frac{D - u\,t}{T - t} - u,\ t\right]\ dt$$

where:

$r[v_E, t]$ is the *redistribution of* aetherinos created by *the emitter* (i.e. the excess/deficit of aetherinos of speed v_E (relative to the emitter) emerging by unit time and by unit solid angle at the epoch t in the direction of the detector).

σ_R is the net collision *cross section of the electrons of the detector* exposed to radiation. If the detector consists of a single electron, then σ_R must be understood to be the cross section of the electron to aetherinical collisions. It is shown in other papers of this model that such cross section depends on the speed v of the colliding aetherinos relative to the electron and therefore it can be written as $\sigma_R[v]$ which in the present evaluation should be rewritten as $\sigma_R[(D - u\,t)/(T-t)]$ making explicit its dependence on t which is the reason why σ_R has been left inside the integral in Eq[6-20].

The Assertion C ("The speed of light in vacuum is c relative to the material detector with which it interacts") can a priori be considered a consequence of *either* the nature of the emission process or the nature of the detection process.

A justification of the Assertion C based on the nature of the emission (due to the specific form of the redistribution of aetherinos supposedly occurring at the emitters of light) is now considered obsolete since it seems unable to explain other physical facts. Its development may still be seen here: http://www.eterinica.net/EVE6/Appendix.pdf

In what follows it is considered that the Assertion C must be justified by the nature of the detection process.

The expression [6-20] of the force suffered by a detector of radiation has been tested under several assumptions about the redistribution $r[v_E,t]$ of aetherinos created by the source and assumptions about the cross section σ_R of the target electrons to aetherino collisions.

Since in this model of light the detector is receiving, at the same epoch T, flows of aetherinos of different speeds, emitted therefore by the source at different epochs t, and therefore with different intensity modulations, the model needs to assume some specific cross section of the detecting electrons so that the emitted modulation is recovered at the detector. The following three options have been analyzed:

Option 1. In this option it is assumed that:

- The cross section of the electron has a sharp resonance for aetherinos of relative speed equal to c

- The redistribution of aetherinos created by an electron that is emitting radiation can simply be described (in a first approximation) by an oscillation of the intensity of the so called "average (over all directions) redistribution of the electron".

Note: In other sections of this work it has been proposed that the average (over all directions) redistribution of aetherino speeds created by a *proton* can be approximated by $r_P[v_E] = - a_S\, v_E^4\, \mathrm{Exp}[-1.5\, (v_E/c)^2]$ and the average redistribution of an electron by $r_e[v_E] = - r_P[v_E] = + a_S\, v_E^4\, \mathrm{Exp}[-1.5\, (v_E/c)^2]$. The electron is supposed to have an intrinsic structure with an axial symmetry characterized by an axis of symmetry, called its PRA, that causes that the redistribution of aetherinos emerging from the electron depends on the angle that the velocity of the emerging aetherino makes with the PRA. Therefore the redistribution of an equal number of non-oscillating protons and electrons with their intrinsic axes randomly aligned is zero.

In the present "Option 1" it will be supposed that the *function* that characterizes the redistributions emerging from the electron along the different directions is *the same* (e.g. has the form $v_E^4\, \mathrm{Exp}[-1.5\, (v_E/c)^2]$) along all directions (whatever its angle with the electron's PRA) *but its intensity changes* with the direction. It will be supposed that when the electrons oscillate (or more precisely perform intrinsic rotations) with a frequency ν , the redistribution emerging from these electrons along the direction of the observer can be represented by $r_e[v_E]\, (1+ \mathrm{Sin}[2\, \pi\, \nu\, t])$. Since, in general, the protons of the emitter do not oscillate then the total redistribution emerging the emitter during its period of activity will be:

[6-42]

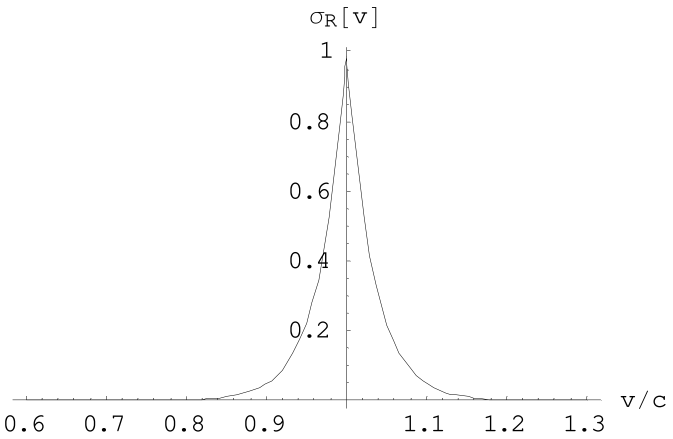
$$r_e[v_E,\ t] + r_P[v_E] = \left(a_S\, v_E^4\, \mathrm{Exp}\left[-1.5\, \frac{v_E^2}{c^2}\right]\right) (1 + \mathrm{Sin}[2\, \pi\, \nu\, t] - 1) =$$

$$= a_S\, v_E^4\, \mathrm{Exp}\left[-1.5\, \frac{v_E^2}{c^2}\right] \mathrm{Sin}[2\, \pi\, \nu\, t]$$

Suppose also that the cross section of the electrons of the detector to impulsion collisions with aetherinos of relative speed v is of the type:

[6-40] $$\sigma_R[v] = a_1 e^{-b_1 |v-c|}$$

where a_1 is a constant with dimension of area, b_1 is a constant with dimension of speed^{-1} and |v-c| is the absolute value of v-c. The following plot shows the behaviour of this cross section with its sharp resonance centred at v=c



Fig[6-40] Example cross section of the electron with a_1 =1 , b_1= 30/c

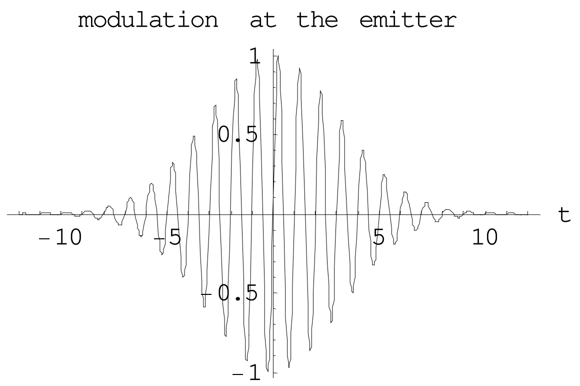
<u>Example</u>:

Suppose in this example that the emission of light in the direction of the detector consists in a *short duration pulse* implemented by an excess/deficit of aetherinos of speed v_E (relative to the emitter) given for example by:

[6-41] $$r[v_E, t] = a_S v_E^4 \text{Exp}\left[-1.5 \frac{v_E^2}{c^2}\right] \text{Exp}[-0.05 t^2] \text{Sin}[2 \pi \nu t]$$

where a_S is a constant.

In the emitted redistribution given by [6-41] has been introduced an additional factor Exp[$-0.05 t^2$] to restrain the activity of the emitter to a short time interval. In this example, the *modulation* Exp[$-0.05 t^2$] Sin[$2 \pi \nu t$] of the basic redistributions is, assuming a carrier frequency ν=1, of the type:



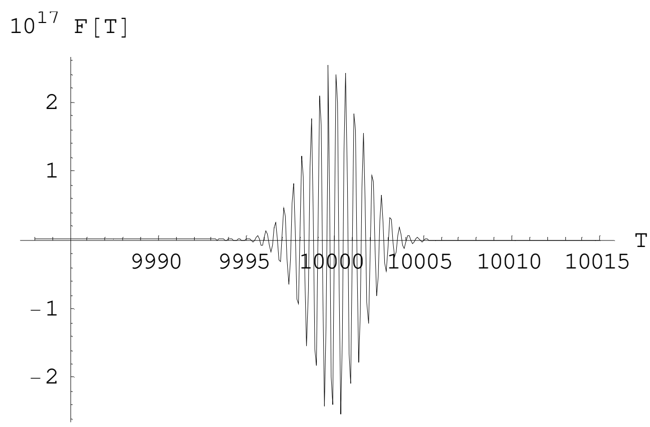
Fig[6-41] modulation Exp[–0.05 t^2] Sin[2 π ν t] with ν=1.

The force suffered by the detector electron at the epoch T can therefore be calculated by direct application of [6-20] replacing in its integrand:

- The cross section σ_R by its expression [6-40] but with a previous substitution of v by `(D-u t)/(T-t)` (see [6-2] and [6-10]).
- The redistribution r by its expression [6-41] but with a previous substitution of v_E by `(D-u t)/(T-t)-u`

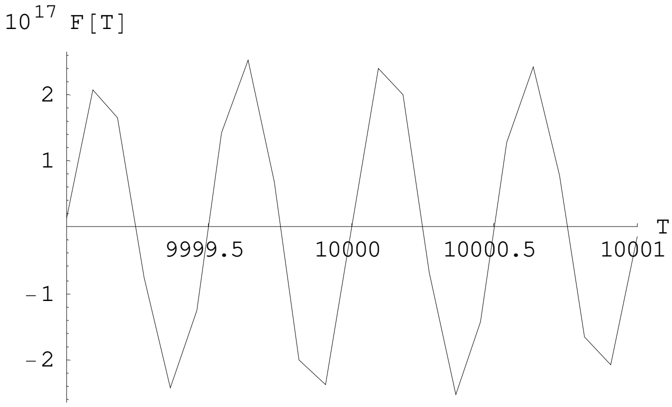
The force [6-20] of this example has been evaluated (with numerical integrations) for a set of closely spaced detecting epochs T in the interval $\{t_i+D/c-2/\nu,\ t_f+D/c\}$.
It has been taken: ν=1, c=1, u=0.5 c, a_1=1, b_1=30/c, a_S=1, D=10000
The integration has been restricted to the integration limits t_i = -15, t_f = 15 which seems reasonable observing Fig[6-41].

The following two plots show the results of these evaluations:



which shows that the pulse has propagated at a speed c *relative to the detector*.

And zooming at the epoch T=10000 at which is received the centre of the signal:



it is seen that, due to the Doppler effect, the detected frequency is in this example about twice the emitted frequency.

NOTE: In the later papers of this work it is proposed that the cross section of the electron (and also that of the proton) to aetherino collisions is not a sharp resonance (like [6-40]) but a function of the type:

[6-43] $$\sigma_I[v_R] = a_I \, \mathrm{Exp}[-b_I \, v_R^2]$$

where v_R is the speed of the colliding aetherino relative to the electron.

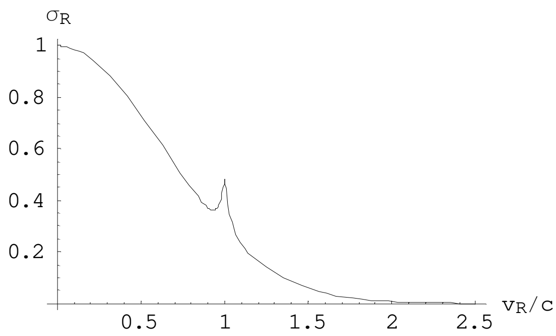
But the electron (and the proton) are supposed to have a anisotropous intrinsic structure and the cross section [6-43] must be considered an average over all directions of space. It could be that the average (over all directions) cross section of the electron is of the type [6-43] and nevertheless is of the sharp type [6-40] along some specific directions like for example when the aetherinos collide the electron along its "equator" (i.e. along the directions orthogonal to its PRA axis). It should then be added that as soon as the electron detects a force coming from a direction of space it reorients its PRA axis perpendicularly to such incoming direction.

Another, less extreme, possibility is that the average cross section of the electron is basically of the type [6-43] but includes a small but sharp resonance at v_R=c. A function describing this possible cross section could be:

[6-44] $$\sigma_I[v_R] = a_I \, (\mathrm{Exp}[-b_I \, v_R^2] + 0.2 \, \mathrm{Exp}[-b_1 \, | v_R - c |])$$

that is shown in the following plot taking

c=1, a_I=1, b_I = 1.255/c^2, b_1=30/c



Fig[6-44]

Possible cross section of the electron to aetherinos of relative speed v_R.

The calculus of the force suffered, at different epochs T, by a detecting electron has been repeated using this cross section [6-44] instead of [6-40] and the same qualitative results have been obtained.

With the assumptions of this Option-1 (and whatever type [6-40] or [6-44] for the electron's cross section to aetherino collisions), many other evaluations have been made of the force suffered by electrons due to an oscillating aetherinical disturbance (light) emitted at a distant emitter. Although the numerical integrations that have been done are not yet considered very reliable when the distance D is very big (i.e. for D >> c/ν), the results of the evaluations show that:

- When the disturbance emitted is *a short pulse*, the *amplitude* of the detected oscillating force decays with the distance approximately as $1/D^4$. But

- When the emitted disturbance is an everlasting (or of *very long duration*) oscillation of constant frequency ν then the *amplitude* of the detected oscillating force decays with the distance as $1/D^3$.

These decays, of the amplitude of oscillation of the detected force, with the distance are considered *too fast* to explain other physical facts.

Option 2. The following hypothesis have next been analyzed in this context of propagation of the light flows and conservation of the modulation.

- As in option 1, the redistribution of aetherinos created by an electron that is emitting radiation can simply be described (in a first approximation) by an oscillation of the strength of the so called "average (over all directions) redistribution of the electron".

- The cross section of the electron is such that *only the aetherinos of relative speed bigger than c are able to give it impulse*.

This last hypothesis will be called *hypothesis c+* (c plus). It is recognized that this hypothesis c+ is ad hoc, unphysical and difficult to justify.

(This hypothesis does not need to be true for collisions between aetherinos and other kinds of elementary particles).

In Section 1 it was postulated that the "elementary *aetherinical* impulse" given to a Simple Particle by an aetherino that collides with it with a relative velocity $\mathbf{v_R}$ is given by $\mathbf{i}_1 = h_1\, \mathbf{v_R}$. The present hypothesis c+ asserts that, at least for the electron, such postulate should be revised as follows:

$\mathbf{i}_1 = h_1\, \mathbf{v_R}$ for $v_R > c$

[6-50]

$\mathbf{i}_1 = 0$ for $v_R \leq c$

The above expression [6-20] of the force suffered by the electrons of the detector must be adapted, for example as follows:
The aetherinos of speed c that arrive to the detector at the epoch T have departed the emitter at an epoch t_c such that:

$$t_c + D[t_c]/c = T \quad \Rightarrow \quad t_c + (D - u\, t_c)/c = T \quad \Rightarrow$$

[6-51] $$t_c = (c\,T - D)/(c-u)$$

These aetherinos of speed c relative to the detector that departed the emitter at the epoch t_c are the earlier-emitted (slower) aetherinos whose impulse contributes to the force detected at the epoch T. This fact can be accounted for changing the limits of integration of [6-20] as follows:

[6-52]
$$F_{c+}[T] = h_1 \int_{Max(t_i,t_c)}^{Max(t_f,t_c)} \sigma_R \frac{(D-u\,t)^2}{(T-t)^3\,(D-u\,T)^2}\, r\left[\frac{D-u\,t}{T-t} - u,\; t\right] dt$$

where Max(*a,b*) is the *maximum* value between *a* and *b*.

The expression [6-52] must only be considered valid for observation epochs T later than t_f so as not to include contributions to the force coming from the "future".
Note: the integration limits of [6-52] are incorrect from a strict *theoretical* point of view but in the *practice* of the evaluations those limits give the correct result. For example, if the force is computed at an epoch T such that $t_c[T] > t_f$, the upper limit Max(t_f, t_c) allows for a contribution of an epoch t in which the emitter was inactive. But in that case the *lower* limit Max(t_i, t_c) of the integral is also equal to t_c and therefore the integral is correctly equal to zero for such epoch T.

Computations of [6-52] have been made for different values of the speed u (of E relative to R) and for different emissive functions r[v_E, t]. Those computations show that the hypothesis c+ has the following consequences:
- In vacuum, the information of the features of the emission (frequency, phase, modulation…) "propagates" at a *speed c relative to the detector,* or more precisely relative to the rectilinear reference frame of the detector at the epoch of detection. The

speed assigned to the radiation *detected* is therefore independent of the velocity of the emitter relative to the detector.
- If the emitter is (at the epoch of emission) moving relative to the reference frame of the detector (at the epoch of detection), the radiation detected appears Doppler-shifted according to the classic (Galilean) expression for an emitter moving in a medium in which the wave propagates at speed c.
- For both short lasting and everlasting (or very long) emissions the amplitude of oscillation of the force detected decays with the distance D as $1/D^3$

In both options 1 and 2 it has been observed that the mathematical function of the aetherinical redistribution (emerging by all directions) of the electron needs not be of the type
v_E^4 Exp[-1.5 $(v_E/c)^2$]) but can adopt in theory have a wide variety of mathematical forms without affecting the preceding predictions. This last feature gives the model much freedom to infer from other phenomena what is the form of the aetherinical redistribution created by the charged particles so as to explain other experimental facts (about forces, etc, not directly related with the speed of light).

Note:
When evaluating the amplitude of oscillation of the force F[T] (given in [6-20]) suffered by the detector at distances *d* (emitter-receiver) much bigger than the wavelength of the disturbance, it happens that:
-- for very short emissions (of only a few oscillations) the amplitude of oscillation of the force F[T] decays very fast with the distance, as fast as $1/d^4$

-- for long purely monochromatic emissions the amplitude of oscillation of the force decays with the distance as $1/d^3$
This decay $1/d^3$ of the amplitude of the force is too fast and the identity of the emission (carrier wave frequency, modulation,...) will be lost, at relatively short distances, obscured by the natural fluctuations of the aether. On the other hand it is considered that a decay of $1/d^2$ in the amplitude of the radiation force of the model will be able to make correct predictions about the energy transferred to the receiver (i.e. the amplitude of the force of the model needs not decay as 1/d like is the case for the oscillating electric and magnetic fields in the "electromagnetism" description of radiation).
Many attempts have been made to predict within the model a $1/d^2$ decay of the amplitude of the force (trying different assumptions about the type of emission and/or about a coupling, resonant, reaction movement of the elementary detector) but no success has been obtained with purely monochromatic emissions (whether coherent or non coherent). But later attempts seem to show that:

-- for *non purely monochromatic* emissions but assuming instead emissions *with a natural line width* (modeled in the evaluations by a finite set of monochromatic emissions of frequencies very close to the central one) a set of intensity "pulses" appear in the signal (due to space and time coincidences of the component waves).
Some evaluations (not yet analyzed in detail) show that *the height of those pulses decays with the distance according to* $1/d^2$
Those pulses in the intensity of the signal that appear (and disappear) in the model have *some similarity with* the mainstream paradigm of *photons*.

Comments about the light described in all these options

The disturbance computed in all the above examples, called F[T], corresponds to an aetherinical force in the direction E-R (i.e. in the longitudinal direction emitter-detector). This *longitudinal* force is controversial and not described by Maxwell electromagnetism. Furthermore the computed disturbance corresponds to an idealized case in which the "detector" remains strictly at rest in spite of being acted by the force. This is of course never the case in practice where the elementary detectors are charged particles of small mass (e.g. electrons). But if the elementary detectors are allowed to move in response to the radiation force that they suffer, then it is expected (according to this model) that (1) its instantaneous velocity will have a strong feedback influence on the amplitude of the displacements suffered by the detecting electrons, and (2*)* *transversal* forces and displacements will also occur as explained in Section 7. A precise computation of these "corrected" forces (when the target electrons are allowed to move) has not been done yet.

Bending of light rays when passing near massive bodies.
As said in the introduction of this work, the description of the main features of Fundamental Physics done with this model of the aether relies on Galilean relativity (including 3D Euclidean Space and Absolute Time). The description scheme (or conceptual frame) is considered a matter of free election that should only be judged *a posteriori* by its power to organize in an economic and simple way as much knowledge of the physical world as possible.
That implies that Special and General Relativity are left aside and the model cannot invoke the warping of space by massive bodies to account for the observed bending of light when it passes near massive stars, galaxies, etc. This model considers instead that Gravitation *is just a force* exerted by (and suffered by) material bodies with specific properties that account for their gravitation mass. See more in Section G of this work (at http://www.eterinica.net/EVEG/Force_between_neutral_bodies.pdf)
But since the aetherinos, that are the carriers of light, have no mass then the gravitation force can neither be invoked to explain the bending of light paths by massive bodies.
It is instead considered plausible that the observed bending of the light path by massive bodies can be explained as a *refraction* phenomenon when light goes through the circumstellar gas and dust that surrounds most celestial bodies. The gas and dust densities generally decrease the farther from the celestial body. Light interacts with those particles being reemitted at each step with a retarding phase. Light will therefore

travel at a lower speed when it crosses the denser parts (those nearer to the massive body) of the circumstellar "cloud". The gradient of speeds between those parts of the light that pass at different distances from the massive body will cause a bending of the light path towards the body.

Summarizing: The aether model of this work describes *light* as an 'angular spread', 'many flows' disturbance of the aetherinos distribution that despite its dominant wave features is able to manifest some 'apparently' corpuscular properties when interacting with matter.

Note: As said many times before, this work does not yet claim to make *quantitative* precise predictions. The mathematical equations presented all along this work just pretend to give hints of how the paradigms of the model can be developed. The main intention of this work is only to draw the attention on the plausibility of new and simpler description paradigms in fundamental Physics.

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Sub poissonian distribution of photoelectrons. (A computer simulation)

Experiments have been made in which the distribution of photoelectrons ejected by light is *sub-poissonian*. According to mainstream physics such sub-poissonian statistics is a signature that light is made of photons because, according to theoretical considerations (e.g. see section 5.8.1 of the book *Quantum Optics* of Mark Fox), a classical (wave-like) light can only produce either a super-poissonian or a poissonian distribution of photoelectrons. But those theoretical considerations rely on some suppositions about classical waves and their interactions with matter that are not considered valid in the aether-based semi-classical model of light.

It will now be shown that making instead other suppositions consistent with the proposed semi-classical model of light, some computer simulations show that, if stable light arrives to the detector, a sub-poissonian distribution of photoelectrons is obtained.

It has been explained above that light only ejects an electron at the detector (e.g. by the photoelectric effect) when the aether noise affecting the electron during the arrival of the wave is smaller than some value related with the intensity of the incident wave. The higher the intensity of the wave the bigger is the maximum noise that can suffer the target electron without destroying its photoejection.

The computer simulation samples the aether noise that supposedly affects the electron at many successive instants during a user-defined time interval ΔT. To evaluate the aether noise at a given instant (epoch) a count is made of the number of aetherinos contained in some specific small volume of space in the vicinity of the target electron. Such specific volume of space will be called *reference region* of the electron. The aether noise at any given epoch is assumed to be given by the actual *fluctuation* in the region's number of aetherinos or more precisely by the modulus of the difference between the number of aetherinos at the given epoch and the mean (time average) of such number.

For example, the noise samples are obtained as follows:

Let the reference region have a volume such that the average (mean) number of aetherinos that it contains is n_M

Suppose that at the beginning of the user-defined time interval ΔT the reference region contains a number of aetherinos $n_r[0]$ equal to the average n_M.

Suppose that the number of aetherinos in the reference region is counted a big number of times all along ΔT, every $\Delta\tau$ seconds. In the simulation it has been assumed that $\Delta T/\Delta\tau$ is equal to 10000 and therefore the noise at the user-defined time interval is sampled at 10000 different epochs. Let $n_r[i]$ be the number of aetherinos contained in the reference region at the i^{th} epoch.

Suppose that every $\Delta\tau$ there are n_E Random[] new aetherinos that, coming from the environment aether, *enter* the reference region.

Suppose that every $\Delta\tau$ there are n_E Random[] $n_r[i - 1]/n_M$ aetherinos that *exit* the reference region. Note: the factor $n_r[i - 1]/n_M$ somehow accounts for the fact that the number of particles that exit in unit time an open region of space is proportional to the number of particles contained in such region.

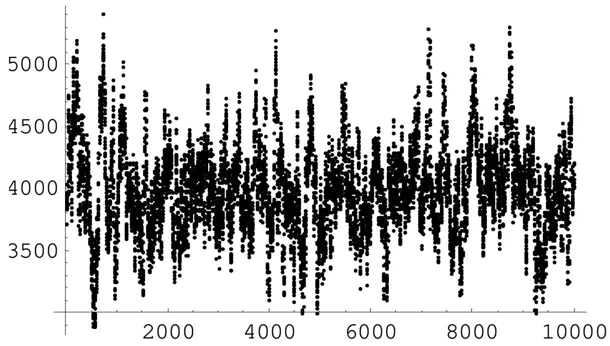
Note: Random[] represents a random real number bigger than 0 but smaller than 1.

In *Mathematica* (of Wolfram Research) such sampling of the number of aetherinos at the epochs {1,2,…i,…,10000} can be obtained with the following instructions:

```
nM=4000;

nr[0]=nM;

nE=200;

Table[increase=IntegerPart[nE*Random[]-nE*nr[i-1]/nM
Random[]];nr[i]=nr[i-1]+increase,{i,1,10000}];
```

And the following graphic shows how the number of aetherinos of the region fluctuates in time along a time interval ΔT:

```
Tnr=Table[nr[i],{i,1,10000}];

ListPlot[Tnr]
```



Suppose that the radiation incident on the detector is monochromatic and of constant intensity. Let I_{rad} be the constant intensity of the radiation.

By hypothesis such radiation ejects photoelectrons from an elementary detector at a rate conditioned by:

(1) The elementary detector has had time to recover from its earlier ejection. The recovery time of an elementary detector will be supposed to be Δt_R

(2) The target electron is in a state of movement adequate to interact with the incident radiation. It can be supposed that the proportion of time during which the electron can interact with the incident radiation is proportional to the quantum efficiency of the detector. The simulation decides randomly (with some specific probability related to the quantum efficiency of the detector) if the electron couples with the radiation and is ejected.

(3) The aether noise at the electron's reference region is smaller than the intensity I_{rad} of the incident radiation. (It must be understood that since the aether noise (as defined above) and the intensity of a radiation are not dimensionally equivalent their comparison needs some relation constant that is obviated in the simulation).

For example, in arbitrary units:

Let the recovery time of the elementary detector be $\Delta t_R = 50\ \Delta\tau$ where, as said above $\Delta\tau$, is the time interval between the successive samples of the aether noise.

Let $\Delta\tau = 1$

Let the intensity of the radiation be $I_{rad} = 150$

Let the quantum efficiency of the detector be 0.65 (i.e. of a 65%).

The following *Mathematica* instructions (together with the above ones) deduce in a probabilistic way the number of photoelectrons ejected during a user-defined time interval ΔT equal to 10000 Δτ :

```
Δτ=1;

ΔtR=50 Δτ;
```

```
Irad=150;
```

```
photoelectrons=0;Table[If[Abs[nr[j]-nM]<Irad &&
Random[]<0.65,photoelectrons=photoelectrons+1],{j,1,10000Δτ
,ΔtR/Δτ}];
```

Repeating 200 times (i.e. obtaining the number of photoelectrons ejected in 200 different time intervals (all of them of duration ΔT) and finding first, for each try, a new set of random fluctuations:

```
repeat=200;
```

```
For[k=1,k<=repeat,nr[0]=nM;Table[increase=IntegerPart[nE*Ra
ndom[]-nE*nr[i-1]/nM Random[]];nr[i]=nr[i-
1]+increase,{i,1,10000}];photoelectrons=0;Table[If
[Abs[nr[j]-nM]<Irad &&
Random[]<0.65,photoelectrons=photoelectrons+1],{j,1,10000Δτ
,ΔtR/Δτ}];ejected[k]=photoelectrons;k++];
```

A distribution similar to the following is obtained:

```
results=Table[ejected[k],{k,1,repeat}]
```

```
{44,44,32,40,39,36,44,34,32,52,37,42,37,48,50,42,52,48,38,4
7,44,45,42,41,37,37,39,40,29,52,36,39,50,46,35,46,46,42,40,
36,46,47,39,36,41,45,37,47,43,35,40,36,44,38,32,45,45,47,38
,59,40,36,32,44,41,40,33,42,40,44,37,38,38,47,42,35,42,38,4
2,51,36,45,38,46,43,39,44,50,52,39,40,42,42,33,40,44,43,39,
41,48,43,48,42,39,38,50,45,36,31,43,36,38,44,48,28,43,47,28
,44,37,37,43,43,52,35,43,42,34,35,39,46,45,41,39,42,39,44,4
4,41,40,48,29,39,38,47,56,38,40,36,47,36,42,44,39,42,35,42,
46,45,34,40,48,53,38,53,32,34,37,44,40,54,36,37,37,33,35,42
,36,40,49,43,43,40,43,39,40,36,42,35,45,48,44,47,40,36,42,4
7,42, 30,46}
```

Whose average is:

```
avg=N[Mean[results]]
 41.235
```

and whose variance is:

```
var=N[Variance[results]]
 30.4319
```

And remembering that a Poisson-type distribution is called:

poissonian when its variance = average

sub-poissonian when its variance < average super-poissonian when its variance > average

the distribution of photoelectrons obtained in the above simulation is sub-poissonian.

Other simulations have been made changing one or more of the variables. For example:

Changing the intensity of the radiation (only) it has been found:

Irad=75   gives a distribution of (approximately) average=21 and variance=17 and hence again sub-poissonian.

Irad=300   gives a distribution of (approximately) average=76 and variance=43 and hence again sub-poissonian.

With a smaller "quantum efficiency" implemented for example with the condition Random[]<0.1 (instead of Random[]<0.65) and with a radiation intensity Irad=150 a distribution is found of (approximately) average=6.37 and variance=6.42 and hence now *super-poissonian.*
