+

7 - Transversal forces.

Abstract:

It has often been argued that if the aether is the medium for the transmission of electromagnetic waves it must have the mechanical properties of rigid solids since only then it can sustain transversal waves with which the polarization features of light can be explained. It is here argued that an aether of aetherinos (that has more in common with a rarefied gas than with a solid) is also able to exert transversal forces and, together with the intrinsic anisotropy of the electron, to implement the polarization of radiation.

The kind of "waves" that an aether of aetherinos can carry are not standard waves of any of the two typical types: i.e. longitudinal and transversal. In those standard waves it is some local variable (or state) of the medium that propagates but the medium itself is not carried across space. On the contrary in the model of aether proposed the aetherinos themselves (i.e. the medium) must travel through space all the way from the source to the detector to carry the information (i.e. to allow the transfer of energy and momentum) because the aetherinos do not interact with other aetherinos but only with matter.

It will now be defended that the transversal features of radiation (mainly polarization) can also be accounted for by "aetherino waves" and not only by standard transversal waves. (The official point of view that "it is the transversal electric and magnetic fields that propagate without a medium" is considered just an euphemism to avoid a public confession of the incapacity to define a consistent medium).

According to the model when the aetherinos collide with the charged particles of matter they re-emerge with a different distribution of speeds. The distribution of aetherinos that emerges from a charged particle is different from that of the standard undisturbed aether (or more precisely, is different from the distribution that would emerge from the region of space “assignable” to the particle if this particle was not there). As a consequence of their *redistribution* of aetherinos, the material particles exert forces on other material particles.

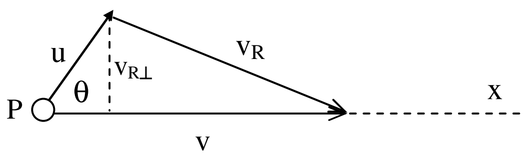
Note: The paper *redistribs_eterinicas_en.pdf* of this work explains the features of the *redistributions of aetherinos* created by the material particles.

A transversal force of the model.

An aetherino travelling from an emitter E to a detector R along the straight line E-R imparts an impulse **i** to the detector. But this impulse will also have a component perpendicular to E-R *if* the elementary detector (e.g. an electron of the detector) is itself moving (relative to E) with a velocity that has a non zero component along a direction perpendicular to E-R.

When an electron of the detector receives a flow of aetherinos modulated in such a way that the density of aetherinos in the flow is periodically smaller and bigger than that of the standard undisturbed aether, the target electron will increase and decrease its transversal speed as an effect of the forces exerted by such periodic flow of aetherinos. For example:

Consider an emitter of radiation E and a detector R. Let S be the rectilinear[1] reference frame associated with the detector R (at the epoch of *detection*). Consider first an aetherino that was "emitted" at E and reaches R. Let **v** be the velocity of this aetherino in S. The direction of **v** in S will be called x. Let P be an elementary detector (e.g. an electron) that forms part of R. The detector R is supposed to be composed of many elementary detecting particles that are the ones that ultimately collide with the aetherinos. The macro detector R is at rest in the frame S of description but its elementary detectors (like P) may move relative to R. Let S' be the reference frame associated with P at the epoch of arrival of the mentioned aetherino.
If P is at rest in R (and hence in S) when the incident aetherino collides with it, P suffers an impulse along the direction x. In this case there is no transversal force.
But suppose now that P is moving in S with a velocity **u** that has a non zero component along the plane perpendicular to x (i.e. the direction of **u** is different from x).
Let θ be the angle that **u** makes with the direction +x.
According to the definition [1-1a] of Section1, the elementary aetherinical impulse given to P in the collision acts along the direction of the velocity of the aetherino *relative to the material simple particle* suffering the collision. Let $\mathbf{v_R}$ be this relative velocity (see Fig[7-0]).



Fig[7-0]

The *elementary impulse* given to P, defined in Section-1 as $\mathbf{i_1} = h_1\, \mathbf{v_R}$, has therefore a *transversal* component (perpendicular to x) that will be called $i_\perp$

[7-1] $$i_\perp = h_1\, v_{R\perp} = - h_1\, u \,\mathrm{Sin}\, \theta$$

The minus sign in Eq [7-1] indicates that the impulse acquired by P, due to the colliding aetherino considered, acts in opposition to the initial component of **u** along the plane perpendicular to x (i.e. to $u_\perp$). This does *not* mean that radiation will always tend to decrease the speed component of P along the plane perpendicular to the direction E-R (see below).

Suppose that, in the absence of radiation, the speed distribution of aetherinos in the reference frame S in the vicinity of R corresponds to that of the canonical (rest standard) aether. Then, in the absence of radiation and other aetherinical material forces, an elementary detector P moving in S will only suffer the aether drag force F_D . But the effects of this aetherinical drag force F_D have been shown to pass unnoticed because it exerts the same acceleration on all the other material bodies local to the detector (whose absolute speeds relative to the aether are supposed to be very similar).

[1] A rectilinear reference frame is one in which all the aetherinos travel in straight lines at constant speeds.

In presence of the radiation emitted by E the detector will alternately detect an excess or a deficit of impulses respect to those of the canonical aether. This excess or deficit will be in those aetherinos whose velocity has the direction x in S.

Suppose now that an *excess* of aetherinos along the direction x reaches P at a given time. All these aetherinos in excess will produce an aetherinical force on P due to impulses of the kind shown in Fig[7-0] that will *decrease* the x-perpendicular velocity component of P. This is so because according to the hypothesis B of the model (Eq[3-1), the aetherino collision shown in Fig[7-0] contributes to an increment of the velocity of P given by:

[7-2] $\Delta_1 \mathbf{u} = \mathbf{i_1}/\mu = h_1/\mu \ \mathbf{v_R}$

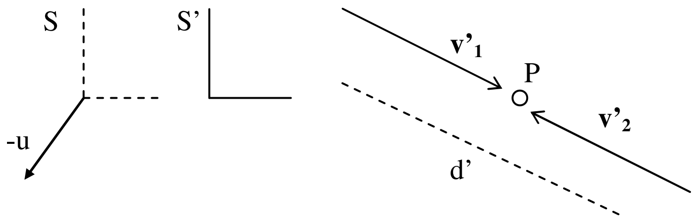
and therefore, in this case, with a *decrease* of the perpendicular-to-x velocity component of P

[7-3] $\Delta_{1\perp} u = (h_1/\mu) \ \mathbf{v_{R\perp}} = - (h_1/\mu) \ u \sin\theta$

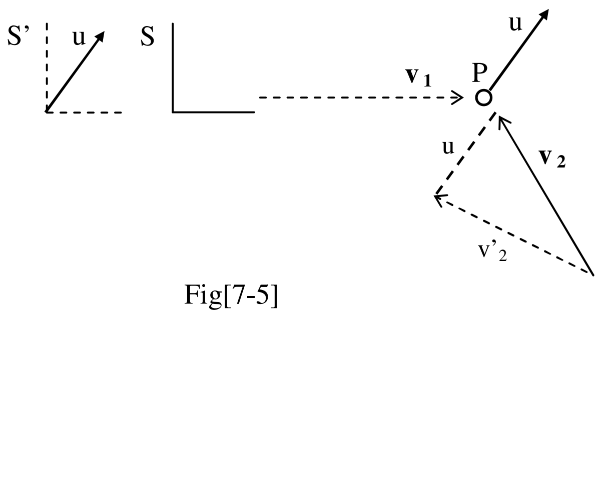
(Note: μ is a constant specific of the impulsed particle that relates the velocity increase suffered by a material particle (like P) collided by an aetherino with the elementary impulse $\mathbf{i_1} = h_1 \mathbf{v_R}$ suffered by the particle. See Section-1. μ can be called the "inertial mass" of the particle P).

But when a *deficit* of aetherinos along the direction x reaches P at a given time, this deficit will exert a force on P that acts in the "opposite" direction to that acting in the excess case and therefore will produce an *increase* in the perpendicular-to-x velocity component of P. Since this might not seem so evident, the next drawings in 2D will try to clarify it.

Let S' be the reference frame associated with the elementary detector P before the pertinent collisions:



Fig[7-4]



Fig[7-5]

Fig [7-4] represents the detecting particle P in its own reference frame S'. Before the arrival of the aetherinos carrying the disturbance emitted at E, P is bathed by an undisturbed aether. The official observer notices that along direction d' (actually along all directions) the aetherinical impulses are balanced (i.e. he assigns a zero net official force). This is represented in S' by two impacting aetherinos of opposite velocities $\mathbf{v'_1}$ and $\mathbf{v'_2}$. (The direction d' of S' corresponds to that of an aetherino of speed v_1 and direction +x in S).

Notice that the velocity $\mathbf{v'_1}$ shown in Fig[7-4] corresponds to that which has above been called $\mathbf{v_R}$ in Fig[7-0].

Suppose now that P is subject to a *deficit* of aetherinos along the direction +x. Fig [7-5] represents this scenario as seen in the reference frame S. Such deficit has been represented by the removal of the aetherino number 1 (represented now with a dotted line). The now unbalanced collision of the aetherino number 2 produces a net impulse on P. (Notice that $\mathbf{v_2}$ represents the velocity in S of the unbalanced aetherino whose velocity in S' is $\mathbf{v'_2}$). According to the hypothesis B (see Eq 7-2) this collision #2 produces an increase in the velocity of P equal to:

[7-6] $$\Delta_2\mathbf{u} = \mathbf{i_2}/\mu = (h_1/\mu)\ \mathbf{v'_2} = -\ (h_1/\mu)\ \mathbf{v'_1} = -\Delta_1\mathbf{u}$$

and (supposing that the axis x' of S' has been taken parallel to the axis x of S) its component perpendicular to x' :

[7-7] $$\Delta_{2\perp}u = (h_1/\mu)\ \mathbf{v'_{2\perp}} = -\ (h_1/\mu)\ \mathbf{v'_{1\perp}} = +\ (h_1/\mu)\ u \operatorname{Sin}\theta$$

which is also the value attributed by S to the perpendicular-to-x component of the *velocity increase* suffered by P (i.e. also as seen by S since *velocity differences* of any given body are Galileo invariant).

Notice also that in a reference frame of the emitter E in which the elementary detector P is moving, the effect of a *deficit* aetherino of velocity **v** *not*-coming along the semi direction +x is *not* equivalent to the effect of one aetherino of velocity -**v** in *excess* coming along the opposite semi-direction (i.e. along the semi direction -x *of S*). In the first case $u_\perp$ is increased as has been said while in the second it would be decreased.

Notice also (see [7-3]) that the decrease (or increase) of $u_\perp$ due to an extra (or missing) collision of an aetherino of direction x in S does not depend on the value of the speed of such aetherino in S but only on the velocity **u** at the epoch of the extra (or missing) collision. This is evident considering that all the aetherinos, whatever their speed, travelling along a given direction (e.g. x) in a given reference frame (e.g. S) have by definition a zero velocity component perpendicular to such direction and therefore the transversal component (perpendicular to such direction) of the velocity of any such aetherino *relative to* the moving particle is made up entirely by the transversal component of the particle's velocity **u**.

If a detector R of radiation receives a balanced flux of aetherinos of the canonical aether by all *its* directions except by a special "one" by which it receives a non standard flux (e.g. it receives radiation) then the velocity components of its electrons along a plane perpendicular to the special direction will increase or decrease according to whether the flux along the semi direction in which the electrons *perceive* the disturbance is smaller or greater than the flux that they receive along the opposite semidirection.

Consider for example that the detector of radiation is a typical antenna in which the conduction electrons (i.e. the elementary detectors) are bound to a surface or to a wire conductor and are only free to move along such surface or wire. If the non standard aetherino flux (i.e. the flux that implements the radiation) entering R increases and decreases in a periodic way and if the conductor is placed somewhat perpendicularly to the direction E-R then the conduction electrons of R will increase and decrease their speeds along the antenna with the same periodicity to that of the non standard flux of aetherinos that reaches them.

Preferred redistribution axis (PRA) of an electron.

As explained in the paper *redistribs_eterinicas_en.pdf* of this work, the redistribution of aetherinos created by *an* electron (and by many other particles) *is not isotropic* (relative to the electron) but has an axis of symmetry that is being called the "preferred redistribution axis" (PRA). That would be consequence of an inner structure of the electron (as the mainstream concept of *spin* implicitly recognizes).

A possible hypothesis is that the redistribution of aetherinos is *stronger* along the directions that make a small angle with the electron's PRA (i.e. along the directions close to that of the PRA "emerge" an excess of aetherinos while along the directions far from that of the PRA “emerge” a deficit of aetherinos) .

An alternative hypothesis is that the redistribution of aetherinos created by an electron is *different* along its PRA than along the electron's equator and possibly also different along the opposite semi-direction to its PRA. *Different* redistribution means that it affects in a different way to the aetherinos of different speeds relative to the electron. (For example it could happen that along the electron's PRA emerge an excess of high speed aetherinos and a deficit of slower ones while in the directions making a big angle with the PRA (say bigger than 90º) emerge a deficit of high speed aetherinos and an excess of slower ones.

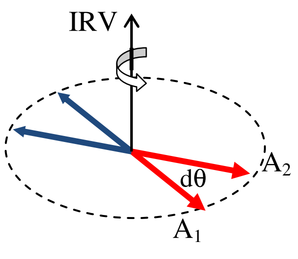
The exact electron's redistribution, as a function of the angle with its PRA, has not been postulated yet (since it must fit many phenomena not studied yet in detail) but a proposal about the *overall* (average over all directions) redistribution of the electron has already been made in the mentioned paper *redistribs_eterinicas_en.pdf* of this work.

It is assumed that when a *free* electron suffers a force (a net impulse due to unbalanced aetherino collisions) and hence an acceleration, its PRA gets aligned perpendicularly to the acceleration and starts to rotate. This rotation is considered a gyroscopic-type reaction that preserves the conservation of the intrinsic angular momentum of the electron.

The vector characterizing the rotation rate and direction of the Preferred Redistribution Axis will be called *intrinsic rotation vector* (IRV).

Suppose that, during a small time interval dt, the electron's redistribution axis PRA rotates a small angle dθ (i.e. if it was pointing to some space direction $\mathbf{A}_1$ it tilts to point to some new direction $\mathbf{A}_2$). As is common in the description of rotations, the vector (IRV) representing such rotation rate is agreed to be a vector perpendicular to the plane formed by $\mathbf{A_1A_2}$, pointing in the semi-direction of a screw that turns clockwise A_1 over A_2 and with a modulus equal to the time rate dθ/dt (angular speed). See Fig(7-7).

Fig [7-7]

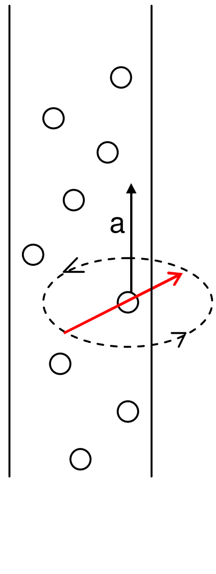


In Fig [7-7], the *preferred axis of redistribution* of the electron is represented by a segment of a straight line whose two opposite semi directions have been distinguished by different colors. The figure represents such PRA in two different orientations. In changing from the orientation A_1 to the orientation A_2 the PRA performs a rotation. Its rate and direction of rotation is represented by the up-pointing vector IRV.
The IRV (vector defining the rotation of the PRA) has by hypothesis the same direction of the electron's acceleration and will be supposed to have also the same semi-direction.

Example of emission of radiation by a rectilinear antenna (e.g. a dipole type antenna).

Consider a group of neighbour conduction electrons of a rectilinear wire antenna (Fig 7-8). Suppose that the electrons are forced to move up and down the antenna by some external harmonic driving force. The average velocity of the electrons will be directed at all times along the antenna and will change in a sinusoidal way. The average acceleration of the electrons will therefore also be directed along the direction of the antenna and will change periodically in a sinusoidal way. The redistribution of aetherinos of each electron is characterized by its specific "preferred redistribution axis" (PRA) but on the whole those redistributions will add up to create a net (or global) redistribution that can also be characterized by a preferred redistribution axis[2]. This global PRA of the pertinent group of electrons will be oriented at all times perpendicularly to their average acceleration and hence to the antenna and will rotate (at an angular rate conditioned by the average acceleration of the electrons along the antenna).

Fig[7-8]



[2] If, for example, the PRA of the electron is such that its redistribution varies with the angle (with such PRA) in a sinusoidal way then the composition of a big number of randomly oriented PRA will add up to a global redistribution with the same angular sinusoidal features as its elementary components.

Fragment of a rectilinear wire antenna. The figure shows the instantaneous acceleration **a** *and the PRA (in red) of one of its electrons.*

An external detector located at the equator plane of the antenna (or at not too big "latitudes") will therefore be “pointed” periodically by the rotating “global PRA” of the electrons. The detector will therefore receive a periodic succession of excess and deficit of aetherinos.

The model’s interpretation of some phenomena suggests that the angular speed at which an electron’s PRA rotates is proportional to the square root of the electron’s acceleration (see Note_8 of the paper radiations_en.pdf). But if that is so, then since the accelerations of the electrons moving up and down a rectilinear antenna do not have a constant value (but change periodically between zero and a maximum a_M) it will happen that the rate at which the antenna emits in a given direction excesses and deficits of aetherinos cannot be assigned a single frequency but a plurality of them.
But whatever small the acceleration of the electrons (and hence the angular speeds of their PRA) they cannot contribute to create a succession of excesses and deficits of aetherinos of a smaller frequency to that with which the acceleration changes its sign (semi-direction) and therefore the PRA changes its sense of rotation. Note: the frequency ν at which the acceleration of the electrons changes its sign is equal to twice the oscillation frequency of the electrons in the antenna.

Note: It has not yet been studied how the “plurality” of frequencies emitted by such type of rectilinear antenna (due to the “plurality” of accelerations suffered by its electrons when performing a sinusoidal movement) can predict the harmonics (multiples of the basic frequency) of a dipole type antenna.

Note: in the paper radiations_en.pdf it is asserted (with so far no electro-mechanical justification) that *“the stable orbits of atoms can be modeled supposing that in these orbits the PRA of the electron remains aligned at all times in the same spatial direction. An observer placed at a distance much bigger than the average radius of the electron’s orbit and looking at the electron will always see the same angle between the direction of observation and the PRA of the electron and will therefore not detect any periodically varying aetherino distribution (radiation).*

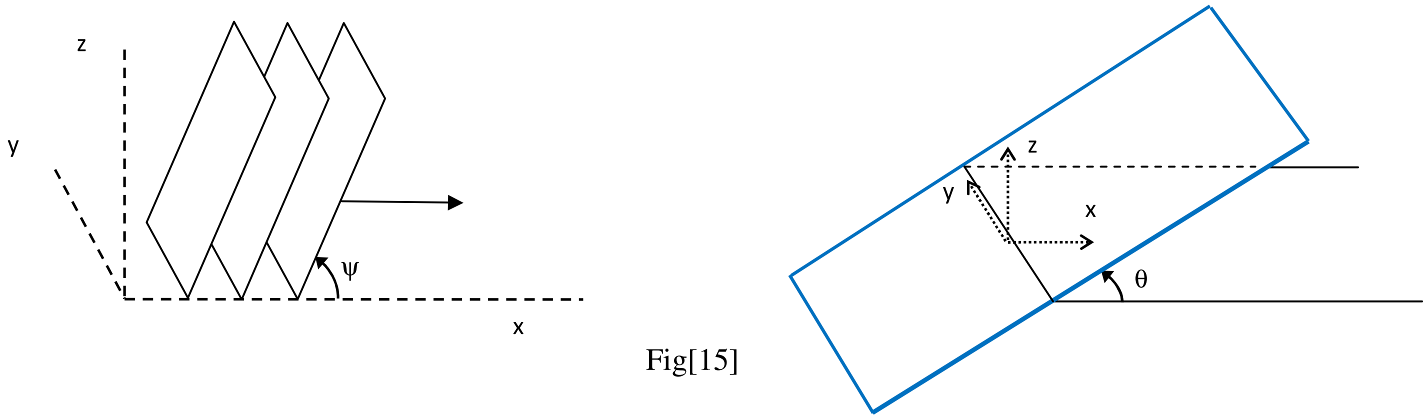
Polarization.

The model is at this stage unable to describe in detail the polarization of radiation but considers that, with the paradigms proposed below, an aether of aetherinos is able to implement the main features of polarization.

The model of aetherinos allows the possibility that linearly polarized light corresponds to *wave fronts* (planes of equal phase) that *are not strictly perpendicular to the ray* (e.g. to the velocity of the wave front and hence of the aetherinos that implement it) but make a small angle (are *tilted*) with the plane perpendicular to the ray.

Two examples of linear polarization:

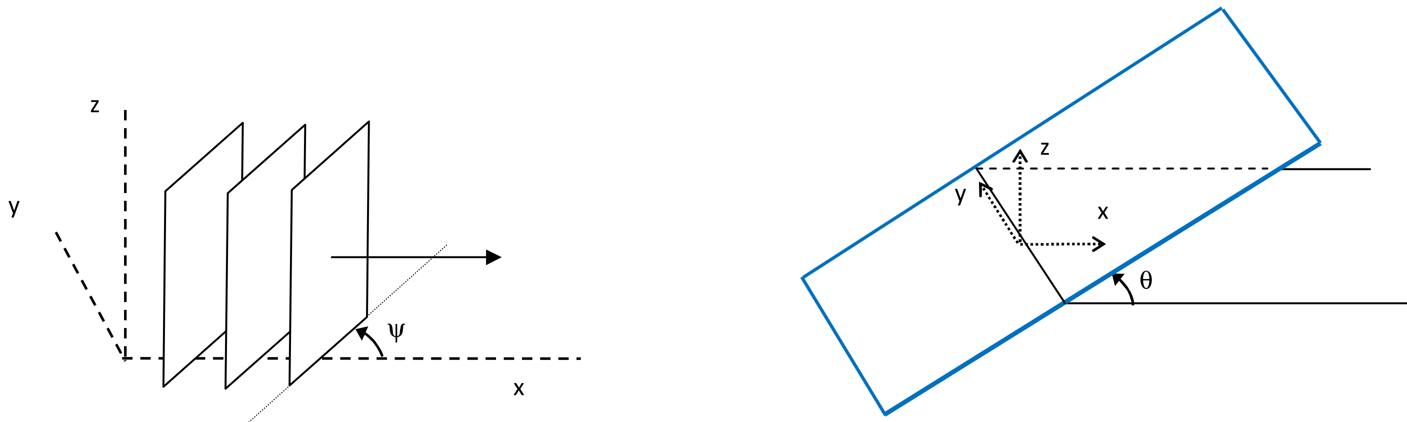
1) The wave fronts are orthogonal to the plane XZ and make an angle ψ with the plane XY



Fig[15]

This case would correspond to what mainstream Physics calls linearly polarized light along the direction Y (i.e. in which the electric vector of the (electromagnetic) wave remains parallel to the axis Y while it oscillates in amplitude). This wave would reflect in the plane of a dielectric oriented as in Fig[15] in which the plane is orthogonal to the plane XZ.

2) The wave fronts are orthogonal to the plane XY and make an angle ψ with the plane XZ



Fig[16]

This case would correspond to what mainstream Physics calls linearly polarized light along the direction Z (i.e. in which the electric vector of the (electromagnetic) wave remains parallel to the axis Z while it oscillates in amplitude). This wave would *not* reflect (at the Brewster angle) in the plane of a dielectric oriented as in Figs[15 & 16] orthogonally to the plane XZ.

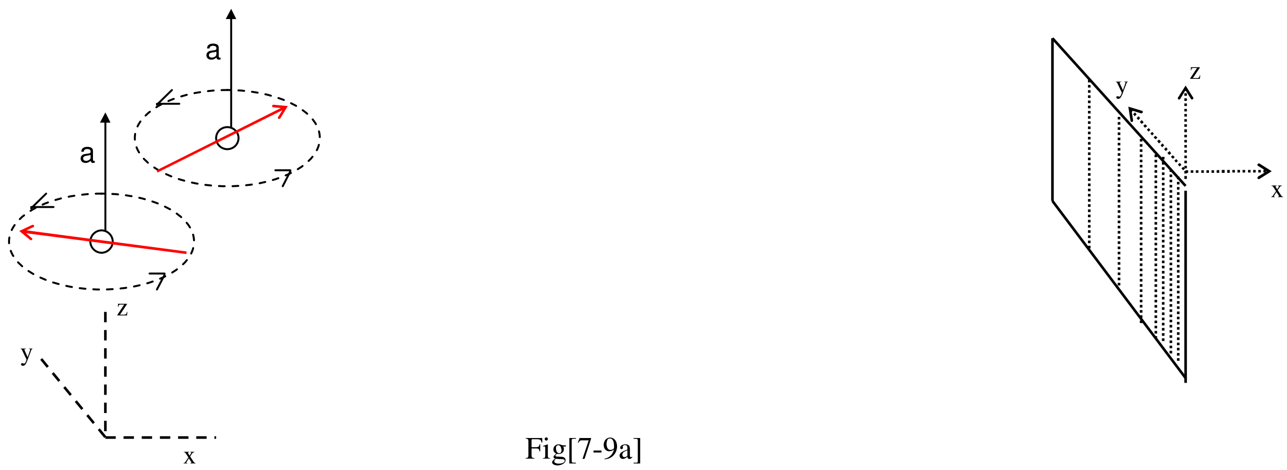
It will now be described, in a somewhat qualitative way, how the model of aether could (perhaps) account for the main features of polarized light. As in mainstream physics, the model's description of polarization relies on the wave nature of light.

Note: The model cannot consider the "photon" a physical entity consistent with the aether but, at most, a concept that can be used to simplify the description of the "non classical" way in which matter gains or looses energy and momentum when it emits or absorbs radiation. This aether model is based on the assumption that the disturbance called *radiation* does *not* concentrate in space in small independent packets (photons) capable to interact with only a single elementary charged particle at a time but, that instead, it spreads over wide areas of space whose extension increases with the distance from the source and within which the aetherino fluxes crossing those areas of space at a given epoch are related by a specific phase relation.

It has often been argued that if the aether is the medium for the transmission of light waves it must have the mechanical properties of rigid solids since only then it can sustain transversal waves (i.e. waves that exert forces in directions orthogonal to that of their propagation) which are the only accepted paradigm to explain the polarization features of light. It will here be argued that an aether of aetherinos (that has more in common with a rarefied gas than with a solid) is also able to implement the polarization features of light thanks to the gyroscopic nature of the elementary detectors (electrons) and to the geometry of the emission.

Consider an emitter E of radiation with its electrons suffering accelerations along the direction Z. The left part of Fig(7-9a) sketches this emitter in which two of its electrons have been represented with their PRA in red.
The scenario of Fig (7-9a) corresponds to what modern mainstream optics should identify as plane polarized radiation in the plane XZ which, in the present model, is the plane defined by the IRV of the emitting electrons and the direction of propagation of the wave.
Note: In the electromagnetic description of light, the scenario of Fig(7-9a) would correspond to a wave with its oscillating electric field aligned in the direction Z. Modern mainstream optics calls "polarization plane" to the plane defined by the electric vector of the wave and the direction of propagation of the wave.

Consider a detecting screen R facing the emitter (i.e. the screen is placed perpendicularly to the straight line E→R joining the emitter and the detector). See the right part of Fig (7-9a).
Suppose that the dimensions of both the emitter E and the detecting screen R are small compared with the distance E_R and suppose, as in Fig (7-9a), that the detecting screen is located at a position of approximately the same coordinate Z as the emitter but at a very distant X.



Fig[7-9a]

The PRA of the emitting electrons remain in the horizontal plane XY during their rotations and therefore the global aetherinical redistribution of these electrons behaves like a "beacon" of aetherinos that is directed periodically towards the detecting screen. The dots on the screen of Fig(7-9a) represent the density number of aetherinos reaching the detector at some given instant. At such instant the number of aetherinos reaching the right part of the screen happened to be greater than the number reaching the left part, i.e. there is a *gradient* of aetherinos on the screen along the direction Y. The magnitude and semi-direction of such gradient will change periodically in time and this will be so whether the PRA of the emitting electrons perform full rotations in a continuous way (e.g due to a long lasting acceleration) or, more frequently, in an oscillating way (oscillating acceleration).

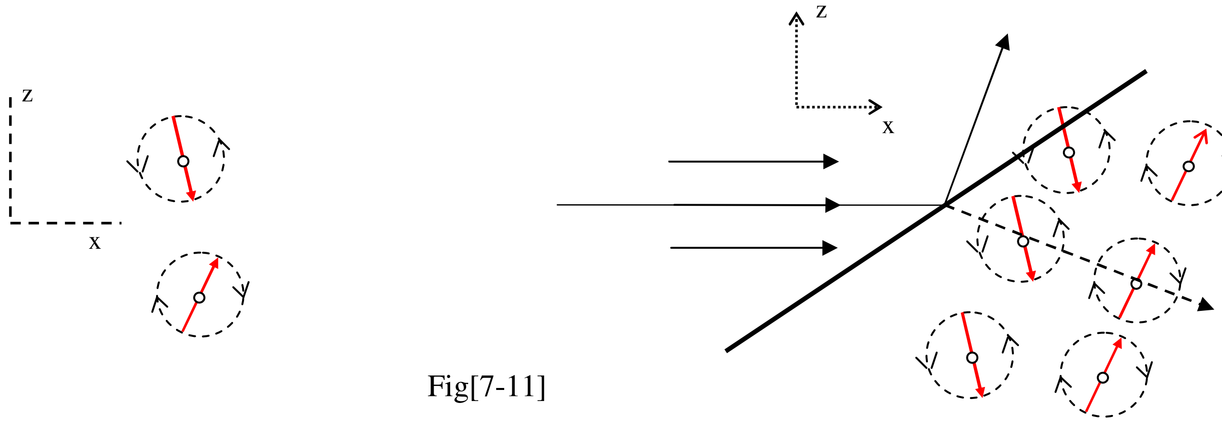
On the other hand, assuming as has been said that the screen is "facing" the emitter, the number of aetherinos reaching at any given instant the upper part of the screen will be, at all epochs, approximately equal to the number of aetherinos reaching its lower part (i.e. there is no gradient of aetherinos on the screen along the direction Z).
In other words, when the PRA of the electrons oscillate (or rotate) in a plane Π, the emitted radiation is (according to the modern mainstream agreement) plane-polarized in the plane that contains the IRV and the propagation vector. Therefore the so called in mainstream physics "plane of polarization" is *perpendicular* to the plane Π in which the PRA of the emitting electrons lean.
The fact to be underlined is that, in the model, a polarized radiation, implemented by a light-house-type emission of aetherinos, singularizes on the detector a symmetry plane (the XY plane in the case of Fig (7-9a)) defined by the direction of the gradient (vector) of the aetherino's flux and by the direction of the "ray". Since this plane is the one *swept* by the oscillating PRAs of the emitting (or re-emitting) electrons it will be called in what follows the "***sweep plane***". This *sweep plane* of the model is therefore orthogonal to the so called polarization plane and more precisely orthogonal to the electric vector.
Note: The term "ray" used above must be understood, as in geometrical optics, as the path along which advances the energy of the radiation.

Note: The radiation based in an aether of aetherinos exerts on the detector (1) longitudinal forces (along the direction emitter-detector) whose strength oscillates in time (probably as much as to reverse their semidirection) at the frequency of the detected wave, and (2) transversal forces that, in turn, increase and decrease the transversal speed of the elementary detectors. In the electromagnetic mainstream description of radiation there are no longitudinal oscillating forces (although there is a radiation pressure along the Poynting vector).
To confirm the longitudinal force of the model, an experiment could perhaps be performed in which the detector (e.g. a mirror) rotates in synchrony with the frequency of the wave. Adjusting the phase of rotation of the mirror with the phase of the wave it could perhaps be observed that the detector (the mirror) suffers an intense force towards the emitter that is not described by mainstream physics.

Fig (7-9b) represents a scenario in which the emitting electrons suffer accelerations along the direction Y. That acceleration makes their PRA rotate in the plane XZ and therefore the "sweep plane" detected at the screen is now the XZ plane.
The screen detects now an oscillating gradient of aetherinos along the direction Z whose magnitude and semi-direction changes periodically in time. There is now no gradient of aetherinos on the screen along the direction Y.
The scenario of Fig (7-9b) corresponds to what mainstream optics should identify as plane polarized radiation in the plane XY (i.e. again a plane perpendicular to the "sweep plane" of the model).

Fig[7-9b]

Reflection of polarized light on the plane surface of a dielectric.

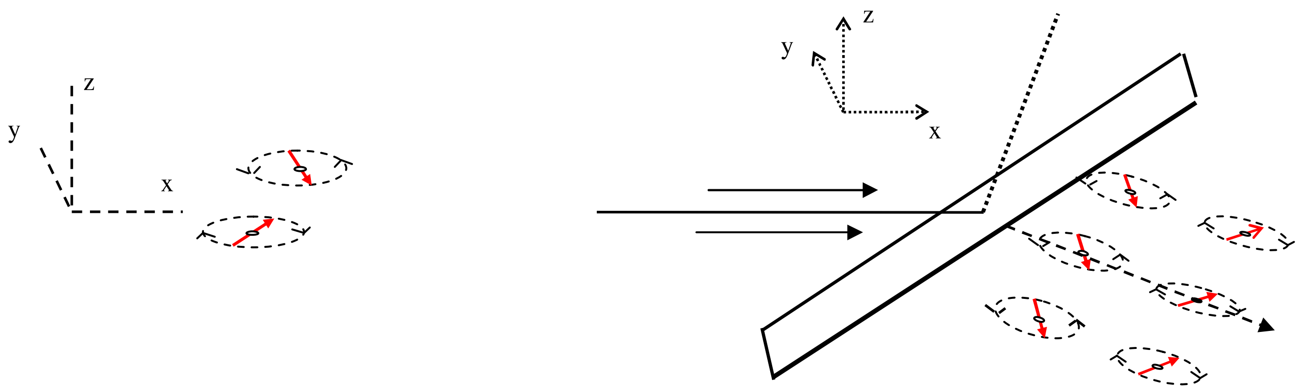


Fig[7-11]

Fig (7-11) represents a 2-D view of polarized light entering a dielectric (e.g. a glass). The surface of the dielectric (drawn as a solid line) must be imagined to be perpendicular to the "paper". The ray bends (due to refraction) when entering the dielectric but in this example the sweep plane does not reorient in the dielectric but is always the plane XZ of the paper.

The model considers that from a typical emitter of radiation emerge aetherinos whose distribution of speeds changes with a given frequency (which is the frequency assigned to the emission). When such oscillating distribution of aetherinos is passing by an electron of the detector it exerts an oscillating force on it. It seems reasonable to expect that the IRV of this detecting electron will swap its semidirection (while always implementing the same sweep plane) at the same frequency at which the force that it suffers oscillates.
The **thesis** is that *the electrons of a dielectric* (those responsible for the transmission (and eventually reflection) of light), *when receiving a polarized radiation, rotate with their Intrinsic Rotation Vector (IRV) oriented perpendicularly to the incoming sweep plane* (and therefore with the PRA of the electrons always lying on that sweep plane). This rotation would be so due to symmetry features of the incoming wave and to mutual electron interactions, that cannot be justified at this stage of the description. The induced rotation is different from that of a *free* electron suffering a driving aetherinical force because the electrons of a dielectric are not free but *bound* by internal forces to the neighbour matter of the dielectric.

It is therefore evident that, in the arrangement of Fig(7-11), the electrons of the dielectric re-radiate in the direction of the reflected ray.



Fig[7-12]

Fig[7-12] represents a 3-D view of polarized light entering a dielectric (whose surface is again perpendicular to the XZ plane) but now the sweep plane of the emitter electrons is the XY plane. (This case would correspond to what mainstream Physics calls light polarized in the XZ plane).

The sweep plane tilts a small angle after entering the dielectric (in the same amount as the incident ray tilts into the refraction ray). The PRAs of the dielectric electrons, although they still rotate in the sweep plane, they now never point in the direction of the expected reflection ray and there is therefore no reflection of the light.

Home page www.eterinica.net

30-7-05 / 16-7-11 **old studies to be revised**

An example of transversal aetherinical force.

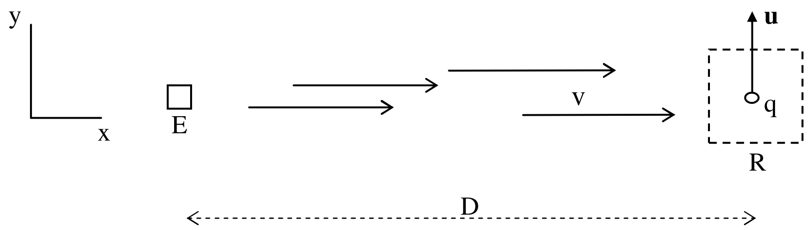


Fig [7A-1]

Let E be an emitter of radiation and let the reference frame of description be associated with it. Let R be a detector of radiation that is at rest relative to E and at a distance D. Let q be an electron of the detector R. Suppose that at the epoch τ of observation of the aetherinical force, the electron q moves with velocity **u** in a direction perpendicular to E-R.

The aetherinical force (at the epoch τ) suffered by the target electron q due to the excess (or deficit) of aetherinos emerged from the emitter E at any earlier epoch τ_E will be calculated from the knowledge of their number density in the vicinity of q at this epoch τ. The density of the different speed aetherinos may on its turn be deduced from the knowledge of how many aetherinos emerge from E at the pertinent epoch τ_E and from the calculus of their "spread" at the epoch τ when they pass by the vicinity of q. This spread depends on its turn on the distance D travelled by the aetherinos in the reference frame of the emitter E, or more precisely, on the distance travelled on that reference frame between their emission at τ_E and their arrival at τ.

The speed v of the aetherinos emerging E at τ_E and arriving at the detector R at τ is:

[7A-4] $$v = D / (\tau - \tau_E)$$

Let $r[v, \tau_E]\, dv$ = redistribution of E = excess (or deficit) of aetherinos with speeds (relative to E) in the interval {v, v+dv} that "emerge" from E by unit time and by unit solid angle at the epoch τ_E.

The calculus of the force suffered at the epoch τ by the electron q will be done adding the contributions of the pertinent aetherinos emerged from E at *all* the epochs τ_E (earlier than τ) in which there is activity at the emitter.

Imagine (for an easier visualization) that all the aetherinos that emerge from E during the time interval $\{\tau_E, \tau_E + d\upsilon_e\}$ do actually depart E instantly at the beginning of such interval. And (only) for the purpose of determining their density at the epoch τ in which they reach the detector, imagine that E emits in an isotropic way (i.e. at the same rate and with the same distribution in all directions). At the epoch τ the aetherinos of whatever speed, emitted at τ_E, that have crossed a sphere of radius D centered at E are

[7A-5] $$N_D = 4\pi\ d\tau_E \int_{\frac{D}{\tau-\tau_E}}^{\infty} r[v, \tau_E]\ dv$$

Those that have crossed a sphere of radius D+ΔD centered at E are

[7A-6] $$N_{D+\Delta D} = 4\pi\ d\tau_E \int_{\frac{D+\Delta D}{\tau-\tau_E}}^{\infty} r[v, \tau_E]\ dv$$

Therefore those that at the epoch τ are between the 2 spheres:

[7A-7] $$N = N_D - N_{D+\Delta D} = 4\pi\ d\tau_E \int_{D/(\tau-\tau_E)}^{(D+\Delta D)/(\tau-\tau_E)} r[v, \tau_E]\ dv$$

Supposing that the region of interest (where the density of the pertinent aetherinos is sought) is the small region occupied by the detector it can be assumed that ΔD << D , and, since a typical redistribution $r[v, \tau_E]$ is expected to vary smoothly with v, the integral [7A-7] can be approximated by:

[7A-8]
$$N \cong 4\pi d\tau_E\ r[v_{min}, \tau_E]\ (v_{Max} - v_{min}) \equiv 4\pi d\tau_E\ r\left[\frac{D}{\tau-\tau_E}, \tau_E\right] \left(\frac{D+\Delta D}{\tau-\tau_E} - \frac{D}{\tau-\tau_E}\right) =$$
$$= 4\pi d\tau_E\ r\left[\frac{D}{\tau-\tau_E}, \tau_E\right] \frac{\Delta D}{\tau-\tau_E}$$

The volume between both spheres is:

[7A-10] $$Vol = 4\pi/3\ (\ (D+\Delta D)^3 - D^3\ )$$

that for ΔD << D, neglecting the terms on ΔD^3 and on ΔD^2 , can be approximated by

[7A-11] $$Vol \cong 4\pi\, D^2\, \Delta D$$

Finally the density (number per unit volume) of the pertinent aetherinos (those that emerge E during $\{\tau_E, \tau_E + d\upsilon_e\}$ and are at the epoch τ at a distance D) is:

[7A-12] $$d\chi = \frac{N}{Vol} = \frac{r\left[\frac{D}{\tau-\tau_E}, \tau_E\right]}{D^2\,(\tau-\tau_E)}\, d\tau_E$$

Consider, in the detector, an electron q of velocity **u** along a direction y perpendicular to E-R. The aetherinos of speed $v = D / (\tau - \tau_E)$ have a speed *relative to such target electron* given by:

[7A-14] $$v_T = (D^2/(\tau-\tau_E)^2 + u^2)^{1/2}$$

The contribution of the activity of E during $\{\tau_E, \tau_E + d\upsilon_e\}$ to the aetherinical force acting on the electron q at the epoch τ can then be calculated as follows:
Let σ_q be the cross section of the electron to aetherino impulsion-collisions. (In what concerns the present calculus of the force suffered by the electron such cross section σ_q can be treated like a geometric cross section).
The number of collisions in unit time between the electron and those aetherinos emerged from E during the time interval $\{\tau_E, \tau_E + d\upsilon_e\}$ (whose density $d\chi$ in the vicinity of the electron is given in [7A-12]) can be found considering that, *in the reference frame where these pertinent aetherinos are at rest,* the electron of geometric cross section σ_q sweeps in unit time a cylindrical volume of length v_T. Hence this rate of collisions is:

[7A-16] $$dn = \sigma_q \; v_T \; d\chi$$

Each of these collisions contributes (see Section 1) with an aetherinical impulse:

[7A-17] $$\mathbf{i_1} = h_1 \, \mathbf{v_R}$$

where $\mathbf{v_R}$ is the velocity of the colliding aetherino relative to the collided particle.

In this case it is $\mathbf{v_R} = \mathbf{v_T}$ and therefore the impulse has the components:
[7A-17b] $i_{1x} = h_1 \, v_{Tx} = h_1 \, D / (\tau - \tau_E)$
[7A-17c] $i_{1y} = h_1 \, v_{Ty} = - h_1 \, u$

along respectively the direction "x" (along E-R) and the direction "y" (perpendicular to E-R). Therefore the y-component (i.e. transversal) of the aetherinical force (impulse by unit time) suffered by the electron at the epoch τ due to the aetherinos emerged from E at the epoch $\{\tau_E, \tau_E + d\upsilon_e\}$ is:

[7A-18] $$dF_y(\tau, \tau_E) = i_{1y} \, dn = -h_1 \, u \, \sigma_q \, v_T \, d\chi$$

and adding the contributions of the pertinent aetherinos emerged from E at *all* the epochs τ_E (earlier than τ) in which there is activity at the emitter, the transversal component of the net force suffered by the electron at the epoch τ is:

[7A-19] $$F_y(\tau) = -h_1 \, u \int_{ti}^{tf} \sigma_q (D^2/(\tau-\tau_E)^2 + u^2)^{1/2} \frac{r\left[\dfrac{D}{\tau-\tau_E}, \tau_E\right]}{D^2(\tau-\tau_E)} \, d\tau_E$$

where u (i.e. the speed of the electron along the direction y) will in general depend on the epoch τ. That is so because the electron is acted in general by internal restoring and/or dumping forces at the detector and by the driving force $F_y(\tau)$ itself. The differential equation predicting the evolution of $u(\tau)$ due to those forces will be analysed below.
Notice also that in those epochs τ in which the integral of [7A-19] takes a negative value (due to a global *deficit* of aetherinos arriving the detector) the force $F_y(\tau)$ has the same sign of u, i.e. acts along the semi direction of *u* tending to *increase* that speed. On the other hand when the integral is positive, the force has an opposite sign to that of u and tends to *decrease* the transversal speed *u* of the electron.

The cross section σ_q of the electron to aetherino *impulsion-type collisions* has been kept inside the integral because it depends by hypothesis on the speed v_R of the aetherinos *relative* to the electron and it therefore depends on τ_E (see [7A-14]). This hypothesis (see redistribs_eterinicas_en.pdf) was:

[7A-20] $$\sigma_I[v_R] = \frac{a_I}{\mathrm{Exp}\left[b_I\ \left(\left(c - v_R\right)^2\right)^{1/2}\right] + 1}$$

where:
v_R is the speed of the incident aetherino relative to the electron
a_I and b_I are constants
c is the speed of light in vacuum.

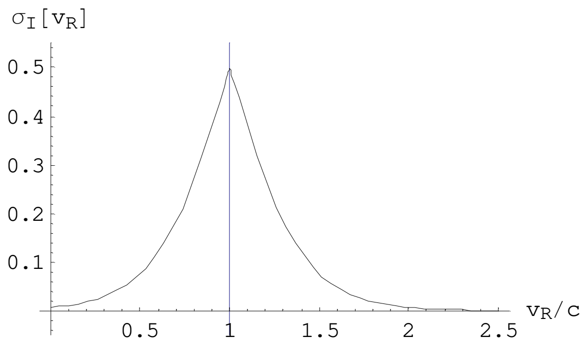


Fig [7A-20]
In arbitrary units, **cross section** of an electron to collisions with n-type aetherinos of relative speed v_R (taking a_I=1, b_I=5/c).

Therefore in this case in which the speed v_R of the aetherinos relative to the electron q of the detector is given (see 7A-14), by:

$$v_R = v_T = (D^2/(\tau - \tau_E)^2 + u^2)^{1/2}$$

the cross section σ_q must be written inside the integral as:

[7A-20b] $$\sigma_q \equiv \sigma_I[v_T] = \frac{a_I}{\mathrm{Exp}\left[b_I\ \left(\left(c - (D^2/(\tau - \tau_E)^2 + u^2)^{1/2}\right)^2\right)^{1/2}\right] + 1}$$

NOTE: According to the model, the aether is made by aetherinos of two types (n and p) of which, in an undisturbed aether, there is an equal number of both types. Furthermore, in an undisturbed aether, both types of aetherinos have the same distribution of speeds. The particles of negative electric charge suffer impulsions (i.e. a change of their velocity) when they are collided by the n-type aetherinos, while the particles of positive electric charge suffer impulsions when they are collided by the p-type aetherinos. When a particle of negative electric charge is collided by a p-type aetherino it does not suffer an impulsion but it *switches* the p-type aetherino into a n-type aetherino. Similarly, when a particle of positive electric charge is collided by a n-type aetherino it does not suffer an impulsion but it *switches* the n-type aetherino into a p-type aetherino.

The expression [7A-19] giving the transversal component of the net force suffered by the target electron q has been evaluated for some "reasonable" examples of the redistribution $r[v, \tau_E]$ characterizing the emission.

Redistribution of the electron. **to be revised**

As said above, the electron is supposed to have a preferred axis of redistribution (PRA). Therefore the redistribution created by a single electron is not isotropic.
Nevertheless there will be many scenarios in which the pertinent electrons are randomly oriented in space. In redistribs_eterinicas_en.pdf an expression for the "*isotropic redistribution of the electron*" was postulated. This isotropic redistribution corresponds by hypothesis to the *average in all directions* redistribution of a big number of randomly oriented electrons.
According to redistribs_eterinicas_en.pdf, the isotropic redistribution of n-type aetherinos created by a *randomly oriented* electron at rest in the aether is (see the Eqs [R-9] and [R-10] of that paper):

[7A-21] $$r_{En}[v_R] = \sigma_S[v_R] \frac{\rho[v_R]}{2} \frac{v_R}{4\pi}$$

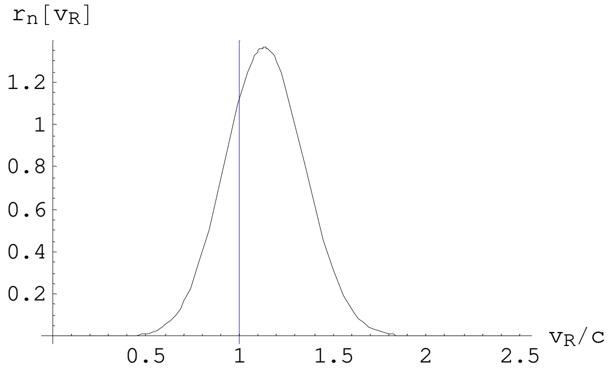
where $\sigma_S[v_R]$ is the cross section of an electron to p-type aetherinos (i.e. those aetherinos that it *switches* into its impulsion n-type aetherinos) given by:

[7A-21b] $$\sigma_S[v_R] = a_S \ \mathrm{Exp}\left[-b_S (c - v_R)^2\right]$$

and where:

[7A-22] $$\rho[v_R] = \frac{4 N_0}{\sqrt{\pi}\ V_M^3} v_R^2 \ e^{-(v_R/V_M)^2}$$

is the canonical distribution of the aether (see [R-6] of redistribs_eterinicas_en.pdf)



Fig[7A-21]

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 $a_S=1$, $b_S=10/c^2$, $V_M=20c$, $N_0=10^5$). See Eq[7A-21].

The *protons* are also supposed to have a preferred axis of redistribution. Therefore the redistribution created by a single proton is neither isotropic. The *average* redistribution of a big number of randomly oriented protons is isotropic and is by hypothesis equal to the negative of the "isotropic redistribution of the electron", i.e.

[7A-24] $$r_{Pn}[v_R] = -r_{En}[v_R] = -\sigma_S[v_R]\ \frac{\rho[v_R]}{2}\ \frac{v_R}{4\pi}$$

During its emission of radiation, the redistribution of aetherinos created by the emitter E along the direction E-R can be considered the result of adding (1) the time varying (oscillating) redistribution of *n* electrons and (2) the isotropous redistribution of *n* non-oscillating protons.
The redistribution along the direction E-R of the *n* electrons oscillates in time because of the rotations of their PRA.

Note: It has been supposed (in another paper) that the anisotropy in the redistribution of a single electron consists in a gradual widening and flattening of such redistribution as the angle with its PRA increases from 0 to π/2. It was also supposed that the functions defining such widening and flattening are such that any group of randomly oriented electrons creates a net redistribution that can also be characterized by a PRA and an anisotropy with the same widening and flattening features to those of the individual electrons. This does not contradict the earlier assertion that the redistribution of a big number of electrons randomly oriented in space creates a net redistribution that can be considered isotropic because this last assertion must be understood to imply not only a random orientation in space but also in time (i.e. the individual electrons change also quickly and randomly in time their spatial orientations). Summarizing: *at any given instant* the net redistribution of a big number of electrons randomly oriented in space will have the anisotropy features of a PRA, but assuming also that the individual electrons change *randomly* in time their orientations the time averaged net redistribution of the group of electrons can be considered isotropic.

Simplified model of emission of radiation. **to be revised**

When a group of *n* electrons rotate their PRA with the same frequency ν_1 and keeping each electron a constant direction of their rotation vector during a non negligible time (the coherence time of the emission) the global redistribution of the group of n electrons will oscillate in time at the frequency ν_1.
This oscillating redistribution will be supposed, for the present purposes (of introducing the description), that along the direction E-R is given simply by:

[7A-25] $$r_{OSC}[v_R, \tau_E] = n\ r_{En}[v_R]\ (1 + a_0 \mathrm{Sin}[2\pi \nu_1 \tau_E])$$

where a_0 is a non dimensional constant such that $a_0 < 1$

The non-oscillating redistribution of an equal number *n* of protons of the emitter, whose contribution to the disturbance that travels towards the detector must be accounted for, is:

[7A-26] $$r_{NON}[v_R, \tau_E] = -n\ r_{En}[v_R]$$

The net redistribution created by the emitter E along the direction E→R is therefore:

[7A-27] $$r[v_R, \tau_E] = r_{OSC} + r_{NON} = n\ r_{En}[v_R]\ a_0\ \mathrm{Sin}[2\pi \nu_1 \tau_E] =$$

$$= \sigma_S[v_R]\ \frac{\rho[v_R]}{2}\ \frac{v_R}{4\pi} n\, a_0\ \mathrm{Sin}[2\pi \nu_1 \tau_E]$$

The redistribution $r[D/(\tau-\tau_E), \tau_E]$ appearing in the integrand of the force [7A-19] is the redistribution that emerged from the emitter at the epoch τ_E and its disturbance, reaching the detector at the epoch τ, is therefore transported by aetherinos of speed $D/(\tau-\tau_E)$. But, since the emitter has been supposed to be at rest relative to the detector, $D/(\tau-\tau_E)$ is also the speed v_R of the aetherinos relative to the emitter responsible of the redistribution created at the epoch τ_E.
In other words, the redistribution $r[D/(\tau-\tau_E), \tau_E]$ that must go into [7A-19] is just the redistribution $r[v_R, \tau_E]$ of [7A-27] replacing in it:

[7A-28] $$v_R = |D/(\tau-\tau_E)| = (\text{ since } \tau > \tau_E) = D/(\tau-\tau_E)$$

Note: the assumption $\tau > \tau_E$ means that it is assumed that the signal received at the detector at an epoch τ will not be affected by the activity of the detector at epochs later than τ. The limits t_i and t_f of integration of τ_E must not be greater than τ.

With all these considerations, the radiation force [7A-19] suffered at the epoch τ by an electron q of the detector that is moving perpendicularly to E-R at a speed u, can be written as:

[7A-29]

$$F_y(\tau) = -h_1\, u \int_{ti}^{tf} \sigma_I[v_T]\,(D^2/(\tau-\tau_E)^2+u^2)^{1/2} \frac{\sigma_S[v_R]\,\frac{\rho[v_R]}{2}\,\frac{v_R}{4\pi}\,n\,a_0\,\mathrm{Sin}[2\pi\nu_1\,\tau_E]}{D^2\,(\tau-\tau_E)}\,d\tau_E =$$

$$= -\frac{h_1\,n\,a_0\,u}{8\pi\,D^2}\int_{ti}^{tf} \sigma_I[v_T]\,(D^2/(\tau-\tau_E)^2+u^2)^{1/2} \frac{\sigma_S[v_R]\;\rho[v_R]\,v_R\,\mathrm{Sin}[2\pi\nu_1\,\tau_E]}{(\tau-\tau_E)}\,d\tau_E$$

where as explained above:

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

$$\sigma_I[x] = \frac{a_I}{\mathrm{Exp}\left[b_I\,\left((c-x)^2\right)^{1/2}\right]+1}$$

$$\sigma_S[x] = a_S\,\mathrm{Exp}\left[-b_S\,(c-x)^2\right]$$

$$v_R = D/(\tau-\tau_E)$$

$$v_T = (D^2/(\tau-\tau_E)^2+u^2)^{1/2}$$

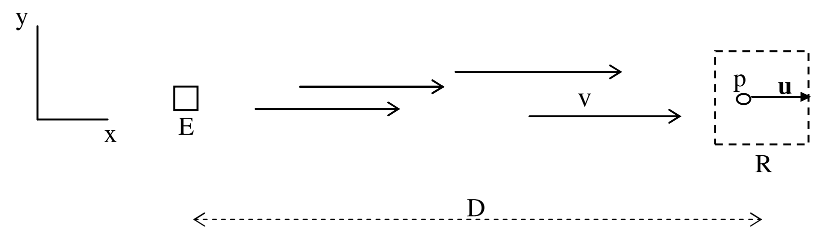
With the mentioned assumptions, no exact expression has been found for the integral [7A-29]. Nevertheless with the help of numerical integrations it has been found that, for "long lasting" emissions and for u<<c, the force $F_y[\tau]$ (i.e. the transversal component of the force suffered at the epoch τ by an electron of the detector) can be approximated very well by:

[7A-30] $$F_{y\,Aprox}(\tau) = -\frac{n\,h_1\,N_0\,a_0\,a_I\,a_S\,b_I\,c^7\,K_0}{2\pi^{3/2}\,V_M{}^3}\,\frac{u}{D^4\,\nu_1{}^2}\,\mathrm{Sin}[2\pi\nu_1\,(\tau-D/c)]$$ for u <<c

where K_0 = 0.0125 (by unknown reasons) and where
u is the speed of the target electron that has been supposed to be moving with a velocity **u** *perpendicular* to the direction E-R. Notice therefore that the above calculus is only valid for *normal incidence* of radiation on the surface of the detector R, though it should not be difficult to deduce the force for incidence under other angles.
Notice that the speed u has been considered constant (independent of the observation epoch τ) and therefore neither [7A-29] nor its approximation [7A-30] pretend to give the time evolution of the actual force suffered by the electron in a real case in which the electron changes its speed u due to the driving force of the radiation and to the restoring and/or dumping forces in the detector. The expression [7A-30] is instead just an *auxiliary expression* from which to deduce, with the pertinent

differential equation, the real movement acquired by a target electron receiving the oscillatory disturbance created at the emitter.

Another calculus that has been performed is the longitudinal force suffered by an electron of the detector that receives radiation when it is moving in the direction E→R with a speed u.



Fig[7A-40]

Consider an electron *p* of the detector of velocity **u** along the direction *x* defined by E→R.
An aetherino of speed $v = D / (\tau - \tau_E)$ coming from the emitter has a speed *relative to such target electron* given by:

[7A-41] $$v_L = |D/(\tau-\tau_E)-u| = \left((D/(\tau-\tau_E)-u)^2\right)^{1/2}$$

Now, the impulse $\mathbf{i}_l = h_l\, \mathbf{v}_R = h_l\, \mathbf{v}_L$ on the target electron *p* due to an aetherino coming from the emitter has the components:

[7A-42] $$i_{lx} = h_l\, v_{Lx} = h_l\, (D / (\tau - \tau_E) - u)$$
[7A-43] $$i_{ly} = h_l\, v_{Ly} = 0$$

Following similar steps as above, the x-component of the aetherinical force (impulse by unit time) suffered by the electron at the epoch τ due to the aetherinos emerged from E at the epoch $\{\tau_E, \tau_E + d\upsilon_e\}$ is:

[7A-18b] $$dF_x(\tau,\tau_E) = i_{lx}\, dn = h_l\, v_{Lx}\, \sigma_p\, v_L\, d\chi$$

and the longitudinal force exerted on the target electron *p* at the epoch τ by all the aetherinos in excess (or in deficit) emerged from the emitter during its activity can be written as:

[7A-44] $$F_x(\tau) = h_l \int_{ti}^{tf} \sigma_p\, (D/(\tau-\tau_E)-u)\, \left((D/(\tau-\tau_E)-u)^2\right)^{1/2} \frac{r\left[\dfrac{D}{\tau-\tau_E}, \tau_E\right]}{D^2\,(\tau-\tau_E)}\, d\tau_E$$

where the oscillating redistribution $r[D/(\tau-\tau_E), \tau_E]$ of the emitter is the same as above (Eq[7A-27] replacing in it $v_R = | D/(\tau-\tau_E) |$) and where the cross section σ_p of the target electron to aetherino collisions takes now the expression:

[7A-45] $$\sigma_p \equiv \sigma_I[v_L] = \frac{a_I}{\mathrm{Exp}\left[b_I \left((c-(D/(\tau-\tau_E)-u))^2 \right)^{1/2} \right] + 1}$$

[7A-46] $$F_{x\,Aprox}(\tau) = \frac{n\, h_1\, N_0\, a_0\, a_I\, a_S\, b_I\, c^8\, K_0}{2\,\pi^{3/2}\, V_M^{\;3}} \frac{1}{D^4\, \nu_1^{\;2}} \mathrm{Sin}[2\,\pi\,\nu_1\,(\tau - D/(c+u))] \qquad \text{for } u \ll c$$

where again $K_0 = 0.0125$ (by unknown reasons) and where
u is the speed of the target electron that, at the epoch of detection of the force $F_X(\tau)$, is moving with a speed u *along* the direction E-R. Notice that now this speed u affects the phase of the detected signal but not its amplitude. The dependence $-2\,\pi\,\nu_1\,D/(c+u)$ of the phase on *u* indicates that the signal travels at speed c *relative to the detecting electron*.
Comparing the former approximate expression [7A-30] of the transversal force with the approximate expression [7A-46] of the longitudinal force it can also be seen that the latter has an extra factor *c* instead of the factor *u* of the former expression.

Notice that the speed u has been considered constant (independent of the observation epoch τ) and therefore neither [7A-44] nor its approximation [7A-46] pretend to give the time evolution of the actual force suffered by the electron in a real case in which the electron changes its speed u due to the driving force of the radiation and to the restoring and/or dumping forces in the detector. The expression [7A-46] is instead just an *auxiliary expression* from which to deduce, with the pertinent differential equation, the real longitudinal movement acquired by a target electron receiving the oscillatory disturbance created at the emitter.

to be revised and completed. **Home page** www.eterinica.net