Redistributions of aetherinos by elementary particles.

Version 12-Sep-2011 with small revisions at 22-Apr-2013, 28-Apr-2014 , 25-Jul-2014, 25-Feb-2015, 19-Mar-2015, 17-Jul-2019, 3-Aug-2019, 21-Oct-2020, 18-Nov-2020

NOTE: In older versions of this model it was assumed that the aether is made of aetherinos[1] of a *single type*. A description of the fundamental forces between material particles was carried out with the help of a few additional hypothesis: (1) concerning the impulses that the aetherinos give to the material particles when they collide with them; and (2) concerning the *velocity changes* suffered by the aetherinos when they collide with the material particles. The redistribution of aetherino speeds depended on the type of matter with which they collided. The two types of matter assumed in the older versions had resonances to aetherino collisions at different relative speeds and changed the speeds of the colliding aetherinos in different amounts).
One problem was that, assuming that the aether is made of aetherinos of a single type, the description of the fundamental forces between elementary particles seems only possible with additional hypothesis (concerning the impulses on the particles and the velocity changes of the aetherinos) that are quantitatively different for a particle and its antiparticle (e.g an electron and a positron). Such lack of symmetry did not seem correct (considering the deep symmetry found in nature between the elementary particles and its antiparticles).
The older description has been replaced by what follows.

It will be supposed that:

1) There are *two* types of matter characterized by the specific way in which they affect and are affected by the aetherinos that collide with them:

- *matter type p* that would correspond to the matter of the elementary particles of positive electric charge.
- *matter type n* that would correspond to the matter of the elementary particles of negative electric charge.

The particles of zero electric charge would be composite particles made by charged, more elementary particles, whose redistributions cancel each other.

Due to the forces that an elementary particle made of "type-n matter" exerts on other elementary particles and due to the forces that it suffers from other elementary particles it can be understood that type-n matter implements the behavior of matter with *negative electric charge*. Similarly type-p matter implements the behavior of matter with *positive electric charge*.

Note: According to the model, the majority of the material particles called "elementary" in mainstream Physics could be considered *composite* particles (CP) made by a bound system of several more elementary particles, made of a single type of matter, which are the ones that ultimately collide with the aetherinos.

[1] The aetherinos are point-like entities of a new special nature and will not be called "particles" to avoid confusion with the material particles of Physics. The aetherinos do not collide with themselves but only with the material particles. The aetherinos have no spin, no mass, etc,… although, like the massless photons of mainstream physics, they can give impulse to the material particles, (but the aetherinos are not photons).

2) There are *two* types of aetherinos that will be called *p* and *n*.

3) There are two types of interactions of the aetherinos with elementary particles: "*Impulsion interactions*" and "*Switch interactions*".
In the "impulsion interactions" the aetherino gives impulse to the particle with which it collides (i.e. it changes the velocity of the collided particle).
In the "switch interactions" the aetherino changes its type (i.e. from *n* to *p* or vice versa) but does not give impulse to the collided particle. This "change of type" of the aetherino does not take place in the former "impulsion interactions".

The type of interaction that takes place depends on the type of matter and on the type of aetherino involved in the collision, as follows:

Impulsion interactions:

4) The n-type aetherinos are able to make "impulsion interactions" with particles of n-type matter. In these interactions a n-aetherino gives impulse to the particle with which it interacts. Similarly:
5) The p-type aetherinos are able to make "impulsion interactions" with particles of p-type matter (but not with those of n-type matter). In these interactions a p-aetherino gives impulse to the particle with which it interacts.
6) Both kinds of matter have a cross section to *impulsion interactions* (with its corresponding type of aetherinos) given by the same function (i.e. the same dependence on the relative speed v_R of the colliding aetherino). (This is not believed to be a necessary hypothesis of the model but just an operative hypothesis to make further descriptions and predictions).
This cross section of an elementary particle to *impulsion* collisions with its corresponding type of aetherinos is given *by hypothesis* by:

[R-1] $$\sigma_I[v_R] = a_I \ \mathrm{Exp}[-b_I \ v_R^2]$$

where:
v_R is the speed of the incident aetherino relative to the particle.
a_I is a constant, with the dimension of area (L^2), specific of the elementary particle.
b_I is a constant, with the dimension of speed $^{-2}$ ($T^2 L^{-2}$), of the same value for all elementary particles.

As usual in physics, a collision "cross section" is a physical magnitude with the dimension of area that is proportional to the probability that the interacting particles (in this case an aetherino and an elementary particle) make an effective collision. In this case, such probability depends on the speed v_R of the aetherino *relative* to the particle.

In the impulsion-interactions, when an aetherino (of the appropriate impulsion-type) collides with a material particle it gives to this particle an *elementary aetherinical "impulse"* that by definition is equal to

[R-2] $$\mathbf{i}_1 = h_1 \mathbf{v_R}$$

where $\mathbf{v_R}$ is the velocity of the aetherino *relative to the particle* and h_1 is a positive constant with the dimension of "mass" (though the aetherinos don't have mass).

As explained before in this work, the so called *aetherinical impulse* is just an *auxiliary concept* with which to define the *aetherinical force* as the net aetherinical impulse by unit time suffered by a material particle.

The velocity change suffered by an elementary particle in an "*impulsion interaction*" by an aetherino is by hypothesis:

[R-3] $$\Delta \mathbf{v} \;=\; \mathbf{i}_I / \mu_P \;=\; h_I / \mu_P \;\; \mathbf{v_R}$$

where μ_P is a positive constant, specific of the collided particle, that the model identifies as its *inertial mass*.

Note: Additional hypothesis of these *impulsion interactions* could be that the interacting aetherino suffers itself a velocity change either in direction or in modulus or in both, but for simplicity of this introduction to redistributions, it will be assumed by the time being that, in an *impulsion interaction* with an elementary particle, the aetherino does not change its velocity. (See more in the parenthesis below).

<u>*Switch interactions*</u>:

In these *switch* interactions the aetherinos suffer a change from on type to the other. More precisely:
7) The n-type aetherinos suffer *switch* interactions when they collide with an elementary particle made of type-p matter (but not with a type-n one). In these interactions the n-type aetherinos are transformed into p-type aetherinos.
8) The p-type aetherinos suffer *switch* interactions when they collide with an elementary particle made of type-n matter (but not with a type-p one).). In these interactions the p-type aetherinos are transformed into n-type aetherinos.
9) Both kinds of matter have a cross section to *switch interactions* given by the same function (i.e. the same dependence on the relative speed v_R of the colliding aetherino). (This is not believed to be a necessary hypothesis of the model but just an operative hypothesis to make further descriptions and predictions).
An additional assumption of these *switch* (non-impulsion) interaction is that
10) The collided particle does not suffer any velocity change

This cross section of an elementary particle to *switch* collisions (with aetherinos of their opposite type) is given by hypothesis by:

[R-5] $$\sigma_S[v_R] = a_S \;\mathrm{Exp}[-b_S \; v_R^{\,2}]$$

where:
v_R is the speed of the incident aetherino relative to the particle.
a_S is a constant, with the dimension of area, specific of the elementary particle.
b_S is a constant, with the dimension of speed $^{-2}$, of the same value for all elementary particles.

Notice that both cross sections σ_I and σ_S are, by hypothesis, described by the same function.

Note: Additional hypothesis of these *switch interactions* could be that the interacting aetherino suffers itself a velocity change either in direction or in modulus or in both, but for simplicity of this introduction to redistributions, it will be assumed by the time being that, in a *switch interaction* with an elementary particle, the aetherino maintains the same velocity that it had before switching type in the collision. (See more in the parenthesis below).

Canonical distribution of the aether.

In the reference frame in which the aether can be considered at rest (i.e. in which the average *velocity* of its aetherinos is zero), the aether has, by hypothesis, an isotropic distribution of aetherino *speeds* given by:

[R-6] $$\rho[v] = \frac{4 N_0}{\sqrt{\pi}\, V_M^3} v^2 e^{-(v/V_M)^2}$$

where
$\rho[v]$ is the number of aetherinos (including both types p and n) of speed v by unit volume and by unit speed interval.
V_M is the speed for which there is a maximum number of aetherinos (i.e. for which the distribution reaches its maximum).
N_0 is the *total* (considering all speeds) number of aetherinos in unit volume.

$$\int_0^\infty \rho[v]\, dv = N_0$$

- The constant factor $4/(\pi^{1/2} V_M^3)$ in the expression of the distribution has been written so that, whatever V_M, the constant N_0 always represents the total number of aetherinos by unit volume (as shows the above integral). This makes easier to test the model for different V_M.
- The $\rho[v]$ of [R-6] is also called the *canonical distribution* of aetherino speeds of the local undisturbed aether. (By "undisturbed" it is meant that its distribution is not sensibly disturbed by radiation nor by the redistributions of nearby material particles).
- It could happen that very far away from our galaxy the distribution of "the local at rest aether" has a quantitatively different distribution (i.e. with significantly different values of N_0 and/or V_M). It could happen that at an epoch very different from our "present epoch" the distribution of the local at rest aether has a quantitatively different distribution (i.e. with significantly different values of N_0 and/or V_M).
It could happen that very far away from our galaxy or very far away in time the reference frame in which the local aether can be considered at rest aether is a frame that is moving relative to the reference frame in which our *local* aether can *today* be considered at rest (e.g. in an expanding universe).
- By hypothesis, approximately half of that number $\rho[v]$ of aetherinos are of the p-type and half are of the n-type.
- As said elsewhere in this work, there are many possible mathematical functions that can *a priori* be assigned to the canonical distribution of the aether, giving all very similar predictions. Considering that the aether of the model, made of "point-like aetherinos that do not collide with each other", is not comparable to a gas in thermodynamic equilibrium, it is *not* imperative to postulate an aether's canonical distribution of the Maxwell-Boltzmann type. (As just said, it has been checked that with many other non-Maxwell-Boltzmann distributions the predictions for the phenomena treated in this article are very similar to the ones shown below).

Redistribution of a material particle.

As postulated above, when the aetherinos collide with an elementary they re-emerge from the collision either unchanged (impulsion interactions) or with a different identity (switch interactions). An *electrically charged particle* (with an unequal amount of type-p and type-n matter) bathed by the aether will create, due to the switch interactions, a *redistribution of aetherinos*.
Due to the switch interactions, the aetherinos re-emerge from a particle with a distribution that is different from that of the standard undisturbed aether (or more precisely, is different from the distribution of aetherinos (types and velocities) that would emerge from the region of space assignable to the particle if this particle was not there).
Due to this redistribution, a "particle with electric charge" exerts a force on another charged particle (since the latter will receive from the "side" of the redistributing particle a distribution of impulsion aetherinos different from the distribution that it receives on the opposite "side" from the undisturbed aether).

The *redistribution* $r[v_R]$ of a material particle is defined in the model as the "excess or deficit *number* of aetherinos of speed v_R (relative to the particle that creates such redistribution) emerging from the particle by unit time, by unit solid angle and by unit speed interval". (Its dimension is $1/(T\ LT^{-1}) = L^{-1}$).

(The *excess* or the *deficit* are in relation to the number of aetherinos of that speed that would emerge from a region of space of the "size" assignable to the particle if this particle was not there).

Suppose for example an electron E *at rest* in an aether that has a canonical distribution of aetherino speeds. See [R-6].
This electron E will receive impulse from the n-type aetherinos that collide with it and it will as well transform the p-type aetherinos that collide with it into n-type aetherinos.
The electron is, in the following simplified description, interpreted to be an elementary particle, with no intrinsic anisotropy, whose cross sections (impulsion and switch) do not depend on the direction of incidence of the aetherino relative to the electron.

The number of p-type aetherinos (of the undisturbed local aether) of speed v colliding with the electron by unit time and by unit solid angle can be calculated to give:

[R-8] $$\phi_{Ep}[v] = \sigma_S[v]\ \frac{\rho[v]}{2}\ \frac{v}{4\pi}$$

Notice that:
* $\sigma_S[v]$ is the cross section of the electron to p-type aetherinos, i.e. the function expressed in [R-5]. Since the electron is at rest in the aether, the speed v_R of the incident aetherinos relative to the electron is equal to the speed v of those aetherinos relative to the aether (as a whole) and that is why the sub-index $_R$ of the speed has been dropped in this case.
* $\rho[v]/2$ is the number of p-type aetherinos (approximately half of the total) with speed v in unit volume of the local aether (see [R-6]). (It has been supposed that such local aether has a canonical distribution).

In this case in which the electron is at rest in the aether, the rate of collisions $\phi_{Ep}[v]$ does not depend on the direction of the velocity **v** of the aetherino relative to the electron but only on its relative speed v. That non dependence of the rate of collisions on the direction implicitly supposes that there is isotropy in the electron's structure. (But, below, it will be asserted that the electron has an intrinsic anisotropy (with axial symmetry) and therefore the isotropy invoked here must be understood as the average behavior of anisotropous electrons randomly oriented in space).

Then, since those $\phi_{Ep}[v]$ p-type aetherinos that collide with the electron "disappear" in the collision (because they are switched into n-type aetherinos), the *redistribution of p-type aetherinos created by an electron at rest in the aether is* given by:

[R-9]
$$r_{Ep}[v] = -\,\phi_{Ep}[v] \;=\; -\,\sigma_S[v]\,\frac{\rho[v]}{2}\,\frac{v}{4\pi} \;=\; -\,\frac{a_S\;N_0}{2\,\pi^{3/2}\,V_M^{\;3}}\;v^3\;e^{-\,b_S\,v^2}\;e^{-\,(v/V_M)^2}$$

and since those deficit p-type aetherinos are transformed into n-type aetherinos, the redistribution of **n-type** aetherinos created by an electron at rest in the aether is given by:

[R-10]
$$r_{En}[v] \;=\; +\,\phi_{Ep}[v] \;=\; -\,r_{Ep}[v]$$

Similarly, a *positron* P (considered in this description context to be, like the electron, an elementary particle, with no intrinsic anisotropy), when at rest in the aether suffers, by unit time and by unit solid angle, a number of collisions with n-type aetherinos given by:

[R-11]
$$\phi_{Pn}[v] \;=\; \sigma_S[v]\,\frac{\rho[v]}{2}\,\frac{v}{4\pi} \;=\; \phi_{Ep}[v]$$

that it switches into p-type aetherinos.
It has been assumed that the switch cross section $\sigma_S[v]$ of the positron (to transform n-type aetherinos into p-type ones) is equal to the switch cross section of the electron (to transform p-type aetherinos into n-type ones).

The redistribution of the n-type aetherinos created by a positron at rest in the aether is therefore:

[R-12]
$$r_{Pn}[v] = -\,\phi_{Pn}[v] \;=\; -\,\sigma_S[v]\,\frac{\rho[v]}{2}\,\frac{v}{4\pi}$$

and the redistribution of **p-type** aetherinos created by a positron at rest in the aether is:

[R-14]
$$r_{Pp}[v] \;=\; +\,\phi_{Pn}[v] \;=\; -\,r_{Pn}[v]$$

Examples:

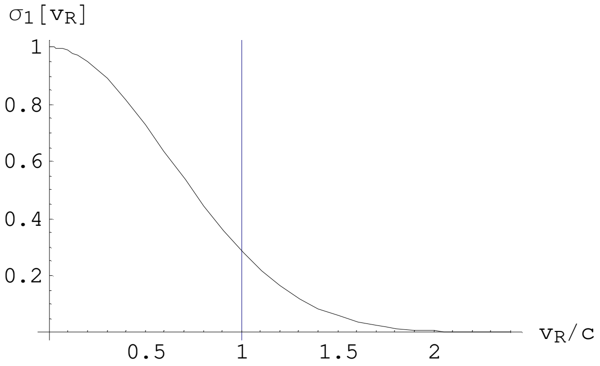
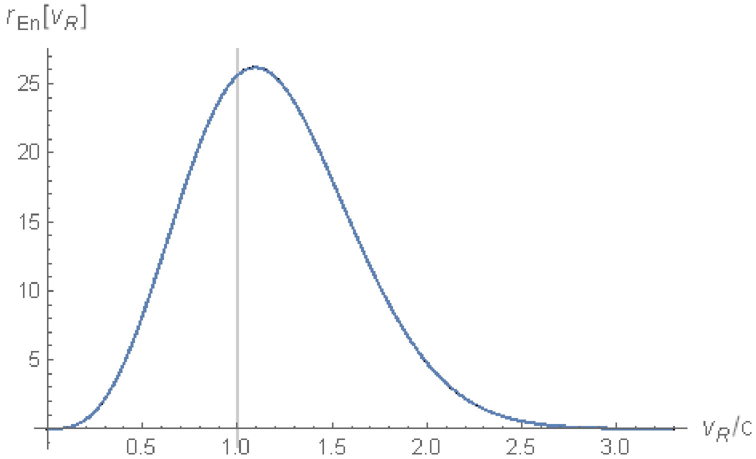


Fig [R-1]

In arbitrary units, **cross section** of an electron to *impulsion* collisions with n-type aetherinos of relative speed v_R (taking $a_I=1$, $b_I=1.255/c^2$). See Eq[R-1].
The same function of v_R also describes the cross sections of (2) an electron to *switch* collisions with p-type aetherinos (3) of a positron to *impulsion* collisions with p-type aetherinos and (4) of a positron to *switch* collisions with n-type aetherinos



Fig[R-10]

In arbitrary units, average **redistribution** of n-type aetherinos created by an electron at rest in the aether.
(v_R is the speed of the aetherinos relative to the electron),
(taking $a_S=1$, $b_S=1.255/c^2$, $V_M=10^{14}$ c, $N_0=10^{45}$). See Eq[R-9].

As a consequence of such *redistributions* of aetherinos, the material particles exert forces on other material particles. For example, in the case of two "isolated" material particles, they each suffer the impulses of the redistributed aetherinos coming from the other particle together with the impulses of other aetherinos of the aether that reach it from all other directions. The *net aetherinical impulse in unit time* suffered by the particle is what is being called *aetherinical force.*

Parenthesis:

It has been supposed above that in an impulse interaction of an aetherino *with an elementary particle*, the colliding aetherino does not change its velocity (and neither its type) and therefore only the switch interactions contribute to the *redistribution* of aetherinos created by the elementary particles.
But it is not discarded that, to explain other physical facts, the model might need to postulate that there are elementary particles that, when collided by an "impulsion aetherino", *this aetherino changes its velocity*. In this case the redistribution of such elementary particles will no longer be given by the simple expression [R-9].
It is neither discarded that there are elementary particles that, when collided by a "switch aetherino", *this aetherino changes not only its type but also the velocity* that it had (before switching its type).

There are many physical facts about the elementary particles, e.g. their spin and magnetic moment, that suggest that most of the elementary particles (like for instance the proton, the neutron, the electron and their antiparticles) have an internal anisotropic structure. The model (of aetherinos) is then challenged to describe the behavior of those particles with anisotropic redistributions, i.e. by redistributions that depend on the direction of emergence of the aetherinos relative to some internal direction (or directions) of the elementary particle.

There are two evident options to implement those anisotropic redistributions:
1) Supposing that the switch interaction cross section σ_S between an aetherino of relative speed v_R and the particle is the same whatever the direction of the incident aetherino relative to the particle (e.g. is of the type $\sigma_S[v_R] = a_S \ \mathrm{Exp}[-b_S \ v_R^{\ 2}]$ where the constant a_S does not depend on the direction) but assuming that the aetherinos change their direction in the interactions and remerge with higher probability in some directions than in others. Or

2) Supposing that the interaction cross sections of the aetherinos with those (anisotropous) particles depend on the direction of incidence of the aetherinos relative to the particle (or more precisely, relative to some direction singularized by its inner structure) and therefore assuming that the constant a_S (and probably also the constant a_I) depends on the direction of incidence of the aetherino relative to the particle.

Furthermore, the model aims to describe the main features of the "*strong force*" invoking anisotropies (e.g. with axial symmetries) in the redistributions emerging from the particles that suffer the strong force (e.g. the neutron and the proton). For example:

In the case of *the proton*,
- suppose that the n type aetherinos incident on the proton from all directions have a probability of being switched into p type aetherinos that depends not only on their relative speed but also on their direction of incidence relative to the inner structure of the proton. Suppose for example that the switch probability is much higher when their direction of incidence is at small angles with the two semidirections of its PRA and tends to zero probability when their direction of incidence is at small angles with the equatorial plane of the proton.
(The n-type aetherinos incident on a proton that don't succeed to perform a switch interaction, would follow their way with the same velocity).

Supposing again that the only aetherinos able to give impulse to the proton are still the p-type aetherinos and that their impulsion probability has the same directional dependence of the switch

probability, then when two protons are placed close to one another with their PRA perpendicular to the straight line joining the protons, those protons should no longer repel each other.
Two protons with their PRA randomly aligned, would still repel each other in the majority of cases.

In the case of _the neutron_,
Following the same paradigms, an anisotropic redistribution model could be sorted out *for the neutron*: (The neutron would also have a symmetry axis, the neutron would be able to switch the type of both types of aetherinos but each type of aetherinos would only suffer a switch if its angle of incidence relative to the symmetry axis of the neutron has the adequate values. On the average of all directions, the same number of p-type and n-type aetherinos emerge from a neutron. The aetherinos able to give impulse to a neutron would be either the n-type or the p-type aetherinos depending on their direction of incidence relative to the symmetry axis of the neutron, ...).
Then again, when two neutrons (or a neutron and a proton) are placed close to each other with some adequate alignments of their PRA, they would attract each other.
Two neutrons (or a neutron and a proton) with their PRA randomly aligned, would still exert a negligible force on each other in the majority of cases.

In the case of _the electron_,
The *electron* does not suffer the strong force but other facts suggest that it should also be assigned an anisotropic inner structure and redistribution. For example it could be supposed that the differential (directional) cross section of the electron to collisions with p-type (switch-type for the electron) aetherinos *is much smaller* but not zero for aetherinos incident at small angles with its PRA and much bigger when their direction of incidence is at small angles with the equatorial plane of the electron.
(The p-type aetherinos incident on an electron that don't succeed to perform a switch interaction, would follow their way without changing their velocity).
It should also be supposed that the only aetherinos able to give impulse to the electron are the n-type aetherinos and that their impulsion probability has the same directional dependence of its switch probability.

Note: The specific anisotropic redistributions of the proton and of the electron just described are only examples to illustrate the description and must not be considered definitive hypothesis of the model since their capabilities to predict non-radiative atomic stable orbits (and a quasi stable neutron) have not yet been studied with detail.

Aetherinical **forces** between two elementary particles.

An *aetherinical force* is defined as the net aetherinical impulse by unit time suffered by a material particle.

Supposing here a high rate of aetherino impulsion-type collisions, the acceleration "**a**" of the particle is related to the aetherinical force that it is suffering by

$$[\text{R-18}] \qquad \mathbf{F} = \frac{1}{\Delta t}\sum_{j}^{n}\mathbf{i}_{1j} = \frac{\mu_P}{\Delta t}\sum_{j}^{n}\Delta\mathbf{v}_j = \mu_P\,\mathbf{a}$$

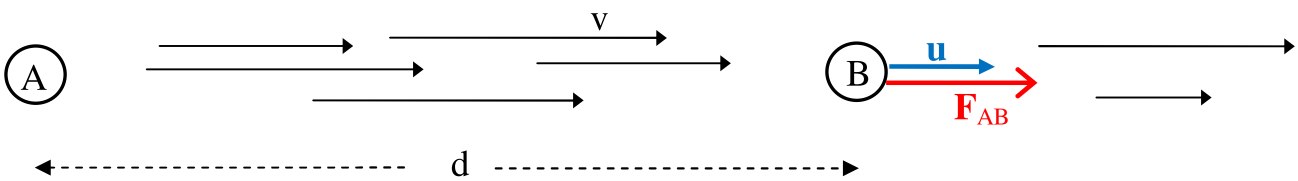
where "n" is the total number of elementary aetherinical impulses suffered by the particle during the time interval Δt, and
where the hypothesis [R-3] $\Delta\mathbf{v} = \mathbf{i}_1 / \mu_P$ has been applied.

But for the relation [R-18] to be a continuous function of continuous derivative, that can be ascribed to the domain of Classical Mechanics, the evaluations of the "instantaneous" acceleration and aetherinical force must be done using time intervals Δt *big* enough to allow that, during them, the number "n" of aetherinical collisions suffered by the particle has *statistical significance*. (Of course, at the same time, the intervals Δt must not be bigger than the time resolution wanted for the description). Otherwise the description domain would be that of Quantum Mechanics and the law [R-18] would cease to be adequate for the description. But on the other hand, if the system being described is the global behavior of a *big number* of elementary particles subject to some aetherinical force, the interval of temporal discrimination can be partly reduced without departing the domain of Classical Mechanics since now the statistical validity of the law relating the net aetherinical force with the global acceleration of the system of particles is again guaranteed by the great number of collisions taking place in these, now shorter, time intervals.

Example. Aetherinical *frontal* force between two elementary particles.

(by "frontal" it is meant that the target particle B moves *directly away (or towards for u<0)* from the particle A (here considered the "origin" of the force) along the straight line joining them, like in Fig[R-20])

The following example analyzes the force that an elementary particle A at rest in the aether exerts on another elementary particle B moving *directly away (or towards)* the first with a velocity **u.** The velocity **u** of B, target of the force that wants to be evaluated, has the direction of the straight line joining both particles. Let the *reference frame of description* (to which are referred in particular the speeds v of the aetherinos and the speed u of the target particle) be the one associated with the particle A (*"origin"* of the force) and hence with the aether at rest.



Fig[R-20]

A generic expression of such aetherinical force suffered by B when moving *directly away (or towards for u<0)* from A with a speed u is:

[R-20] $$F_{AB}[u] = \frac{1}{d^2}\int_0^{\infty} r_A[v]\,(1-u/v)\,\sigma_{IB}[v_R]\,h_1 v_R\,dv$$

where:

$v_R = |v-u| = (v^2 + u^2 - 2\,u\,v)^{1/2}$ is the *speed relative to the target particle* of a v-speed aetherino.
$r_A[v]$ is the redistribution created by A in the type of aetherinos (either n or p) able to impulse the elementary particle B (i.e. those aetherinos of the same type as the matter of B.
$\sigma_{IB}[v_R]$ is the cross section of B to those type of aetherinos that produce Impulse on it.

Notice that at a distance *d,* the target B (of cross section σ_{IB}) is seen from the "source" A under a solid angle σ_{IB}/d^2 and therefore, from the definition of redistribution r[v], if the target B was at rest relative to the source particle it would receive by unit time an excess/deficit of speed-v aetherinos equal to $r_A\,\sigma_{IB}/d^2$ but since the target B is moving away from the source of the redistribution at a speed *u,* that number of incident aetherinos per unit time must be corrected by a factor (1-u/v).

Example 1. Frontal force between two elementary particles of unit electric charge.

Suppose in this example that both elementary particles are (in their internal structure and redistribution) *isotropic* particles. I.e. the anisotropies of the particles are ignored and the force described here is evaluated assigning them cross sections (and redistributions) that are an *average over all directions* of their real anisotropic interaction cross sections.

Any elementary particle of unit electric charge has by hypothesis *the same average* (over all directions) *cross section to switch interactions* which is the one postulated above in [R-5]:

[R-5]
$$\sigma_{S1}[v_R] = a_{S1}\ \mathrm{Exp}[-b_S\ v_R{}^2]$$

with the same constant a_{S1} for all unit charge particles (e.g. the electron, positron, proton,...). Furthermore, the constant b_S is postulated to be the same for all ordinary elementary particles, whatever their electric charge.

Similarly, any elementary particle of unit electric charge has by hypothesis *the same average* (over all directions) *cross section to impulsion interactions* which is again the one shown above in [R-1]:

[R-1]
$$\sigma_{I1}[v_R] = a_{I1}\ \mathrm{Exp}[-b_I\ v_R{}^2]$$

with the same constant a_{I1} for all unit charge particles (e.g. the electron, positron, proton,...). Furthermore, the constant b_I is postulated to be the same for all ordinary elementary particles, whatever their charge.

It will also be supposed that the constant b_I (of the *impulsion* cross section of an ordinary elementary particle) is equal to the constant b_S (of the *switch* cross section of an ordinary elementary particle).

According to [R-20] the aetherinical force suffered by an elementary particle B of unit electric charge when moving *directly away (or towards, for u<0)* with speed u, from a elementary particle A of unit electric charge which is at rest in the aether, can be written as:

[R-22]
$$F_{A1B1}[u] = \frac{1}{d^2}\int_0^\infty \pm\, r_{A1}[v]\,(1-u/v)\,\sigma_{I1}[v_R]\,h_1\,v_R\,dv =$$
$$= \frac{1}{d^2}\int_0^\infty \pm\sigma_{S1}[v]\,\frac{\rho[v]}{2}\,\frac{v}{4\pi}(1-u/v)\,\sigma_{I1}[v_R]\,h_1\,v_R\,dv =$$

$$= \pm\frac{a_{S1}\,a_{I1}\,h_1}{8\pi\,d^2}\int_0^\infty \mathrm{Exp}[-b_S\ v^2]\,\rho[v]\,v\,(1-u/v)\,\mathrm{Exp}[-b_I\ v_R{}^2]\,v_R\,dv =$$

$$= \pm\frac{a_{S1}\ a_{I1}\,h_1\,N_0}{2\pi^{3/2}\ d^2\,V_M{}^3}\int_0^\infty \mathrm{Exp}[-b_S\,v^2]\,v^3\,\mathrm{Exp}[-(v/V_M)^2]\,(1-u/v)\,\mathrm{Exp}[-b_I\,v_R{}^2]\,v_R\,dv$$

where in this case of "frontal" movement, the *speed relative to the target particle* B of a v-speed aetherino is:

$$v_R = |v-u| = (v^2 + u^2 - 2\,u\,v)^{1/2}$$

The following figure (obtained with a Wolfram's Mathematica 10.0 "Table" of numerical integrations of expression [R-22] for a wide sample of values of u) shows how varies the aetherinical force exerted by an elementary particle on another that moves frontally relative to the first at a speed u.

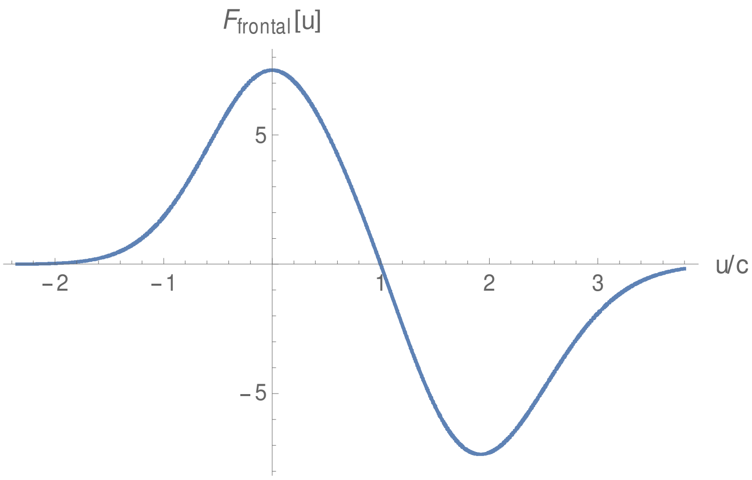


Fig [R-22]

Aetherinical force exerted by a unit charge elementary particle
on another that moves directly away (or towards) the former at a relative speed u.
(taking $a_S=1$, $b_S=1.255/c^2$, $a_I=1$, $b_I=1.255/c^2$, $V_M=10^{14}$ c, $N_0=10^{45}$, d=1).
See Eq[R-22].

Note: The force changes its sign for u > c (i.e. the repulsion force becomes an attraction force) because in that speed range the target particle reaches from behind many slow aetherinos (of v < u that departed A at earlier epochs) which impulse the particle B in the semi direction opposite to its velocity **u**.

The following function

[R-23] $$F_F[u] = F_0 \left(1 - \frac{u^2}{c^2}\right)^{3/2} \qquad \text{for} \quad |u| << c$$

happens to be a good *approximation of the frontal force* between the two particles (for $|u| << c$) as can be seen in the following figure:

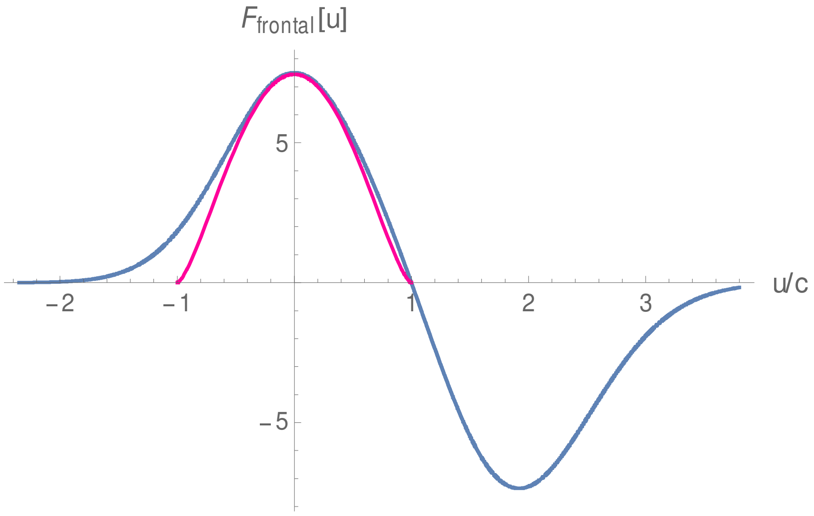
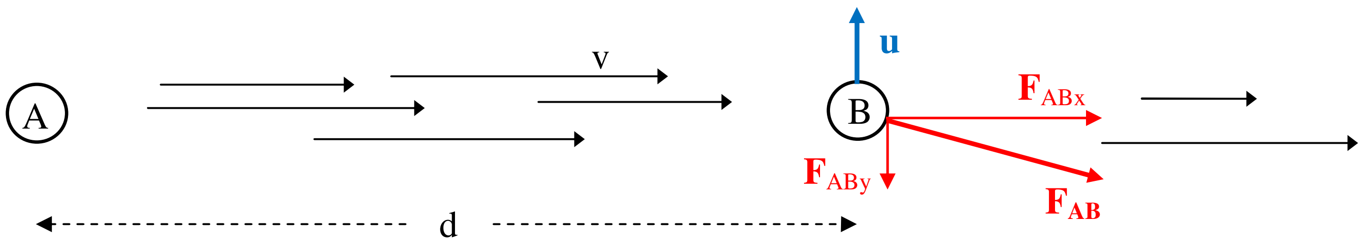


Fig [R-23]

In blue: Force exerted by an elementary particle on another that moves directly away (or towards) the former at a relative speed u.
In red: Approximation given by the function k $(1-u^2/c^2)^{3/2}$
(with: $F_0=7.5$, $a_S=1$, $b_S=1.255/c^2$, $a_I=1$, $b_I=1.255/c^2$, $V_M=10^{14}$ c, $N_0=10^{45}$, d=1).

Example 2. Transversal force exerted by a particle A on a particle B that is moving with a velocity **u** perpendicular to the straight line AB joining the particles.



Fig[R-25]

Suppose again that the reference frame of description is the one defined by the particle A and suppose that this particle A is at rest in the aether (and therefore its redistribution of aetherinos is the one given for example in [R-9]).
Suppose that the instant of evaluation of the force $\mathbf{F}_{AB}$ suffered by B this particle is passing "abeam A" (i.e. the velocity **u** of B is, at that instant, perpendicular to the straight line AB) .
The force $\mathbf{F}_{AB}$ acts along the direction of the average velocity $<\mathbf{v}_R>$, relative to B, of the aetherinos, redistributed at A, that succeed to perform an impulsion interaction with B.
Therefore now the force $\mathbf{F}_{AB}$ has a component along the direction AB (that will here be called F_{ABX}) and another (in general much smaller) component along the direction of **u** (that will here be called F_{ABY}).
NOTE: as explained in another paper of this work, this component in the direction of **u** (here perpendicular to AB) acts in the semi direction opposite to that of **u** when A repels B and acts in the semi direction of +**u** when A attracts B (being called in this latter case the "forward force").

It can be easily deduced that those two components of the force $\mathbf{F}_{AB}$ are:

$$[R\text{-}25a] \qquad F_{ABx}[u] = \frac{h_1}{d^2}\int_0^\infty r_A[v]\,\sigma_{IB}[v_R]\,v_R\,dv$$

$$[R\text{-}25b] \qquad F_{ABy}[u] = -\frac{h_1}{d^2}\int_0^\infty r_A[v]\,\sigma_{IB}[v_R]\,\frac{u}{v}\,v_R\,dv$$

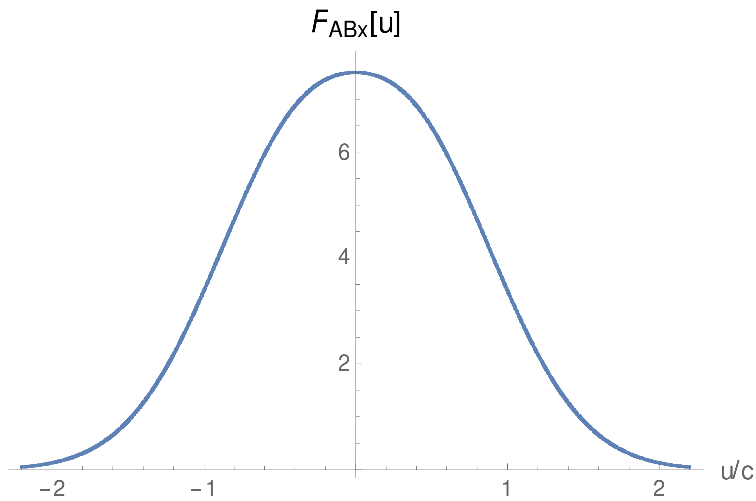
but where now the speed v_R relative to B of an aetherino of speed v (in the reference frame of description) is given by:

$$v_R = |v\text{-}u| = (v^2 + u^2)^{1/2}$$

Note: the "minus" sign in Eq[R-25b] and the "plus" sign in Eq[R-25a] assume that A and B represent electric charges of the same sign. (i.e. A repels B because B receives from A an excess (and not a deficit) of impulsion-type aetherinos).

as before:
$r_A[v]$ is the redistribution created by A in the aetherinos of the type that give impulsion to B. (See [R-9])
σ_{IB} is the cross section of B to its impulsion-type aetherinos. (See [R-1])

The component F_{ABX} (along the direction AB) is represented in the next Fig[R-25a] for a wide interval of values of u.



Fig[R-26]
Component along AB of the force F_{AB} exerted by an elementary particle A on another particle B that moves abeam A with a speed u.
(taking a_S=1, b_S=1.255/c^2, a_I=1, b_I=1.255/c^2, V_M=10^{14} c, N_0=10^{45}, d=1).
See Eq[R-25a].

The following function

$$[R\text{-}27] \qquad F_T[u] = F_0\left(1 - \frac{u^2}{c^2}\right)^{1/2} \qquad \text{for } |u| << c$$

happens to be a good approximation (for |u| << c) of the component along AB of the force $\mathbf{F}_{AB}$ exerted by a particle A on a particle B that moves abeam A with a speed u, as can be seen in the following figure:

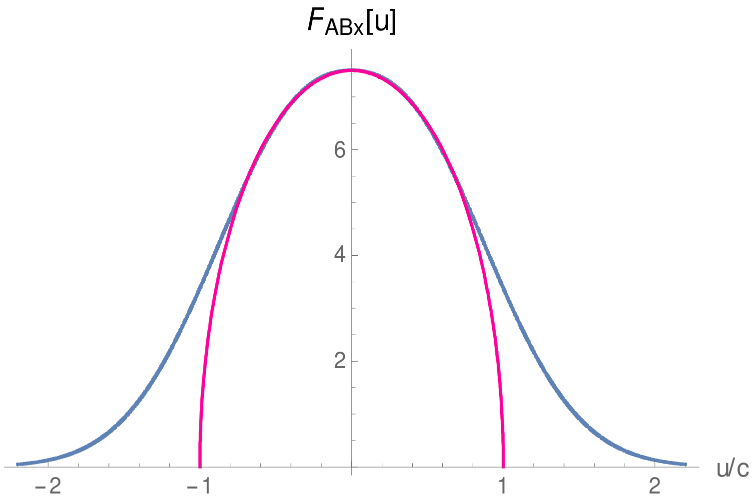


Fig [R-27]

In blue: Component along AB of the force exerted by a particle A on a particle B that moves abeam A with a speed u

In red: Approximation given by the function k $(1-u^2/c^2)^{1/2}$
(with: F_0=7.5, a_S=1, b_S=1.255/c^2, a_I=1, b_I=1.255/c^2, V_M=10^{14} c, N_0=10^{45}, d=1).

NOTE: It is considered of interest that *the forces between charged particles of the model decrease with their relative speed u* Several phenomena that official physics explains, within Lorentz transformations, as an increase with speed of the "relativistic mass" can now be interpreted, in the scenario of Galilean relativity, as the consequence of such force decrease. (A description of *Fundamental Physics* based in Galilean Relativity promises to be simpler and to avoid the paradoxes of Einstein's Relativity. See more in the section Eve12 of this model).
In Fig[R-22] it can be seen that the force between two electrons moving frontally relative to each other decreases to zero at approximately u = + c. (This result is a consequence of having chosen *ad hoc* the values of the constants b_S and b_I). At higher relative speeds, if the target moves away from the source (i.e. for u>c) the force changes its sign (becomes attractive) but tends to zero if the target particle moves *towards* the source, i.e. for u < – c.

An expression for a more general force between two particles is obtained in the Annex A (http://www.eterinica.net/EVAANA/annex_a.pdf) of this work.

<u>Redistributions and forces due to elementary particles moving through the aether</u>.

It has next been studied to what extent the redistribution of an elementary particle varies with its absolute speed through the aether.
Note: the particle will be assumed to be isotropous and therefore its redistribution will also be assumed to be isotropous when the particle is at rest in the aether.
When moving through the aether, the particle will no longer receive, from the surrounding aether, the same distribution flow of aetherinos by all its directions and there are a priori no reasons to expect that the output redistribution will be isotropous. But it can be seen (with the evaluations commented

below) that*, even in the case that it is supposed that the canonical distribution of the aether has its maximum for a speed as small as V_M=30c*, the redistributions emerging the elementary particle by its different directions do not change "noticeably" for absolute speeds of the particle of, let's say, $u_A < 2$ c. In fact, the hypothesis concerning the creation of redistributions (e.g. the [R-5] and [R-6] with $V_M >> c$) have been adopted caring that they predict that the redistribution of a moving particle has a "high degree" of invariance with its absolute speed. This invariance is considered a necessary feature of the model to safeguard the stability of fast moving atoms, molecules, etc,…, when they move at high speeds relative to the aether.
Note: obviously such "invariance" of the particle's redistributions of aetherinos also imply the "invariance" of the forces between particles because *the forces depend only on the relative speeds of the interacting particles but not on their absolute speeds.*

The precise (analytical) calculus of the redistribution of a particle *that moves through the aether* seems at first sight quite demanding for the author's skills and has been postponed. Example redistributions of moving elementary particles have been instead obtained doing simulations with a computer program (in Visual Basic) that implements the above redistribution hypothesis. Calling $\mathbf{u}_A$ the velocity of the particle trough the aether, this program (whose code can be found in the links at the end of this article) evaluates the specific redistributions that emerge from the particle in a fair sample of directions that form different angles ϕ with the semi-direction of the vector $\mathbf{u}_A$.
(Note: The redistributions shown below are referred as usual to the reference frame of the particle causing the redistribution of aetherinos).

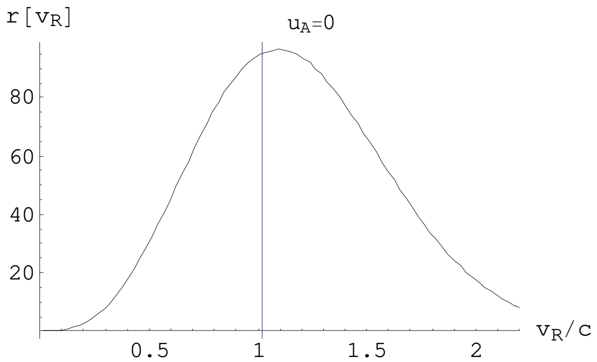


Fig [R-28]

redistribution of n-type aetherinos created in all directions by an isotropous n-type particle *at rest* in the aether (u_A=0) according to the computer program simulation.
(v_R is the speed of the aetherinos relative to the particle),
(taking a_S=1, b_S=1.255/c^2, V_M=30c, N_0=10^8). It is the same redistribution shown above in Fig[R-10] but for different values of V_M and N_0.

The following three figures show the n-redistributions (predicted by the computer program) emerging from an n-type elementary particle along three different directions (relative to the particle) when this particle moves relative to the aether at four times the speed of light (u_A= 4c). The three sampled directions shown in Figs R-30a, R-30b and R-30c are respectively ϕ=0 (i.e. along the semi direction of $\mathbf{u}_A$), $\phi=\pi/2$ (i.e. along a direction perpendicular to $\mathbf{u}_A$) and $\phi=\pi$ (i.e. along the opposite semi direction to that of $\mathbf{u}_A$).

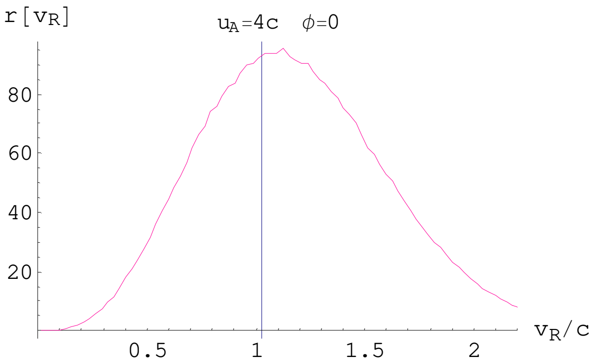


Fig [R-30a]

redistribution of n-type aetherinos emerging from a particle (of negative electric charge) along the semi-direction $\phi=0$ (that of its velocity $\mathbf{u}_A$) when the particle *moves relative to the aether* at $u_A=4c$. (v_R is the speed of the aetherinos relative to the particle), (taking $a_S=1$, $b_S=1.255/c^2$, $V_M=30c$, $N_0=10^8$).

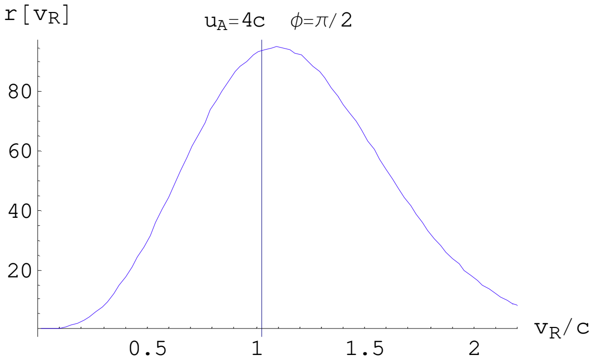


Fig [R-30b]

redistribution of n-type aetherinos emerging from a particle (of negative electric charge) along the semi-direction $\phi=\pi/2$ (i.e. perpendicularly to its velocity $\mathbf{u}_A$) when the particle *moves relative to the aether* at $u_A=4c$. (v_R is the speed of the aetherinos relative to the particle), (taking $a_S=1$, $b_S=1.255/c^2$, $V_M=30c$, $N_0=10^8$).

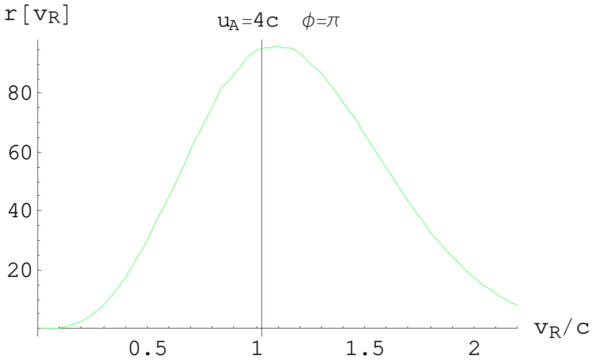


Fig [R-30c]

redistribution of n-type aetherinos emerging from a particle (of negative electric charge) along the semi-direction $\phi=\pi$ (i.e. opposite to its velocity $\mathbf{u}_A$) when the particle *moves relative to the aether* at $u_A=4c$. (v_R is the speed of the aetherinos relative to the particle), (taking $a_S=1$, $b_S=1.255/c^2$, $V_M=30c$, $N_0=10^8$).

The result is that, with the resolution and precision used in the computer program, the differences observed between the three redistributions are relatively very small, i.e. only a very small anisotropy is detected so far at u_A=4c. For example, plotting those three redistributions together in a single figure, the redistributions nearly overlap:

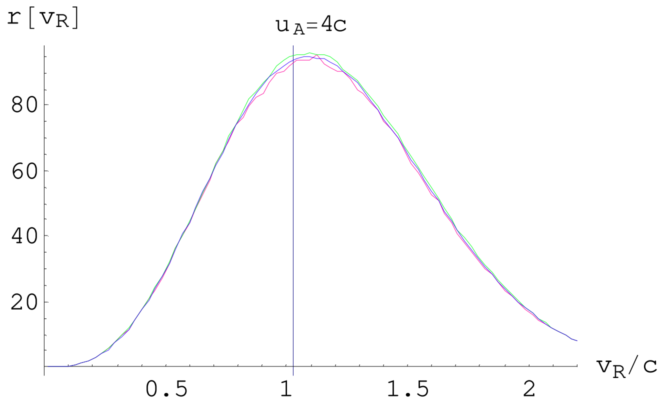


Fig [R-30d]

Observing the redistributions with more detail in the zone of their maximum it can be seen that the redistribution emerging at ϕ=0 is less intense than the redistribution emerging at $\phi=\pi/2$ which on its turn is less intense than the redistribution emerging at $\phi=\pi$:

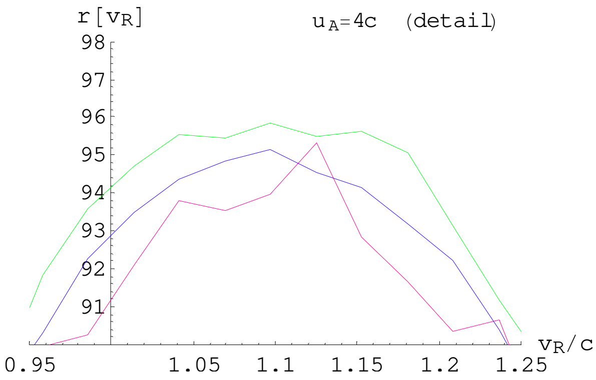


Fig [R-30e]

Furthermore, at all angles, the redistributions created by an elementary particle moving through the aether at u_A=4c are slightly less intense than the redistribution emerging from the particle at rest in the aether (that of Fig R-28 in black):

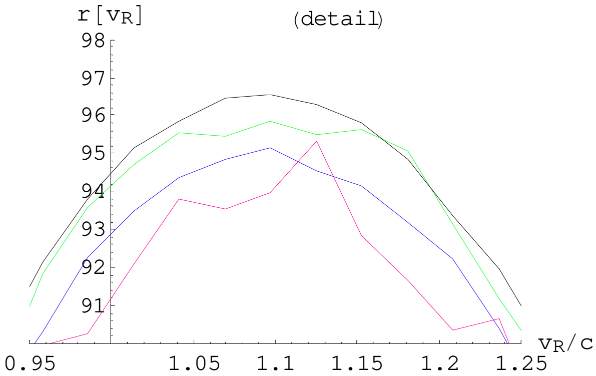


Fig [R-31]

Other simulations with u_A = 4c but assuming instead that V_M>1000c show that, with the resolution and precision used in the computer program, the differences observed between those redistributions are indistinguishable, i.e. no significant anisotropy is detected so far at u_A=4c.

Summarizing: In the description scenario adopted by the model that assumes (1) the Galilean transformation of velocities and (2) a Maxwell-Boltzmann distribution of the speeds of the aetherinos of the local aether, there must exist a dependence of the redistributions (and hence of the forces that they exert) on the absolute speed of the pertinent particles. But the redistribution hypothesis adopted by the model predict that such dependence remains relatively small even for absolute speeds of the order of a few times the speed of light.
The model does not presently exactly quantify how do the forces between particles vary with their *absolute speed* through the aether.

On the other hand, as shown above (e.g. in Fig[R-22]), the model predicts a specific and strong dependence of the *forces* on the *relative speed* of the interacting particles.

Intrinsic and extrinsic anisotropies of the redistribution of an elementary particle.

The cross sections and the redistributions of an elementary particle shown above have been assumed to be *isotropous* but it must be admitted that even an isotropous particle will manifest some "extrinsic" anisotropy *related with the direction of its velocity relative to the aether when this velocity is "high".*

But many experimental facts show that the electron, the positron, the proton,... have *intrinsic* anisotropic properties (e.g. spin, magnetic moment, …) that can not be modeled by an isotropous redistribution.

This intrinsic anisotropy has not been introduced from the start to facilitate the presentation of the basic features of the redistribution of an elementary particle but it is now postulated that:
- The electron and the positron have some inner structure that endows their redistributions with an axial symmetry. More precisely, the redistribution of these particles, *even when at rest in the aether*, is characterized by a *preferential redistribution axis* (PRA) so that the specific redistribution "emerging" along a given direction relative to the particle depends on the angle that such direction makes with the particle's PRA.

Note: The model interprets that the, so called, electromagnetic radiation is implemented by a flow of aetherinos whose distribution varies in space and time and is therefore different from the distribution of an undisturbed aether. To explain the emission of such oscillating distribution of aetherinos, the electrons are supposed to have an intrinsic asymmetry (plausibly an *axial symmetry*) in their redistribution of aetherino speeds and it is interpreted that in any ordinary process in which electrons emit radiation (transitions between atomic or nuclear quasi-stable states, electron accelerations (including Bremsstrahlung), etc,…) what happens is that the radiating electron performs a rotation of its structure of the same periodicity (or half?) to that of the emitted radiation, because with such rotation the electron presents periodically a different redistribution to the observer.

A straightforward way to implement an *intrinsic* anisotropy of a redistribution is to postulate that *the cross section* (to aetherino collisions) of the particle depends on the angle that the velocity of the incoming aetherino makes with some internal axis of the particle's structure.

Example (1)
Consider a plane perpendicular to such symmetry axis and let α be the angle that the velocity of the pertinent aetherinos make with such "equatorial" plane. Let the equations [R-1] and [R-5] be replaced respectively by:

[R-1b] $$\sigma_I[v_R,\alpha] = a_I[\alpha]\ \mathrm{Exp}[-b_I[\alpha]\ v_R^2]$$

[R-5b] $$\sigma_S[v_R,\alpha] = a_S[\alpha]\ \mathrm{Exp}[-b_S[\alpha]\ v_R^2]$$

that make explicit that the dependence of the cross sections on the angle α is postulated to rely on the constants a_I, a_S, b_I and b_S .

Note: α can be called the "latitude" angle along which the pertinent aetherinos emerge (This means that $\alpha=0$ for those aetherinos that enter/emerge along a direction perpendicular to the Preferential Redistribution Axis of the particle, while $\alpha=\pi/2$ and $\alpha=-\pi/2$ correspond to the "polar" directions of the particle, i.e. along its PRA)

Example (2)
The directional cross sections need not be of the form $\sigma[v_R,\alpha] = a[\alpha]\ \mathrm{Exp}[-b[\alpha]\ v_R^2]$ to predict an average (over all directions) cross section of the proposed type

[R-39] $$\sigma[v_R] = a_k\ \ \mathrm{Exp}[-b_k\ v_R^2]$$

For example the following anisotropous cross section:

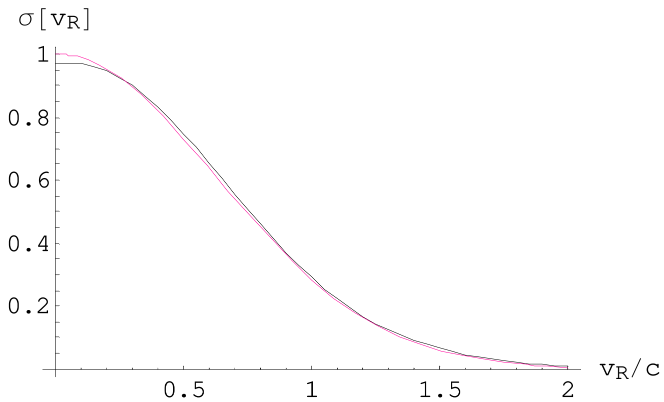
[R-40] $$\sigma[v_R,\alpha] = a[\alpha]\ \ \mathrm{Exp}[-b[\alpha]\ \ (c[\alpha]-v_R)^2]$$

with the additional assumptions:
$a[\alpha] = a_k$
$b[\alpha] = 1/\mathrm{Sin}[\alpha]$
$c[\alpha] = c.(1-\mathrm{Sin}[\alpha])^4$

gives rise to the average (over all 3D directions) isotropous cross section

[R-41] $\sigma_{AVG}[v_R] = \frac{1}{2}\int_0^{\pi} \text{Sin}[\alpha]\ \sigma[v_R, \alpha]\ d\alpha$

that is a function very similar to $\sigma[v_R] = a_k\ \text{Exp}[-b_k\ v_R^{\ 2}]$ as is shown in the following figure:



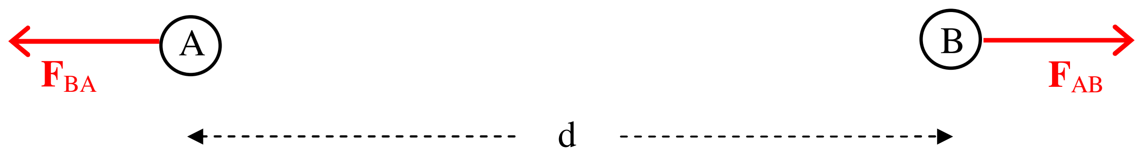
Fig[R-42]
Average over all directions of the function [R-40] (in black) compared with the function [R-39] (in red) which represents the cross sections assumed by the model for a randomly oriented electron or positron (taking a_k=1, b_k=1.255/c^2)

An anisotropy like the one described in [R-40] would imply that the anisotropic redistribution of a particle would be given (see also [R-10] and [R-9]) by:

$$\text{[R-42]}\quad r_{En}[v_R, \alpha] = \sigma_S[v_R, \alpha]\ \frac{\rho[v_R]}{2}\ \frac{v_R}{4\pi} =$$

$$= a_S\ \text{Exp}\left[-\frac{1}{\text{Sin}[\alpha]}\left((1-\text{Sin}[\alpha])^4\, c - v_R^{\ 2}\right)^2\right] \frac{4\, N_0}{2\sqrt{\pi}\ V_M^{\ 3}}\ v_R^{\ 2}\ e^{-(v_R/V_M)^2}\ \frac{v_R}{4\pi}$$

<u>Force between two elementary particles at rest and Newton's 3rd Law.</u>



Consider the special case of two elementary particles A and B at rest relative to one another. The force that the particle A exerts on the particle B is, according to the model:

$$\text{[f-1]}\qquad F_{AB} = \frac{1}{d^2}\int_0^{\infty} r_A[v]\ \sigma_{IB}[v]\ h_1\ v\ dv =$$

$$= \frac{1}{d^2}\int_0^{\infty} \sigma_{SA}[v]\ \frac{\rho[v]}{8\pi}\ v\ \sigma_{IB}[v]\ h_1\ v\ dv$$

where
$\sigma_{SA}[v]$ is the cross section of A to "switch interactions" (in which the aetherinos of *different type* to that of the matter of A, change their type).
$\sigma_{IB}[v]$ is the cross section of B to "impulsion interactions" (in which the aetherinos of the same type as the matter of B, give impulses to it).

Similarly, the force that the particle B exerts on the particle A is:

[f-2] $$F_{BA} = -\frac{1}{d^2}\int_0^{\infty} \sigma_{SB}[v]\ \frac{\rho[v]}{8\pi}\ v\ \sigma_{IA}[v]\ h_1\ v\ dv$$

where
$\sigma_{SB}[v]$ is the cross section of B to "switch interactions".
$\sigma_{IA}[v]$ is the cross section of A to "impulsion interactions".

Suppose that the particles A and B are *different* (of different nature) and suppose for a while that the particle A creates a strong redistribution of aetherinos (because of having a big σ_{SA}) but that on the other hand A is weakly sensible to being impulsed by aetherinos (because of having a small σ_{IA}). Furthermore, suppose for a while that for the particle B the opposite happens (i.e. B would have a small σ_{SB} and a big σ_{IB}) so it would for example happen that $\sigma_{SB} < \sigma_{SA}$ and $\sigma_{IB} > \sigma_{IA}$. Then, since the integrand of F_{AB} contains the product $\sigma_{SA}\ \sigma_{IB}$ and the integrand of F_{BA} contains the product $\sigma_{SB}\ \sigma_{IA}$, and since in this example it is $\sigma_{SA}\ \sigma_{IB} > \sigma_{SB}\ \sigma_{IA}$ it would happen that $|F_{AB}| > |F_{BA}|$ and therefore, in contradiction to the experimental facts (of forces between two particles at rest), the model would be inconsistent with Newton's 3rd law.
To remain consistent with Newton's 3rd law (for forces between 2 particles at rest) the model adopts the following hypothesis:

[f-3] *"For every ordinary elementary particle X, its switch cross section* $\sigma_{SX}[v_R]$ *is by hypothesis equal to* κ *times its impulsion cross section* $\sigma_{IX}[v_R]$ *where the constant* κ *is the same for all ordinary elementary particles"*

With that hypothesis, in the case of two different particles A and B (at rest) it will always happen that $|F_{AB}| = |F_{BA}|$ since now the products $\sigma_{SA}\ \sigma_{IB}$ and $\sigma_{SB}\ \sigma_{IA}$ that appear in their respective integrands of the force will be the same since the product in the integrand of F_{AB} can now be rewritten for example as $\sigma_{SA}\ \sigma_{SB}/\kappa$ and that of the integrand of F_{BA} can be rewritten as $\sigma_{SB}\ \sigma_{SA}/\kappa$
In the case of anisotropous particles with a PRA symmetry axis, their cross sections will depend not only on the relative speed v_R of the interacting aetherino but also on the angle α that the velocity $\mathbf{v}_R$ of the aetherino makes with the equatorial plane of the particle. For this reason, so as to preserve Newton's 3rd law, the model will adopt the following generalization of the above hypothesis [f-3]:

[f-4] *"By hypothesis, for every (ordinary) elementary particle with axial symmetry it happens that* $\sigma_{SX}[v_R, \alpha] = \kappa\ \sigma_{IX}[v_R, \alpha]$ *"* (where α is the angle that the velocity $\mathbf{v}_R$ of the incident aetherino makes with the equatorial plane of the redistribution of the particle and) *where* κ *is the same constant for all angles* α *and for all ordinary elementary particles).*

and therefore, in the case of the forces between any two elementary particles, it will happen that, independently of the orientation of the PRA axis of A relative to the PRA axis of B, the integrands of F_{AB} and F_{BA}, that contain respectively the products $\sigma_{SA}[v,\alpha_A]\ \sigma_{IB}[v,\alpha_B]$ and $\sigma_{SB}[v,\alpha_B]\ \sigma_{IA}[v,\alpha_A]$,

will be the same since those products can be rewritten respectively as $\sigma_{SA}[v,\alpha_A]\ \sigma_{SB}[v,\alpha_B]/\kappa$ and $\sigma_{SB}[v,\alpha_B]\ \sigma_{SA}[v,\alpha_A]/\kappa$, and it will be $|F_{AB}| = |F_{BA}|$.
(Notice that, for two particles A and B at rest (unless they rotate), *the angle* α_A *that an aetherino* emerging from A (with semi-direction AB) *forms with* A's *equator* is the same as the angle that an aetherino coming from B (with semi-direction BA) forms with such A's equator. And the same is true for the particle B and its angle α_B)

Strength of the aether drag force compared with the strength of the electric force between two electrons at rest relative to each other.

The average electric force between two electrons (of inner structure randomly oriented in space) *at rest* can simply be obtained from the above equation [R-22] making the speed u of the target electron equal to zero. Therefore:

[R-22b]
$$F_{EE}[0] = \frac{1}{d^2}\int_0^\infty r_E[v]\ \ \sigma_I[v]\ h_1\ v\,dv\ = \\ = \frac{1}{d^2}\int_0^\infty\ \sigma_S[v]\ \frac{\rho[v]}{2}\ \frac{v}{4\pi}\ \ \sigma_I[v]\ h_1\ v\,dv$$

where (see above)
$\rho[v]$ is the canonical distribution of the aether (see [R-6]).
$\sigma_S[v]$ is the cross section of the electron to switch p-type aetherinos into n-type ones.
$\sigma_I[v]$ is the cross section of the electron to the n-type aetherinos (that are the ones able to give impulse to the electron)

Note: If h_1 is assumed to have the dimension of mass then it can be easily checked that $F_{EE}[0]$ has indeed the dimension $M\ L\ T^{-2}$ (i.e. the dimension of force).

It has been calculated (performing numerical integrations of [R-22b]) that:
- assuming the expressions [R-1] and [R-5] for the respective cross sections $\sigma_I[v]$ and $\sigma_S[v]$ of the electron, and
- assuming $b_I = b_S = 1.255/c^2$

then the force F_{EE} between two electrons at rest, can be approximated by:

[R-43]
$$F_{EE}[0]\ \cong\ 0.067\frac{h_1\,a_I\,a_S}{d^2}\ \frac{1}{8\pi}\ \frac{4\,N_0}{\sqrt{\pi}\ V_M{}^3}\ c^5$$

Since, according to the experiments of physics, the electric force between two electrons, in the MKS system of units, is given numerically by:

[R-45]
$$F_{exp} = 1/d^2\ \ 2.304 * 10^{-28}\qquad \text{(Newtons)}$$

then, in the MKS system, the numerical value of the product of constants ($a_S\ a_I\ h_1\ N_0\ c^5/V_M{}^3$) of [R-43] must be (equating $F_{EE} = F_{exp}$):

[R-46] $a_S\, a_I\, h_1\, N_0\, c^5/V_M^3 = 2.304 * 10^{-28} * 2\, \pi^{3/2} / 0.067 = 3.83 * 10^{-26}$

On the other hand, **the aether drag force** suffered by a material particle, made entirely of n-type matter (like is supposed to be the case with the electron), that has a speed u_A relative to the aether is given by (see [2-9b] of Section 2)

[R-47] $$F_{DRAG}[u_A] = \frac{h_1}{2} \int_0^{\infty} \int_0^{\pi} (v \operatorname{Cos}\theta - u_A)\ \sigma_I[v_R]\ v_R\ \frac{\rho_o[v]}{2} \operatorname{Sin}\theta\ d\theta\, dv$$

where

$v_R = (u_A^2 + v^2 - 2\, u_A\, v \operatorname{Cos}\theta)^{1/2}$ is the speed of the pertinent aetherinos relative to the moving material particle (in this case an electron)

$\sigma_I[v_R]$ is the cross section of the material particle to *impulsion* collisions with aetherinos

$\rho_0[v]$ is the canonical distribution of the aether.

Assuming that the cross section $\sigma_I[v_R]$ of the electron is given by the above expression [R-1] with $b_I = 1.255/c^2$

it can be seen (performing “function fits” based on the results of the pertinent numerical integrations of [R-47]) that the aether drag force suffered by the electron can be approximated by:

[R-48] $$F_{DRAG}[u_A] \cong -0.68\ \frac{h_1\, a_I\, N_0\, c^6}{\sqrt{\pi}\ V_M^5}\, u_A$$

The electric force F_{EE} between two at rest electrons separated d=1m and the aether drag force F_{DRAG} suffered by an electron that moves through the aether at a speed of u_A =1 m/s are therefore related (see [R-43] and [R-48]) by:

[R-49] $$\frac{F_{EE}[d=1]}{F_{DRAG}[u_A=1]} \cong 0.016\frac{V_M^2}{c} a_S$$

where a_S is the cross section of the electron to *switch* interactions with aetherinos and V_M is the speed for which the canonical distribution of the aether has a maximum number of aetherinos.

If, for example, it is supposed that the “size” of the electron is of the order of the so called “classic radius of the electron” r_e= 2.82*10^{-15} m, and that therefore the cross section a_S of the electron should be equal (or smaller) to the area of a circle of that radius then:

$a_S \leq \pi\, (2.82*10^{-15})^2\ m^2$

and if it is supposed, for example, that V_M is of the order of

$V_M = 10^{10}\, c$ (with c= 3*10^8 m/s)

then:

[R-50] $$\frac{F_{EE}[d=1]}{F_{DRAG}[u_A=1]} \cong 0.016\frac{V_M^2}{c} a_S \leq 0.016\frac{10^{20}\, c^2}{c}\pi\ (2.82*10^{-15})^2 = 0.012$$

which is a quantity too small to be acceptable.

It seems instead, at first sight, that, to make “reasonable” predictions, the model needs V_M to be many orders of magnitude bigger than c.

For example if it is supposed that

$V_M = 10^{17}\, c$ then

[R-50b] $$\frac{F_{EE}[d=1]}{F_{DRAG}[u_A=1]} \leq 0.016 \frac{10^{34}\, c^2}{c} \pi\, (2.82*10^{-15})^2 = 1.2*10^{12}$$

that (since the aether drag force is directly proportional to the speed u_A of the moving particle) can be interpreted as saying that the force between two electrons at rest placed 1m apart would be equal to the aether drag force suffered by an electron moving relative to the aether at a speed $u_A = 1.2*10^{12}$ m/s (i.e. at approximately $4*10^4$ c)

The time that a material particle, moving relative to the aether, would take to reduce its speed to half its initial value due only to the aether drag force can be calculated as follows:

From comparison of [R-46] and [R-48] the aether drag force could be rewritten as:

[R-51] $$F_{DRAG}[u_A] \cong -\frac{0.68}{\sqrt{\pi}} \frac{h_1\, a_I\, N_0\, c^6}{V_M{}^5} u_A = -\frac{0.68}{\sqrt{\pi}} \frac{a_S\, h_1\, a_I\, N_0\, c^5}{V_M{}^3} \frac{c}{a_S\, V_M{}^2} u_A = \\ = -\frac{0.68}{\sqrt{\pi}} * 3.83*10^{-26} \frac{c}{a_S\, V_M{}^2} u_A$$

that with the example suppositions ($a_S = \pi\, (2.82*10^{-15})^2$ m^2 and $V_M = 10^{17}$ c) gives:

[R-51b] $$F_{DRAG}[u_A] \cong -1.96*10^{-40}\, u_A$$

that predicts a slow down of the electron:
$m_e\, du_A/dt = F_{DRAG}$ =>
$m_e\, du_A/dt = -1.96*10^{-40}\, u_A$ =>
replacing the mass of the electron by its MKS value $m_e = 9.1 *10^{-31}$ Kg and solving the differential equation:
=> $u_A[t] = u_A[0]$ Exp[$-2.15*10^{-10}$ t]
and therefore the time $t_{1/2}$ taken by the electron to decrease its speed from $u_A[0]$ to $u_A[0]/2$ would be (solving Exp[$-2.15*10^{-10}$ t] = 1/2 for t):

[R-52] $t_{1/2} = 3.22*10^9$ seconds (i.e. approximately 102 years)

Charge and mass.

The electric charge and the inertial mass of a material particle are described and related as follows.

According to the model there exist two types of matter p-type matter and n-type matter.
If the "amount" of p-type matter of a particle is bigger than its n-type matter the particle is said to have a positive electric charge.
If the "amount" of n-type matter of a particle is bigger than its p-type matter the particle is said to have a negative electric charge.
If the particle has an equal amount of both types of matter the particle is said to be electrically neutral or equivalently that its electric charge is zero.

The "amount" of matter of a given type (either p-type or n-type) of a particle can be described by the average (over all directions) switch cross section that this matter presents to the aetherinos.
Since by hypothesis (see the hypothesis f-3 above) the impulsion cross section of a given amount of matter is related with its switch cross section by a constant factor κ, the same for all ordinary particles, it can also be asserted that the "amount" of matter of a given type (either p-type or n-type) of a particle can be described by the average (over all directions) *impulsion* cross section that this matter presents to the aetherinos.

The electric charge of a particle is, by definition, given by the *net* switch cross section of the particle taking account of its both types of matter.
More precisely if a_{Sp} is the switch cross section of the p-type of matter in the particle and a_{Sn} is the switch cross section of the n-type of matter in the particle then the **electric charge Q of the particle** is

[R-60] $$Q = k_Q \, (a_{Sp} - a_{Sn})$$

where k_Q is a constant for dimensional consistency whose value depends on the election of units (for charge and for area).
(The force that a charged particle P exerts on a test particle of unit charge is indeed proportional to the *net* switch cross section of P since that net cross section a_S determines the excess (or the deficit) of p-type aetherinos emerging from P).

The inertial mass of a particle is proportional to the *total* amount of its both types of matter, and therefore is proportional to the total impulsion cross section (and also total switch cross section) of the particle taking account of its both types of matter.
More precisely, the **inertial mass M of the particle** is:

[R-61] $$M = k_M \, (a_{Sp} + a_{Sn})$$

where k_M is a constant for dimensional consistency whose value depends on the election of units (of mass and of area).
(The acceleration acquired by a particle T when suffering a force is indeed inversely proportional to its *total* cross section (adding the cross sections of its both types of matter) since it can be reasoned as follows: Suppose that the particle T target of the force is made of Np units of p-type matter and Nn units of n-type matter and suppose just for the sake of the argument that each unit of matter is an individual sub-particle of the particle T. The velocity of T should be defined as the average of the velocities of all the Np+Nn sub-particles of T. According to the hypothesis of the model (see R-3) when a p-type sub-particle is collided by a p-type aetherino of relative velocity $\mathbf{v_R}$ (or when a n-type sub-particle is collided by a n-type aetherino) the sub-particle increases its velocity by an amount $\mathbf{\Delta v} = \mathbf{i}_1 / \mu_1 = h_1/ \mu_1 \; \mathbf{v_R}$ (where h_1 is a universal constant and μ_1 would be a constant specific of the gedanken unit matter sub-particle). Averaging over all the Np + Nn sub-particles making T, the particle T would suffer a velocity increase $\Delta V = \Delta v/(Np + Nn) = \mathbf{i}_1 / (\mu_1 \, Np + \mu_1 \, Nn)$ and $(\mu_1 \, Np + \mu_1 \, Nn)$ in which participate both types of matter (and hence the addition of the cross sections of both types of matter) should be called *the inertial mass of the particle* T).

NOTE: It must be acknowledged that all the phenomena described so far by the model (e.g. the behaviour of the forces between charged particles) are not *qualitatively* affected by the value of V_M as long as it is significantly bigger than c.

$V_M = 10^{17}$ c appears to be an excessively big value. But V_M would not need to be as big if the cross section constant a_S of the electron to aetherino collisions (of the switch type) is assumed to be much bigger than the "size" that the modern experiments assign to the electron. The reasoning is as follows:
The *physical "substance"* from which the elementary particles of matter (and hence all matter) is ultimately made, and whose size (spatial extension) conditions the values of the collision cross sections of those particles with the aetherinos, can be postulated to be such that the space assigned to the matter of an elementary particle *can share* the space, or part of it, assigned to the matter of another particle without producing a "discontinuity" in the physical effects of the system. In other words it can be supposed that the matter substratum making a material particle can penetrate (intersect) the matter substratum of another particle without the particles exerting *new-type* repulsion forces on each other. The only forces exerted between material particles are those implemented by interactions with aetherinos and vehicled by them (like for instance the electric force).
The experiments to determine the "size" of an x elementary material particle consist (as far as the author knows) in throwing a bunch of x-type particles into another bunch o x-type particles having the bunches a relative speed of the order of c, and counting the number of particles that suffer significant deviations of their initial direction. But according to the model the force between two charged particle tends to zero when their relative speed tends to c and therefore it is to expect that an electron will not be deviated by another electron (whatever near, including intersection, it passes from the other) as long as their relative speed is of the order of c. In the case of two protons of relative speed close to c they will instead exert a force on each other if it is assumed that the protons are made of component subparticles of high internal speeds that therefore will not in general have a speed c relative to the subparticles of the other proton even if the relative speed of the global particles (protons) in the experiments is equal or close to c. (NOTE: the incapacity of the high energy accelerators to accelerate the particles to speeds bigger than c is considered a confirmation of the model's prediction that the force between two charged particle tends to zero when their relative speed tends to c).

Then, supposing *for example*, that the radius of the electron is two orders of magnitude bigger than the so called "classic radius of the electron" $r_e = 2.82*10^{-15}$ m and that therefore the cross section constant a_S is four orders of magnitude bigger (than the value supposed above) it can now be supposed that the constant V_M is two orders of magnitude smaller (i.e. that $V_M = 10^{15}$ c) and the same predictions of F_{EE}/F_{DRAG} shown at [R-50b] and of $t_{1/2}$ shown at [R-52] can be obtained.

Notes about the computer program used for the simulations.

The code of the Visual basic 6 program used in the simulations can be seen at:
https://www.eterinica.net/sp_redistributions_code.txt
(the REM guides to the code are written in Spanish).

The full application (including the code) can be downloaded (and "run" if you have a compatible Visual Basic interpreter) at:
https://www.eterinica.net/sp_redistributions_program.zip