ASJ

EVE, A MODEL OF AETHER.

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1 - THE MODEL.

Some simple assumptions are made to construct the model. They can be qualified as "ad hoc" hypothesis. In fact, every description of the “model kind” is by definition constructed ad hoc, and this is not considered as a defect as long as these hypothesis represent a small pack of data compared with the descriptive power of the model.

The model proposed is geometrical. It leans on geometry in a direct way (and also in an indirect way through the use of kinematics).
The Euclidean 3-Dimensional geometry and the Galileo transformation are *chosen* for the description.

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* The so called vacuum is populated everywhere by “particles” of a new kind that will be called *aetherinos*.

* The aetherinos are "point particles" in the sense that they can be assigned a zero volume. This means that it can be supposed that in an arbitrarily small volume of space it may exist an arbitrarily large number of aetherinos. (Nothing is said yet about the typical density of aetherinos in vacuum).

* The aetherinos are free to move in vacuum with any velocity. They can move in any direction and with any speed including those greater than the speed of light in vacuum.

* Rectilinear reference frame:
Consider an Euclidean 3-dimensional system of coordinates for the description of the positions of the particles of this model. Consider a clock for the description of the time evolution of these positions. (This clock is just a criterion to order the “instants” i.e. the space distributions of the particles). It is postulated that all the aetherinos move following straight lines maintaining a constant speed (i.e. they move at constant velocities) in that particular reference frame. The clock readings associated with the definition of this reference frame can now be thought to be given by the distance traveled by a given aetherino, assigning equal time intervals to equal distances traveled by it. This particular “aetherino clock” will be used as the only and "absolute clock" to refer all movements. (Absolute time is used for the description). Many reference frames can be defined. The relative velocity between the different frames is calculated with the absolute clock just singled out. The Galileo transformation between reference frames is chosen for the description. Thus, infinite reference frames moving at constant velocity relative to each other will be found to be *rectilinear frames*.

* The model assumes, by the moment, the existence of only two kinds of basic physical entities in our world:

1) Aetherinos that can be represented by points (or spheres of zero radius).

2) Elementary Particles of *matter* that, in what respects their interactions with the aetherinos, must be assigned a finite non-zero size. The elementary particles are considered, as in mainstream physics, the basic components of all matter.

The aetherinos will not be called "matter" neither “material particles”.

* Interaction:
This work assumes that the aetherinos are the only vehicles of the known interactions of matter (that mainstream physics classifies as gravitational, electromagnetic, weak and strong). This means that, as far as possible, the model will attempt to represent all basic fields and radiation as specific distributions of aetherinos.

This geometrical model bases its description in interactions that can be analyzed in terms of geometrical collisions:
Consider two spheres of radii r_1 and r_2 whose positions can change in space. A collision between these two spheres can be defined to occur when the separation between their centers is equal to $r_1 + r_2$.

* The aetherinos do not interact with themselves (i.e. they do not collide with themselves).

* The aetherinos can interact with matter (i.e. they collide with the elementary particles that make matter) .

The assertion that the aetherinos do not interact with themselves can be understood as a consequence of the fact that the probability of collision of two spheres of zero radius is zero.
It could be defined that an aetherino collides with an elementary particle when its separation to the center of the elementary particle is equal to the radius r attributed to the particle. But in most calculations of this work there will be no need to invoke the radius of the material particles but only their collision cross section σ with aetherinos.

* In a *rectilinear frame* an aetherino maintains a constant velocity as long as it does not interact with an elementary particle (i.e. with matter), but when interacting (colliding) with it, the aetherino can change its velocity.

* A material elementary particle changes its velocity when suffering an impulsion collision by an aetherino.

Note: These two assertions related with the collision of an aetherino with an elementary particle (i.e. about the velocity changes suffered respectively by the aetherino and by the material particle) will be further discussed and developed for example in the paper
http://www.eterinica.net/redistribs_eterinicas_en.pdf where it is asserted that there are actually two “types” of aetherinos (p-type and n-type) and two types of matter (p-type matter and n-type matter). The result of the collisions depends on the type of aetherino and the type of matter of the particle with which they collide. (In the “*switch type*” collisions the collided particle does not change its velocity and the aetherino switches its type. In the “*impulsion type*” collisions the collided particle does change its velocity and the aetherino does not change its type).

* The aetherinos do not have mass, or more precisely, *the concept of mass is not of application to the aetherinos*. This should be evident considering that the classic concept of mass of a body is associated with its behavior either when it suffers a force (inertia) or when it is the origin of a force (gravitation). But in this model the aetherinos are considered the *vehicles* of *all* forces and as such they can not

themselves suffer forces (since they do not interact with themselves) and neither be individually the origin of a force.

A *general type of interaction* between two pieces of matter (elementary particles, atoms, ions, molecules etc) can be understood as follows: From piece #1 "emerges" constantly in all directions a specific velocity distribution of aetherinos. The emergent aetherinos travel in straight lines (in any rectilinear frame) maintaining their initial speed. Some of them reach the position of the material particle, piece #2, colliding with some of its elementary particles. As a consequence of the collision with an aetherino the particle receives a specific "impulse" (see below). But piece #2 is subject not only to the impacts of the aetherinos coming from piece #1 but also to impacts of aetherinos from the surrounding aether that reach it from "all other" directions. The combined effect of all the impulses acquired by its elementary particles will be discussed below. It suffices here to remark that this effect depends on the aetherinos velocity distribution "detected" at piece #2 which on its turn depends on the aetherinos distribution "emerging" from piece #1 and on the speed distribution of the aetherinos of the local aether. The aetherinos distribution *emerging* from any piece of matter depends on the nature, position and movement, of its constituent elementary particles (matter).

The term "emergent" distribution is preferred to the term "emitted" since the latter could suggest the existence of sources (creation) of aetherinos. It is believed that the description should proceed as far as possible without invoking the existence of sources or sinks of aetherinos. Such restriction adds some mathematical difficulties to the description but *conservation* produces a deeper sensation of "understanding" than *creation*. In this sense, this model of the aether aims to explain the *emergent distribution* of any piece of matter as a *redistribution of the velocities of the aetherinos* that collide with it. (See example in Annex D). In a similar way the description will try as far as possible to deduce all the effects of matter from the nature, the positions and the movements of its elementary particles deducing the redistribution of aetherinos that they cause.

The behavior of an aether of aetherinos is very different from that of a typical gas of atoms or molecules. The molecules of a gas interact with each other making the gas tend towards homogeneity and equilibrium. The pressure waves that the gas can carry soon dissipate. On the contrary the aether proposed cannot carry pressure waves because the aetherinos do not "push" each other, but, if by some mechanism a group of aetherinos is endowed with a given velocity **v** these aetherinos will travel "unlimited" distances maintaining their initial velocity and consequently their initial spatial distribution (i.e. their relative positions) implementing some sort of "moving packet" until they find matter with which to collide. Similarly, if by some mechanism, a "deficit" of aetherinos of a given velocity **v** (compared to the mean density of aetherinos of that velocity in a standard aether) is produced, this deficit will travel through vacuum maintaining its structure until it encounters matter. Of course, the word "unlimited" is used in a restricted sense since the probability of having a group of aetherinos endowed with "the same" velocity tends to zero as the velocity is singled out with more precision. In consequence a dispersion and dissipation of the initial spatial structure does take place. (The concept is similar to the dispersion of wave packets in quantum mechanics).

It should also be assumed in this model that "normal density matter" has a very *small* collision cross section for the aetherinos (i.e. even big amounts of matter let through *most* of the aetherinos without suffering any collisions with its elementary particles). Only thus it can be explained, for example, that gravitational forces are proportional to the amount of matter of the attracting bodies. On the other hand, in "non-normal density matter" (e.g. in neutron stars...) it can be expected that most of the aetherinos reaching such bodies would suffer collisions (and hence speed redistributions) before being able to reach the inner layers of such matter.

* Aetherinos velocity distribution.

Note: as is well known, a "velocity distribution" of an ensemble of particles is a mathematical function that for each velocity gives the number of particles of the ensemble with such velocity.

The aetherinos velocity distribution at a given place and time is, to some extent, conditioned by the matter in the "neighborhood" since matter is assumed to "redistribute" aetherinos in a specific way (that depends on the structure of that matter). The relative influence of a given piece of matter in the distribution of aetherinos in the region being analyzed decreases as the distance to that matter increases. If the region observed is "far enough" away from all matter of the Universe it could be agreed to call such a region "undisturbed". An attempt could then be made to *deduce* the aetherino's velocity distribution in such "undisturbed" regions. Nevertheless, strictly speaking, many cosmological models of the Universe would suggest that every aetherino entering the region of observation could in principle be assigned to a redistribution process occurred at "some" piece of matter if the search is carried deeply enough in space and time. (In this sense there would not exist any undisturbed region of space. This idea reminds of Mach's principle). At this stage it appears specially confusing to discuss whether or not it has any meaning or interest to invoke regions of space free from the aetherinical influence of all matter. It also seems premature to discuss here how the aetherino's velocity distribution of an "undisturbed" region of space is ultimately conditioned by the distribution of matter in the far Universe. In this context, the concept itself of "undisturbed" region is considered too imprecise to be useful. For these reasons a more abstract line of description will be followed postulating the standard distribution that the aether has at locations "sufficiently far away from all matter". The local matter pertinent to the problem will of course alter such distribution . The reasonability of such postulate (guess) and its capability to account for a wider number of facts will only be modified "a posteriori" if necessary (i.e. ad hoc). An aether at a given location will be called *undisturbed* therefore in the sense that its distribution of aetherinos conforms to such postulated standard distribution.

* Referential Domain (or simply "domain"): A specific region of 3-Dimensional space (defined in practice in relation with some given matter) together with a specific interval of time (defined in practice in relation with some given absolute epoch). The purpose of this definition is to specify the domain of validity of any given aetherino's distribution. Because it seems important to remark that the distributions at two *distant* imaginary regions of space may be very different even if those regions are at rest relative to each other and the velocities are referred to the same reference frame. Therefore, if it is said that (from the point of view of a given reference frame) a given velocity distribution exists in a domain, it should be understood that such distribution exists in a given region of space during a given time interval.

* Local aether (or surrounding aether) : specific aetherinos distribution existing in the referential domain pertinent to the problem.

* Canonical Aether (or standard aether at rest):
The aether of a referential domain will be called *canonical* when in the domain:
- the aetherinos move in straight lines at constant speeds.
- the aetherino's velocity distribution is homogeneous (i.e. the same at every place of the domain).
- the aetherino's velocity distribution is isotropic (i.e. the same in all the directions of space). Hence it can be said that the aether is "at rest" in the domain.
- furthermore, the aetherino's speed distribution of the "undisturbed" aether has a specific mathematical form (to be postulated ad hoc), that will be called *canonical*.

In a given domain, the reference frame S where the aether is canonical is a privileged frame compared with other reference frames moving relative to S in the sense that in these other reference frames the velocity distribution of the aetherinos present at the given domain will no longer be isotropic. But it is a relative and local privilege since nothing forbids to invoke for *another distant domain* (i.e. at a different space-time location), the existence of anisotropies in its local aetherinos velocity distribution relative to the same reference frame S. (Imagine for example that this second

domain is surrounded by matter in an asymmetric way). Also, it is mathematically possible to have distant domains in all of which an isotropic distribution can be found but only when referred to a specific reference frame that might be *different* from that of the other domains. (It is possible in this sense to define an expanding or contracting Universe). It might be better understood what has just been said keeping in mind that a "reference frame" is a universal concept (valid at all epochs and at all locations) whereas a "referential domain" is a local concept (related to the "vicinity" of a given epoch and a given location).

When the aether of a given domain is called "*undisturbed*" it is assumed that a reference frame can be found relative to which the aetherinos of that domain have a canonical distribution.

* Definition of the elementary aetherinical impulse:

When an aetherino collides with an elementary particle with a relative velocity $\mathbf{v_R}$ it gives, by definition, to the particle *an aetherinical impulse* $\mathbf{i_1}$ equal to:

[1-0] $$\mathbf{i}_1 = h_1 \mathbf{v_R}$$

where h_1 is a dimensionless constant.

The *"aetherinical" impulse* should not be confused with the concept of impulse *F dt* (nor with that of a momentum increase) used in mainstream Physics. The aetherinical impulse has the dimension of velocity.

The aetherinical impulse is just an *auxiliary* concept with which to define the concept of force (see below).

The word "elementary" is to remark that the impulse corresponds to a collision by a single aetherino.

NOTE 1-0. In Section 3 an aetherinical impulse will be related to an instantaneous velocity *increase* of the collided particle, i.e. to the vector difference of two velocity vectors at a given instant. But within Galilean relativity *a velocity increase* vector is an invariant that has the same direction and modulus in *all* reference frames that move relative one another. Therefore it can be concluded that the aetherinical impulses (and therefore also the aetherinical forces, see below) have the same direction and modulus for all observers moving relative to one another.

* An "aetherinical" force is defined as the sum of the aetherinical impulses communicated by a specific group of aetherinos to a given piece of matter in unit time.

An aetherinical impulse is said to have been given to a piece of matter when an aetherinical impulse has been given to any one of its elementary component particles. The magnitude of the aetherinical impulse received by the piece of matter (as a whole) *at each collision* is defined to have the same value as the elementary aetherinical impulse received by the specific elementary particle that suffered the collision.

As a consequence of the fact that the aetherinical impulses are defined as vectors, the aetherinical force is a vector.

The *"aetherinical" force* should not be confused with the standard concept of force used in Physics although it will be shown that they are equivalent in many aspects and the concept of "aetherinical" force will be related below to what mainstream physics calls a force.

The behavior of an elementary particle after receiving the impact of an aetherino will be discussed below. It is advanced that the model seeks to explain/deduce the concept of *mass*. No attempt should be made at this stage to assign a mass to any material particle. (The dynamics of the model aims to be deduced from its kinematics).

NOTE 1-1.

The main purpose of this work is to show with some example calculations the capability of a model of this kind to describe many physical facts and to make predictions of new ones. The present version of the model does not pretend to make exact *quantitative* predictions of the related physical phenomena. But it is of course believed that with some further work and calculus the model will be able to describe also in a quantitative way the pertinent physical phenomena of its domain of application.

EXAMPLES OF DEVELOPMENT OF THE MODEL.

What follows intends to show how the model can be applied to some simple examples of physical phenomena.

Electrostatic (Coulomb) force.

It seems natural for the model to admit that a proton bathed by the aether redistributes the aetherinos that collide with it in such a way that the velocity distribution "emergent" from the proton is different from the distribution incident upon it. The same can be said of the electron and other material particles.

In what follows the particle suffering the force under study will be called the "target" particle. The particle responsible of the force acting on the target (i.e. the particle that causes the redistribution pertinent to the problem) will be called the "source" particle.

In the first part of this section it will be assumed, for example, that the source particle is a proton and the target an electron

Imagine first an *isolated* electron at rest in a canonical aether. The net aetherinical force suffered by this electron due to the impacts of the aetherinos of the surrounding aether is then zero. Now suppose that a proton is located at a distance d of the electron and at rest relative to it (and suppose that this configuration has existed during a long enough time so that the flux of aetherinos reaching each particle can be treated as stable). Then, the aetherinos, of any given speed v, received by the electron at a given epoch are the result of subtracting, from those that it would receive if it was alone in the aether, those of speed v that on their initial way to the electron have been scattered in collisions with the interposed proton and adding those that after such redistributing collisions at the proton emerge with the pertinent speed v in the direction of the electron. Writing this in symbolic form:

[1-2] $$T(v) = C(v) - S_{PE}(v) + N_{PE}(v)$$

where (at the given epoch of observation):

T(v) = total number of aetherinos of speed v and any direction that reach the electron when the proton is present.

C(v) = number of aetherinos of speed v and any direction that reach the electron when isolated, i.e. when the proton is not present. (The letter "C" has been chosen to remind that these aetherinos make part of the Canonical aether).

$S_{PE}(v)$ = number of aetherinos formerly making part of the above defined C(v) that no longer reach directly the electron when the proton is present (due to the Scattering at the proton).

$N_{PE}(v)$ = number of aetherinos of speed v that reach the electron after having collided with the proton.

(The sub index $_{PE}$ indicates that those aetherinos reach the electron from the direction of the proton).

The particle being treated as "source" of the force (in this case the proton) receives an isotropic shower of aetherinos since it has been supposed that it is surrounded by a canonical aether. (A second order effect due to the presence of the electron may be neglected supposing that the distance d is big enough). Supposing also, for the present purposes that the proton has an isotropic internal structure then there is no need to consider the space *direction* as a variable in the following defined distributions:

$s_P(v,t)$ = scattered distribution at the proton = number of aetherinos of speed v that collide with the matter of the proton at the epoch t by unit speed interval, by unit time and by unit solid angle.

$n_P(v,t)$ = emergent distribution at the proton = number of aetherinos that after colliding with the proton emerge "from it" with speed v by unit speed interval, by unit time and by unit solid angle.

$r_P(v,t)$ = redistribution (residual distribution) of the proton = $n_P(v,t) - s_P(v,t)$ [1-3]

Therefore *the residual distribution (or redistribution) of a material particle gives the excess/deficit number of aetherinos of speed* v *(relative to the particle) that emerge by unit time and by unit solid angle from the space region assignable to the particle in comparison to those that would emerge at that position from that space region if the particle was not there.*

It is implicit in the idea of redistribution that the redistributing particle is neither a source nor a sink of aetherinos. This will be called postulate of "conservation of the number of aetherinos in their interaction with matter" (in this case with a proton). Therefore:

[1-4] $$\int_0^\infty s_P(v,t)\,dv = \int_0^\infty n_P(v,t)\,dv$$

[1-5] $$\Rightarrow \int_0^\infty r_P(v,t)\,dv = 0$$

NOTE 1- 2.

A typical "elementary" particle (e.g. an electron or a proton) could be assumed to be composed of some bounded more elementary "Simple Particles of matter" in a similar way (but on a different scale) to which the nuclei are composed of nucleons, the atoms are composed of a nucleus and electrons, etc. The internal positions and velocities of the Simple particles that compose the structure considered may be used to explain that the emergent distribution differs from the incident one in some specific way. (See Annex D).

It would then seem natural for the model to invoke the existence of anisotropic emergent distributions from elementary particles since most bounded dynamical structures can only be stable if its component particles adopt preferred relative directions in their orbits, oscillations, etc. Nevertheless, in this introductory section, for the purpose of describing the Coulomb force, the redistributions of the responsible particles (electrons, protons,) will be assumed, by the time being, to be isotropic. In this case the validity of the model can be considered to be restrained to the mean behavior of those forces in situations where there exist many electrons and/or protons free to adopt all space orientations (or if there exist only 2 or a few, the behavior is understood to correspond to the mean of many random experiments).

As it was said above, the net aetherinical force suffered by the electron due to the impacts of those aetherinos C(v) that it would receive in isolation is zero. This is a consequence of having assumed in this example that the electron is at "rest" in the aether and receives therefore a symmetrical shower of impacts that cancels the net force due to the environment aether. It will be shown later that if the

isolated electron moves in its local aether (and therefore C(v) has no longer a canonical distribution in a reference frame associated with the electron) it suffers instead a non-zero aetherinical force that will be called *aether drag*. But it will also be shown that this *drag force* only produces a noticeable slow down of the material bodies that move relative to the aether at high speeds and *free of other bounding material forces*. The calculus of the Coulomb force reduces therefore to evaluate the contribution of the terms $S_{PE}(v)$ and $N_{PE}(v)$ of equation [1-2].

Suppose that the distance *d* (proton-electron) is big compared with the "size" of both the proton and the electron. In this case all the speed v aetherinos, coming from the proton, that collide at a given epoch t with the electron have approximately the same direction. The *emergent* distribution $n_P(v, t)$ of the proton is detected at the position of the electron as a flux density (of nearly parallel aetherinos) given by:

[1-6] $$\Phi_n(v,t) = \frac{n_P(v,\ t - d/v)}{d^2}$$

$\Phi_n(v, t)$ = number of aetherinos of speed v that, having been redistributed at the proton, cross in unit time at the epoch t a unit surface (perpendicular to their velocity) that is located in the vicinity of the electron.

In the present example it will be assumed for simplicity that the characteristic distributions of the source particle defined above (i.e. $n_P(v, t)$, $s_P(v, t)$ and $r_P(v, t)$) do not depend on the epoch. Hence, supposing also by the moment that the electron does not move relative to the proton, it can be stated that the flux [1-6] of aetherinos does not depend on the epoch and may be rewritten (dropping the time dependence) in the simpler form:

[1-7] $$\Phi_n(v) = \frac{n_P(v)}{d^2}$$

where $n_P(v)$ is the, now time independent, *emergent* distribution defined above.

Similarly, the beam of aetherinos (from the canonical aether) scattered by the proton (i.e. the screened flux) “would have” represented a flux (at the position of the electron):

[1-8] $$\Phi_S(v) = \frac{s_P(v)}{d^2}$$

where $s_P(v)$ is the, now time independent, *scattered* distribution defined above.

If the target electron consisted of one or more "Simple particles" *at rest* (relative to the proton) presenting a total geometrical cross section equal to σ_E then the expression of the aetherinical force suffered by such electron due to the presence of the proton would simply be (see definitions above of aetherinical impulse [1-0] and aetherinical force):

[1-9] $$\mathbf{F}_{PE} = \int_{\mathbf{v}} h_1\, \mathbf{v}\, \sigma_E \left[\Phi_n(v) - \Phi_S(v)\right] d\mathbf{v}$$

and since in this example all the pertinent (residual distribution) aetherino velocities have the same direction P-->E , the modulus of such aetherinical force would be

[1-10] $$F_{PE} = \frac{h_1 \sigma_E}{d^2} \int_0^\infty v\, [n_P(v) - s_P(v)]\, dv$$

Note: when dealing with a *negative flux* (that implements a *deficit* of aetherinos like for example in [1-9] or [1-10]) it must be understood that a "missing" aetherino of velocity **v** relative to the elementary particle contributes on this particle with an aetherinical impulse equal to:

[1-12] $\mathbf{i} = -\mathbf{i}_1 = -h_1 \mathbf{v}$

This assertion, that seems straightforward when the impacted particle is at rest in the local aether, also applies when the particle moves in the aether. This point of view is analyzed/defended in section 7.

An expression will now be obtained for the case in which the target particle is composed of *internally moving* Simple (i.e. more elementary) Particles. In this case the target composite particle suffers an aetherinical force that depends on the internal speeds of its component particles. The target particle as a whole is, as before, supposed to be at rest relative to the redistributing source particle (It is the Simple Particles that make the inner structure of the target particle that move relative to the target as a whole).

Consider first:

A simplified model for the structure of a Composite Particle (CP).

The following model of Composite Particle (CP) will be analyzed:

* A CP is composed of a finite number of equal more elementary particles, here called Simple Particles (SPs) each of which has a geometrical cross section σ.
* The component particles (SPs) move around the whole structure keeping nevertheless reunited in space (confined).
* The SPs are confined in a small space in all parts of which there is (on the average along small time intervals) an homogeneous distribution of them. For the present purposes it may be imagined that the space where the SPs are confined is a virtual sphere.
* The SPs move relative to the whole with the same speed w (that can also in a first order approximation be considered as a mean value of a wider real variety of speeds). The component particles are understood to move at speed w *relative to the global structure* called the CP. These movements will be called "internal".
* All space directions of the SP velocities (relative to the CP) are equally probable (isotropic internal structure).

It is indifferent for the present purposes how many particles actually constitute the structure considered. The relevant supposition is that their positions and velocity states have the mentioned distribution.

For simplicity in the following calculations it will also be supposed that the SPs forming the CP do not screen each other sensibly from the flux of aetherinos incident on the CP. This can be called a *non-compact Composite particle*. These non-compact Composite particles are therefore those for which

$$m\,\sigma << \Sigma$$

m = number of SPs forming the CP.
σ = geometrical cross section of a SP (i.e. area of a circle of radius equal to that of the sphere "representing" the Simple Particle).
Σ = geometrical cross section of a CP (i.e. area of a circle of radius equal to that of the virtual sphere where the SPs are confined).

For the present purposes, the target electron will be considered to be modeled by this CP-type internal structure. But this supposition must not be considered an intromission into the theory of elementary particles. It is just an attempt to show the capability of the model to describe some actions between material particles making very general suppositions about their inner structures.

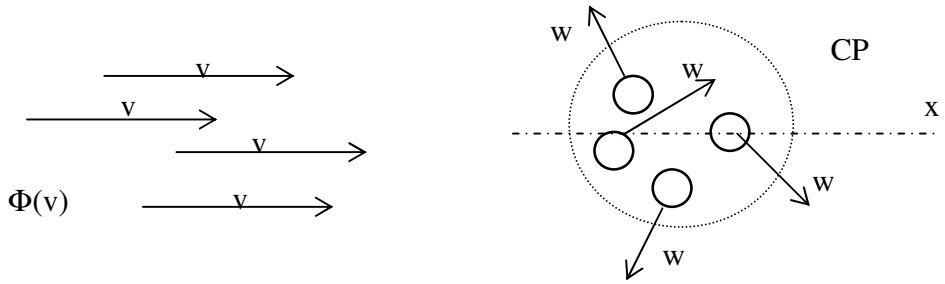
The description presented here could assign a geometrical size to the Simple particles. (It may be useful in many contexts to simply think of these Simple particles as spherical. Instead of referring to the size or to the radius of a Simple particle the concept of cross section will be applied. In this case the concept makes reference to a geometric cross section). The aetherinos are only scattered and hence redistributed when they collide with any of the constituent Simple particles of the global matter being considered.

NOTES 1-3.

a) A *single* Simple Particle, being in constant jumping due to the effects of aetherino collisions from its local aether, can also be assigned a distribution of "internal" velocity states and hence can also be considered a "composite" particle, in the above defined sense. Furthermore, it can be guessed that according to Annex D, this single jumping Simple particle constitutes by its own a source of aetherino redistributions (i.e. an origin of force).

b) The SPs of a Composite particle are believed to remain bound in space, forming a specific structure, due to internal, aetherino-transported, forces that will not be analyzed. No knowledge of these internal forces is required for the present purposes.

Aetherinical force exerted on a Composite Particle by a flux of parallel aetherinos of speed v.



[1-14]

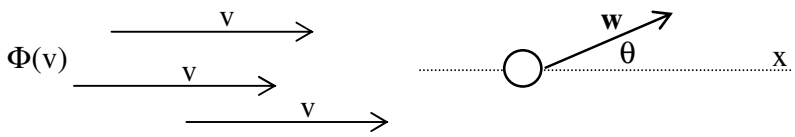
Let v be the speed of the incident aetherinos relative to the CP.

Let X be the direction of those aetherinos in the reference frame of the CP.

Consider a SP whose velocity **w** makes an angle θ with X (see Fig 1-15).

Let Φ(v) be the flux density of aetherinos (in the reference frame of the CP) at the position of this SP. More precisely:

Φ(v) = number of speed v aetherinos that cross in unit time a unit area perpendicular surface. The symbol Φ will generally be used for a density flux (i.e. flux per unit perpendicular area) although the word "density" will most often be omitted.



[Fig 1-15]

The density (number per unit volume) of such aetherinos of speed v in the vicinity of the SP is therefore:

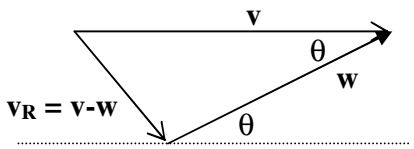
[1-16] $$\rho(v) = \frac{\Phi(v)}{v}$$

... since it can be imagined that through a unit area surface perpendicular to the flux passes in unit time a cylinder of aetherinos of length v, and unit base, whose volume is therefore numerically equal to v.

The number of speed v aetherinos that collide (are scattered) in unit time with this SP in the state (w, θ) may be expressed by:

[1-18] $$N(\theta) = \rho(v)\ \sigma\ v_R$$

where
σ is the geometrical cross section of the SP
v_R is the modulus of the velocity of the aetherinos *relative* to the moving SP.
Therefore v_R is also the "distance" travelled in unit time by the SP *in a reference frame in which the incident aetherinos are at rest* (since in that reference frame, the SP sweeps in unit time a cylinder of base σ and length v_R).



[Fig 1-19]

[1-19] $$v_R = |\mathbf{v}-\mathbf{w}| = (v^2 + w^2 - 2\ v\ w\ \mathrm{Cos}\ \theta\ )^{1/2} \quad =>$$

[1-20] $$N(\theta) = \sigma\ \Phi(v)/v\ \ (v^2 + w^2 - 2\ v\ w\ \mathrm{Cos}\ \theta\ )^{1/2}$$

Let m be the total *number* of SPs composing the CP. Since the component Simple particles have an isotropic distribution of velocities (within the CP), the number of them moving in the cone of directions $\{\theta, \theta + d\theta\}$ is:

[1-22] $$m\frac{\mathrm{Sin}\,\theta}{2}d\theta$$

Using [1-20], the number of aetherinos scattered in unit time by those SPs with directions in $\{\theta, \theta + d\theta\}$ is therefore:

[1-23] $$N(\theta)\ m\ \frac{\mathrm{Sin}\,\theta}{2}d\theta$$

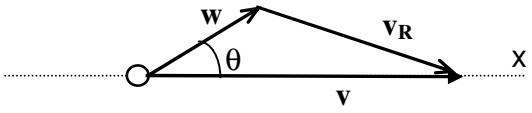
Incidentally, the total number of aetherinos scattered in unit time by *all* the *m* SPs whatever the direction of their velocity is:

[1-24] $$\frac{m}{2}\int_0^{\pi} N(\theta)\ \mathrm{Sin}\,\theta\ d\theta$$

but notice that this estimation of the total number of aetherinos scattered in unit time (by all the SPs making the CP) is valid only when the SPs do not screen each other from the incident flux of aetherinos.

According to definition [1-0] the aetherinical impulse exerted by one aetherino when colliding with a SP of velocity $\mathbf{w} = \{ w, \theta \}$ is:

[1-30] $$\mathbf{i}_1 = h_1\ \mathbf{v}_R\ = h_1\ (\mathbf{v} - \mathbf{w})$$



[Fig 1-31]

The x component of this 'aetherinical impulse' is:

[1-32] $$i_{1x} = h_1\ v_{Rx}\ = h_1\ (v - w\,\mathrm{Cos}\,\theta)$$

The x component of the 'aetherinical impulse' exerted by all the aetherinos that collide *in unit time* with *this* SP is then, see [1-16..20]:

[1-33] $$F_{x\,SP} = i_{1x}\ N(\theta) = h_1\ (v - w\,\mathrm{Cos}\,\theta)\ \ v_R\ \frac{\Phi(v)}{v}\ \sigma$$

The x component of the 'aetherinical impulse' exerted by all the aetherinos that collide in unit time with *all* the SPs is therefore (adding for all the possible θ of the SPs), see [1-22] :

[1-34]

$$F = F_{X\,CP} = \int_0^{\pi} F_{XSP}\ \frac{m\ \mathrm{Sin}\,\theta}{2}\ d\theta$$

$$= \frac{h_1\ \sigma\ \Phi(v)\ m}{2\ v}\int_0^{\pi}\ (v - w\,\mathrm{Cos}\,\theta)\ v_R\ \mathrm{Sin}\,\theta\ d\theta$$

where v_R is also a function of θ as expressed in [1-19].

It has been written $F = F_{X\,CP}$ because it is evident, by symmetry reasons, that the other two components of the aetherinical force need not be considered since they cancel (when a statistically large number of collisions is considered).

In the present calculus of the aetherinical force suffered by a target particle in presence of a source particle P at a distance d it will be assumed that the target particle is a CP with m_E Simple Particles of internal speed w_E . It will also be supposed that the source particle creates a redistribution of aetherinos $r_P(v)$ (without inquiring which is the internal structure of the source particle able to create such redistribution).

The pertinent flux of aetherinos reaching the target due to the presence of the source particle P at a distance d is, see [1-7..8] :

[1-40] $\Phi(v)= \Phi_n(v) - \Phi_s(v) = 1/d^2 \ [n_P(v) - s_P(v)] = r_P(v) / d^2$

where $r_P(v)$ is the residual distribution of the source particle P. See [1-3].

The model asserts that the electrostatic Coulomb force F_{PE} suffered by a charged target particle E due to a charged source particle P, at rest relative to E, can be described by the aetherinical force result of integrating the expression [1-34] for all speeds v of the pertinent incident flux:

[1-41] $$F_{PE} = \frac{h_1 \sigma m_E}{2 d^2} \int_0^\infty \int_0^\pi \frac{r_P(v)}{v} (v - w_E \operatorname{Cos}\theta) \ v_R \operatorname{Sin}\theta \ dv \ d\theta$$

Similarly the expression of the aetherinical force suffered by a charged particle E due to the presence of another particle E (of the same type) at a distance d is obtained simply substituting in Eq [1-41] the residual distribution $r_P(v)$ of P by that of the particle E that will be called $r_E(v)$:

[1-42] $$F_{EE} = \frac{h_1 \sigma m_E}{2 d^2} \int_0^\infty \int_0^\pi \frac{r_E(v)}{v} (v - w_E \operatorname{Cos}\theta) \ v_R \operatorname{Sin}\theta \ dv \ d\theta$$

where, see [1-19], in this case in which $w = w_E$, it is:

[1-19b] $v_R = (v^2 + w_E^2 - 2 \ v \ w_E \operatorname{Cos} \theta \ )^{1/2}$

The main interest of this section has been to show how the model faces the description of inverse square law attractive and repulsive forces (at least in the case when both the source and the target interacting composite particles are at rest in the local aether).

The redistributions (residual distributions) of the proton and of the electron (or more generally of a unit positive charge and a unit negative charge) must somehow cancel each other to be consistent with the fact that the net electrostatic force exerted on any charged particle by a distant compact group formed by an equal number of protons and electrons is zero.
A simple ad hoc hypothesis, adopted in earlier versions of the model, was to suppose that such redistributions are related by:

[1-43] $r_P(v) = - r_E(v)$

together with the assumption that there is only one type of aetherinos.

It is evident that according to Eqs [1-41..43] :

[1-44] $F_{PE} = - F_{EE}$

Note: In those earlier versions of the model, attempts were made to *deduce* the relation [1-43] from more basic hypothesis about (1) the internal structures of those particles and (2) the velocity change suffered by an aetherino that collides with them. In this respect, promising results were obtained with the old redistribution paradigm presented in the Annex D.
Furthermore, adding specific hypothesis about the cross section to aetherino collisions of (a) an elementary particle of unit positive charge and (b) an elementary particle of unit negative charge,

those earlier versions of the model were able to account not only for [1-44] but for all the basic relations:

[1-44b] $F_{EE} = -F_{PE} = F_{PP} = -F_{EP} > 0$ (F >0 means that F is a repulsive force)

between unit charge particles at rest.
The problems arose when applying the old paradigms to the description of the forces between two charged particles that move relative to one another. In those cases the model predicted unacceptable asymmetries depending on whether the interacting charges were positive or negative.
To remove those asymmetries the model has now adopted the *hypothesis of the existence of two types of aetherinos.*

Basically, now **the model supposes that**:

1) There are *two* types of matter, p-type and n-type, characterized by the specific way in which they affect and are affected by the aetherinos that collide with them. One type of matter represents the positive electric charge and the other the negative electric charge.

Note: According to this model, the material particles called "elementary" in mainstream Physics must be considered to be made either of p-type matter either of n-type or either by an aggregation of p-type matter and n-type matter. Some elementary particles can be considered *composite* particles (CP) made by a bound system of more elementary particles which are the ones that ultimately collide with the aetherinos.

Note: It will initially be considered that the *electron* can be described by a single elementary particle made entirely of n-type matter while the *positron* can be described by a single elementary particle made entirely of p-type matter.

The present work will not attempt to explain the behavior of the two types of matter with deeper assumptions about their complexity or structure.

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 the material particles: "Impulsion interactions" and "Switch interactions".
In the "impulsion interactions" the aetherino gives impulse to the elementary 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 "type switch" 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 the elementary particles made of n-type matter (but not with the those of p-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 the elementary particles made of p-type matter (but not with the those of n-type matter). In these interactions a p-aetherino gives impulse to the particle with which it interacts.

6) Both kinds of elementary particles of *unit charge* have the same cross section to Impulsion interactions with its corresponding type of aetherinos.

Switch interactions:

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 p-type matter (but not with the n-type matter). 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 n-type matter (but not with the p-type matter). In these interactions the p-type aetherinos are transformed into n-type aetherinos.
9) Both kinds of elementary particles of *unit charge* have the same cross section to Switch interactions with its corresponding type of aetherinos.

(see more in the paper http://www.eterinica.net/redistribs_eterinicas_en.pdf)

NOTE 1-5
An elementary model of a *real* (material) clock can be thought to be implemented by a group of material particles confined to a small region of space. The particles making the clock move relative to the position of the clock as a whole but are bound by their mutual (internal) forces. Those internal movements of the particles under bounding forces give rise to repeating cycles of movement (e.g. orbits or vibrations). It can be understood that the clock "ticks" (i.e. gives out a time unit) when some characteristic particle or group of particles completes a cycle.
The rate (tick rate compared to that of a standard) of a material clock depends on the strength of the forces that bound its particles. According to mainstream physical laws, it will be agreed that for most real clocks (atomic, quartz, spring, …) their tick rate is expected to increase if the forces that govern their internal movement are increased. That is for example the case if their internal oscillations can be described using Hooke's law, being well known that the frequency of a harmonic oscillator increases when the "Hooke" restoring force (at a given elongation x_0) increases in strength.

But according to the general description of forces made in this work, the strength of the forces between particles depends on the specific parameters of the (local) aether bathing those particles. For example, the force that a particle A exerts on a particle B is conditioned by the velocity's distribution of the aetherinos "emerging" from A which on its turn depends on the distribution of the local aether bathing A.

- Time dilation due to speed.
This model of the aether does also predict a time dilation of moving clocks but the interpretation is different from that of Special Relativity (SR). As will be shown, this model predicts that the time dilation of a moving clock increases with its *absolute speed* and therefore only relative to other clocks of less absolute speed. SR on the contrary predicts that any clock that moves relative to the reference frame of the observer runs slower compared to the clocks at rest in such reference frame. But since for SR all inertial reference frames are equivalent, it asserts that for an observer associated to the earlier moving clock it is now the earlier rest clocks that slow down because they are now the moving clocks. I.e. SR's "new logic" accepts that both assertions "A > B" and "B < A" are true all the time, but of course for consistency it also "forbids" some comparisons that it calls "frame jumping" that would manifest the contradiction.

When a material body (e.g. a real clock) has a high speed *relative to the aether* and therefore so do have its particles, the model predicts that the forces between those particles will be weaker than if the

body was at rest in the aether. (Some hints of this prediction are given in Annex A and in Section 12). But as said above, weaker forces correspond in general to a slower ticking rate of a material clock.

No *quantitative* estimations can be made at this stage of the time dilation due to speed predicted by the aether model. That is so mainly because this work has yet open theoretical issues that must be studied before trying to find numerical values for its constants (e.g. speed distribution of the rest-aether, number of aetherinos per unit volume, speed of the Earth relative to the aether, etc…) able to fit the experimental facts. It is on the other hand believed that if the experiments related with time dilation (e.g. Ives & Stilwell and other Doppler shift experiments, lifetimes of fast particles, etc, …) seem to confirm the predictions of Special Relativity it must be due to the fact that the speed of the Earth relative to the aether is small compared to the speed of light and therefore all the particles that have high speeds in our labs do also have high *absolute* speeds.

- Time dilation due to Gravitation:

A gravitation field can be described by a specific kind of non standard (non canonical) distribution of aetherino velocities. When bathed by this non standard aether, the particles of a clock are expected to exert on each other weaker forces than the ones that they would exert in an undisturbed canonical aether. As said above, weaker forces correspond in general to a slower ticking rate of the clock. Of course, the bigger the strength of the gravitation field bathing the clock (e.g. the nearer to a massive gravitation-active body responsible of the aether disturbance) the slower will be the internal oscillations of the clock.

It is of interest for future approximate calculations to define the concept of:

Effective aetherinical impulse of a speed v aetherino on a non compact CP:

The aetherinical force exerted by a parallel flux $\Phi(v)$ of aetherinos of speed v relative to a non compact CP (made by m SPs of internal speed w) was calculated above and expressed in Eq [1-34].

Let Σ be again the geometrical cross section of the CP (i.e. of the virtual sphere of confinement representing the CP). Σ is a somewhat "vague" concept but its value will cancel in most approximations based on it.

If the CP is receiving a parallel flux $\Phi(v)$ of aetherinos it can then be said that in unit time $\Phi(v)\,\Sigma$ aetherinos of speed v are incident on the CP. Since these $\Phi(v)\,\Sigma$ aetherinos produce on the CP a total impulse *per unit time* equal to the force F of Eq [1-34] it can then be defined:

"*Effective aetherinical impulse of a speed* v *aetherino on a CP*" =

= [total impulse exerted on the CP in unit time when being bombarded by a parallel flux of speed v aetherinos] / [number of aetherinos of the parallel flux incident on the CP by unit time] =

= [aetherinical force exerted on the CP by the parallel flux of speed v aetherinos] / [(cross section Σ of the CP) x (incident flux)]

Therefore, with the present assumptions of the model (see Eq [1-34]):

"Effective aetherinical impulse of a speed v *aetherino on a non compact CP"* =

[1-50] $$i_{1CP} = \frac{F}{\Phi(v)\,\Sigma} = h_1 \frac{\sigma\, m}{\Sigma} \frac{1}{2v} \int_0^{\pi} (v - w\cos\theta)\; v_R\; \sin\theta\; d\theta$$

which as said above is valid only when the SPs do not screen each other from the incident flux of aetherinos, or more precisely, is valid only when

$\Sigma >> m\,\sigma$

v is the speed of the aetherino *relative to* the CP.

The effective aetherinical impulse is actually a vector whose direction is that of the velocity of the incident aetherino in the reference frame of the CP.