Eve 14 *(28-10-2018 / 11-11-2018/ 15-11-2018)*

P.S. This model of an electron structure able to respond to a radiation that has lost its oscillations after travelling great distances, is being thoroughly revised. See a sketch of the new model in http://www.eterinica.net/EVE14/Eve14_b.pdf (in spanish).

14- Model of the electron acting as a detector of light.

In other sections of this work it has been proposed that the electron has an internal structure due to which the redistribution of aetherinos, that it creates, has an axial symmetry that allows to define a *preferred redistribution axis* (PRA).
It has also been proposed that an electron emits a radiation of frequency ν when such electron performs an intrinsic spin (rotation) so that its PRA points towards the observer (like a lighthouse) with that same frequency.

In the Section 6 of this work are described the calculi that were done to deduce the force suffered by a target electron due to the aetherinical redistribution created by the electrons of the emitter whose PRA rotate with a given frequency ν. Those calculi show that, for a "long lasting" emission, the oscillation amplitude of the force suffered by the detecting electron decays with the distance *d* (between emitter and detector) as $1/d^3$. With such fast decay the model seems unable to describe the experimental facts about the propagation of light. But in Section 6 the internal structure of the target electron (elementary detector) was not taken into account.

But suppose that the distribution of aetherinos emerging from an active emitter has an excess of aetherinos of some given interval of speeds and/or a deficit of aetherinos of some other interval of speeds.
Note: Those excesses or deficits are so when compared to the distribution of speeds that is ascribed to an undisturbed aether (or more precisely to the undisturbed local aether in the vicinity of the detector at the epoch in which it receives the radiation). An "excess" (or a "deficit") must here be understood as the ratio between (i) the time average number of aetherinos of a given speed (by unit speed interval) that cross in unit time with a given direction (by unit solid angle) a given surface and (ii) the number of the corresponding ones that would cross that given surface if the emitter had been inactive.

It seems evident that those excesses (or deficits) decay with the distance (between the emitter and the given surface) according to $1/d^2$ (i.e. to the inverse square of the distance) at least in the case of a long lasting emission (that allows to neglect the longitudinal dispersion of the aetherinos of the speed interval being considered). I.e. although the amplitude of the oscillations in the number of aetherinos (originated at the emitter of radiation) decays with the distance as $1/d^3$, the average (in time) value of the supposed excesses and deficits of aetherinos only decays as $1/d^2$.

The question then arises of how a distribution of aetherinos, whose oscillations have vanished, can be capable to originate, at a distant detector, oscillations of a specific frequency ω related univocally to the "form" of the distribution but not to its intensity.

It will here be shown that such behavior is possible under certain suppositions related to the internal structure of the electron.

Note: It is assumed that when some matter receives radiation (implemented by a flux of aetherinos with a characteristic distribution of speeds), *the electrons* of such matter *are the elementary detectors* that respond to such radiation. The global response of the elementary detectors (electrons) then determines to which degree the radiation is reflected, transmitted or absorbed.

The model.

Suppose that the electron is composed by two (or perhaps more) "*nuclei of sensibility*" to the colliding aetherinos of respective cross sections σ_A , σ_B and respective masses m_A , m_B separated by a small distance *s*.

The system is able to rotate about its center of mass (that will be called *O*) located at a distance r_A from the nucleus A and at a distance r_B from the nucleus B in such a way that (as in Classical Mechanics):

[14-1] $r_A/r_B = m_B/m_A$

with

[14-2] $s = r_A + r_B$

Several mathematical simulations have been done that describe the behavior of an electron when it is radiated by a stable aetherinical distribution that exerts on the nuclei of such electron a force F[u] that depends on the speed *u* at which the pertinent nucleus moves away from the emitter of the radiation.

Several expressions of the force F[u] (considered "reasonable" from the point of view of the aether model) have been tested. At this stage, the expression that makes the more adequate predictions is:

$$F[u] = k\,\sigma\,\mathrm{Exp}\left[-\frac{1}{q}\left(\frac{u}{c}+\frac{u^2}{2c^2}\right)\right]$$

[14-3]

where:

u is the speed at which the pertinent nucleus moves away from the emitter.

q is a positive constant that characterizes the pertinent radiation. Its value is conditioned by the aetherinical distribution emerging the emitter and therefore by the frequency of oscillation of the electrons of the emitter.

σ is the cross section of the pertinent nucleus to aetherinical collisions.

k is a constant that characterizes the intensity of the radiation and that therefore, as explained above, decays with the distance d (emitter-detector) according to $1/d^2$ (because it is at this rate that decay the excesses and deficits of the associated distribution).

The evaluations show that a target electron suffering such force acquires an intrinsic rotation (of its nuclei around the centre of mass of the electron) that stabilizes at an angular frequency ω that:

(1) depends on the parameter *q*.

(2) does not depend on the intensity k of the force.

But those results (1) and (2) are only obtained if:

(a) $m_A/m_B \neq \sigma_A/\sigma_B$ (i.e. the masses of the nuclei are *not* proportional to their cross sections).
(b) *the instantaneous orbital plane (of the nuclei around the center of mass) rotates at the same time with the same frequency* ω (with a rotation axis resting on the orbital plane and passing by the center of mass. See an example in Fig[14-1]). This condition (b) occurs, perhaps, in a straightforward way as a gyroscopic behavior consequence of the forces suffered by the internal components of a bound electron (bound to the matter of the detector and that is therefore not accelerated by the radiation force F[u]), but by the moment such mechanical behavior has not been studied and therefore it can be considered an ad hoc supposition.

NOTE: It is not difficult to find different expressions for the force F[u], qualitatively reasonable for the model, that also predict (as does [14-3]) that the electron's rotation stabilizes at some frequency ω that depends on some parameter of the force but does not depend on its intensity k. This suggests that what determines the behavior (1) and (2) is not so much a specific feature of the force but the gyroscopic behavior of the target electron.
Example of forces that predict those behaviors (1) and (2) are:
[14-3b] $F[u] = k\ \sigma\ Exp[-(1/q)(u/c)]$
or
[14-3c] $F[u] = k\ \sigma\ (u_L - u)$ (where the parameter here called u_L (instead of q) is the one conditioned by the nature of the emission and which, on its turn, conditions the behavior of the detecting electrons).

But besides leading to the predictions (1) and (2) it must happen that the frequency acquired by the target electrons changes when changing the speed of the emitter relative to the matter of the detector to which the target electrons are bound. I.e. the model of force must (3) be compatible with the (experimental) Doppler effect. But it happens that neither the expression [14-3b] nor the [14-3c] lead to acceptable predictions of the Doppler effect. The expression [14-3] does instead lead to reasonable predictions of the Doppler effect, (it has in fact been guessed ad hoc for that purpose).
It remains a task of the model to justify the expression [14-3] (or another that makes similar predictions) deducing it from the expected distribution of aetherinos emerging from an emitter electron that rotates with an angular speed ω (that conditions the value of the constant q that appears in such expression of the force).

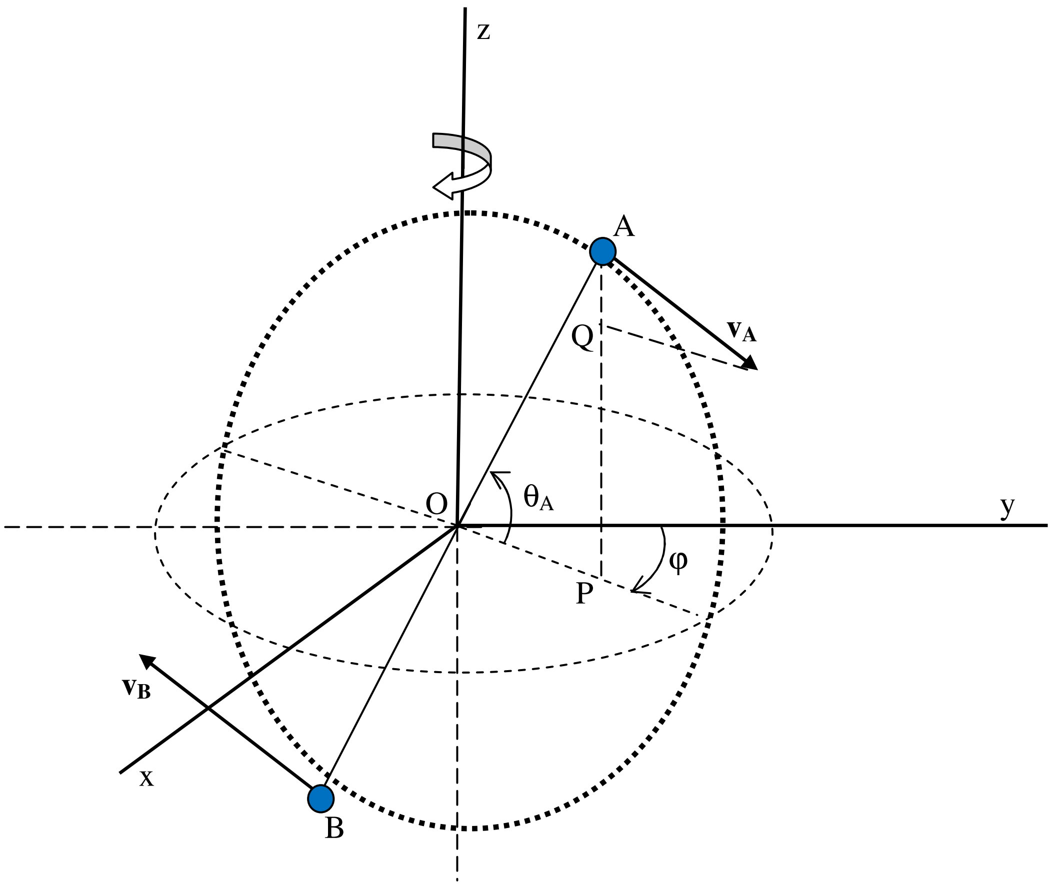

Fig [14-1]

Consider for example the nucleus A of cross section σ_A (to impulsion collisions by aetherinos), of mass m_A and at a constant distance r_A = OA from the center of mass of the electron.
Let $\mathbf{v}_A$ be (in the reference frame of the detector) the instantaneous *velocity* of A.
The angular speed ω at which A rotates (that is also the angular speed at which B rotates around O, even if it were $r_B \neq r_B$) is by definition:

[14-5] $\omega = d\theta_A/dt$ (where θ_A corresponds in the figure to the angle PÔA)

If the velocity $\mathbf{v}_A$ has the semi-direction that increases the angle θ_A, we can write $\omega = v_A/r_A$. Otherwise (like with the origin of angles chosen in Fig[14-1]) it will be $\omega = -v_A/r_A$.

It will be supposed that *the instantaneous orbital plane* (of the orbit defined by a small interval of positions θ_A) *does also rotate with an angular speed* ϖ *of equal modulus as* ω. (In the example of Fig[14-1] the axis of rotation of the orbital plane is the -z axis.

The angular speeds ω and ϖ would have different sign due to the election of the origins of the angles θ_A y φ). Therefore:

[14-6] $|\varpi| = |\omega|$

where

[14-6b] $d\varphi/dt = \varpi$ (where φ is in the figure the angle that the instantaneous orbital plane makes with the axis +y)

(Again, if the rotation of the orbital plane tends to increase the angle φ (like in Fig[14-1]) ϖ will be positive. Otherwise it will be negative).

It will first be deduced the instantaneous speed u_A at which the nucleus A moves away from the emitter (which is supposed to be located far away in the axis -y) because as expressed above in [14-3] the radiation force suffered by each nucleus depends on the relative speed u of each nucleus).

In the case of the nucleus A, the speed u (here called u_A) is the y-component of the velocity $\mathbf{v}_A$. This y-component can be deduced as follows:

Let v_x, v_y, v_z be the Cartesian components of $\mathbf{v}_A$.

From the Fig[14-1] it is evident that:

[14-7] $v_z = AQ = - v_A \text{Cos}[\theta_A]$

where the minus sign has been assigned because, in the example of the figure, $\mathbf{v}_A$ tends to *decrease* the angle θ_A.

It is also evident from the figure that the components v_x , v_y of $\mathbf{v}_A$ satisfy:

$$v_x = k \ \text{Sin}[\varphi]$$
$$v_y = k \ \text{Cos}[\varphi]$$

where the value of the auxiliary constant k can be deduced from the expression of the modulus of $\mathbf{v}_A$ as a function of its three components:

$$v_x^2 + v_y^2 + v_z^2 = v_A^2 \quad =>$$
$$k^2 \text{Sin}[\varphi]^2 + k^2 \text{Cos}[\varphi]^2 + v_A^2 \text{Cos}[\theta_A]^2 = v_A^2 \quad =>$$
$$k^2 + v_A^2 \text{Cos}[\theta_A]^2 = v_A^2 \quad =>$$
$$k^2 = v_A^2 \text{Sin}[\theta_A]^2 \quad =>$$

[14-8] $k = v_A \text{Sin}[\theta_A]$

and therefore

$$v_x = v_A \text{Sin}[\theta_A] \text{Sin}[\varphi]$$

[14-9] $u_A = v_y = v_A \text{Sin}[\theta_A] \text{Cos}[\varphi]$

Although, in general, the forces implemented by aetherinos do not only act along the direction of the velocity of the aetherinos but they also have transversal components when the targets move in different directions than those of the aetherinos, the following calculus will ignore (to simplify) the contribution of those transversal components and will assume that the radiation force [14-3] suffered by the "nuclei" of the target electrons only acts along the direction emitter-detector (that in the figure is the direction *y*). A more rigorous study of the behavior of the target electron accounting for the transversal components of the force in those parts of the orbits in which the velocity of the nuclei has non negligible v_x and/or v_z components, is postponed.

Then, the radiation force acting on A (whose strength depends on its speed u_A relative to the emitter and whose direction has here been supposed that is always along the axis y) has a component along the direction of the velocity $\mathbf{v}_A$ (tangent to the instantaneous orbit) that can be calculated from the expression of the *dot product* between both vectors:

$$F_{vA} = \mathbf{F}[u_A] \bullet \mathbf{v}_A/|\mathbf{v}_A| = (Fx[u_A]\, v_x + Fy[u_A]\, v_y + Fz[u_A]\, v_z) / v_A =$$
$$= (0 + F[u_A]\,(v_A \operatorname{Sin}[\theta_A] \operatorname{Cos}[\varphi]) + 0) / v_A =$$

[14-10]
$$= F[u_A]\,(\operatorname{Sin}[\theta_A] \operatorname{Cos}[\varphi])$$

That component F_{vA} of the radiation force along the direction of the orbital velocity $\mathbf{v}_A$ exerts a *torque*:

[14-11] $$\tau_A = F_{vA}\, r_A = F[u_A]\,(\operatorname{Sin}[\theta_A] \operatorname{Cos}[\varphi])\, r_A$$

Similarly for the nucleus B:

[14-12] $$\tau_B = F_{vB}\, r_B = F[u_B]\,(\operatorname{Sin}[\theta_B] \operatorname{Cos}[\varphi])\, r_B =$$
$$= F[u_B]\,(\operatorname{Sin}[\theta_A + \pi] \operatorname{Cos}[\varphi])\, r_B =$$
$$= - F[u_B]\,(\operatorname{Sin}[\theta_A] \operatorname{Cos}[\varphi])\, r_B$$

Considering both nuclei, the *moment of inertia* of the electron (around a rotational axis passing by the center of mass and orthogonal to the instantaneous orbital plane) is known to be:

[14-14] $$I_O = m_A\, r_A^2 + m_B\, r_B^2$$

and therefore the sum of both torques $\tau_A + \tau_B$ causes to the electron an angular acceleration:

[14-15] $$d\omega/dt = (\tau_A + \tau_B) / I_O =$$

$$= \operatorname{Sin}[\theta_A] \operatorname{Cos}[\varphi]\,(F[u_A]\, r_A - F[u_B]\, r_B) / (m_A\, r_A^2 + m_B\, r_B^2)$$

which is the expression applied in the evaluations described below to deduce the angular speed w of intrinsic rotation of the target electron.
(It must be remembered that the angular speed of rotation of the orbital plane ($\varpi = d\varphi/dt$) is assumed to be equal (in modulus) to ω, at all times).

Note: in all the above expressions it must be acknowledged that

$$v_A = \omega\, r_A$$

[14-16] $$v_B = \omega\, r_B$$

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to be continued

Example of (Wolfram's) Mathematica notebook used in the evaluations:

28-10-2018 / 7-11-2018 / 12-11-2018

(To understand the evaluations that follow, see
http://www.eterinica.net/EVE14/Eve14.doc)

Some evaluations of the intrinsic angular frequency ω acquired by a bound (non-free) electron whose "nuclei" suffer a (non-oscillating) aetherinical force of the type:

F[u] = k σ Exp[-(1/q)(u/c+u^2/(2c^2))]

where:
σ is the cross section of the given nucleus (of the target electron) to be impulsed by the colliding aetherinos.
q is a constant that depends on the frequency of the emitter and hence on the "signature" of its emerging distribution.
u is the speed of the pertinent nucleus (of the target electron) *relative to* the emitter
c is the speed of light
k is a positive constant that implements the intensity of the force.

(Since the force F[u] relies on the distribution of aetherinos emerging from the emitter, and since these distributions are made of some excesses and some deficits of aetherinos at some speed intervals, and since the magnitude of those excesses and deficits decay with the distance emitter-target as $1 / d^2$ then it must be understood that the constant k decays with the distance as $1 / d^2$)

The inputs shown below (in blue) should be written and executed in a (Wolfram's) Mathematica notebook.
(but those readers already owning a Wolfram's Mathematica software can download the notebook at the following link http://www.eterinica.net/EVE14/Eve14_en.nb)

To understand the evaluations that follow, see
http://www.eterinica.net/EVE14/Eve14.doc

Let the electron be composed of two centers of sensibility ("nuclei") to the aetherinos.
Let σA and σB be the respective cross sections of those nuclei to collide with impulsion type (n-type) aetherinos.
Let mA and mB be the respective masses of those nuclei.
Let rA and rB be the respective radii at wich they orbit the center of mass O.
It will be assumed (as in Classical Mechanics) that rA/rB = mB/mA

The distance rA+rB between both nuclei is supposed to remain unchanged due to internal bounding forces not studied by the time being.

Therefore the two nuclei remain in opposite sides of the center of mass (and center of rotation) and it can be asserted that if the nucleus A is at a "declination" angle θA then the nucleus B is at a "declination" angle θA+π

It is here (in this Mathematica notebook) called:
θ the angle that in Eve14.doc is called θA
acAng the angular acceleration that in Eve14.doc is written as dω/dt

```
Clear[ω,ϖ,t,Δt,Frad,r,θ,φ,c,u,b,rA,rB,mA,mB,k,q]
```

It has been found "a posteriori" that the desired results (a final ω that depends on the value of the constant q but is independent of the intensity k) are only achieved if it is supposed that
mA/mB ≠ σA/σB. For example, suppose that (in arbitrary units):

```
σA=2;σB=1;mA=2;mB=2;

rA=0.000001;rB=rA*mA/mB;
```

The moment of Inertia IO of the electron of the model is:

```
IO=mA rA^2 + mB rB^2;
```

The radiation force acting on a a nucleus (of the electron) is implemented by:

```
Frad[θ_,φ_,r_,σ_]:=k σ Exp[-(1/q)(u/c+u^2/(2c^2))]/.u->ω*r*Sin[θ]Cos[φ]
```

In the following input of "initial conditions", other values of the constants k and q (and of the initial declination angle θ of A) should be tried to check the results.

```
c=1;
θ=π/2;φ=θ-π/2;ω=0;ϖ = ω;
k=8;q=0.2;

t=0;repeat=500000;

Δt=0.000002;
```

The following input cell is the routine that evaluates, by steps, the angular frequency ω of the electron

```
timeθω=Table[{t=t+Δt,acAng=Sin[θ]Cos[φ](Frad[θ,φ,rA,σA] rA-Frad[θ+π,φ,rB,σB] rB)/IO,θ=θ+ω*Δt,ω=ω+acAng*Δt,ϖ = ω,φ=φ+ϖ*Δt},{i,1,repeat,1}];


tθ=Table[Part[Part[timeθω,i],{1,3}],{i,1,repeat,1}];

θt=ListPlot[tθ,PlotLabel->"θ(t)",PlotRange->All,PlotJoined->True]
```

```
speedAng=Table[Part[Part[timeθω,i],{1,4}],{i,1,repeat,1}];

ωt=ListPlot[speedAng,PlotLabel->"ω(t)",PlotRange-
>All,PlotJoined->True]
```

After each execution of the routine timeθω it should be checked that the time-step-interval Δt chosen for the evaluation is at least (about) twenty times smaller than the period T=2π/ω of revolution of the target electron because otherwise the results will not be reliable.

```
ω
T=2π/ω;
T/Δt

ω*rA
```

To study the behaviour of the model in what concerns the Doppler effect , the above routine timeθω can be reused but, supposing that the target electron moves away from the emitter at a speed *b* then the speed u of a target nuclei will change to u+b and therefore the input

```
Frad[θ_,φ_,r_,σ_]:=k σ Exp[-(1/q)(u/c+u^2/(2c^2))]/.u-
>ω*r*Sin[θ]Cos[φ]
```

should be replaced by

```
Frad[θ_,φ_,r_,σ_]:=k σ Exp[-(1/q)(u/c+u^2/(2c^2))]/.u-
>ω*r*Sin[θ]Cos[φ]+ b
```

and in the initial conditions input a value of the speed b like for example:

```
b=0.3 c;
```

Seguir explicando cómo justificar la existencia de una fuerza eterínica que para una velocidad de alejamiento u puede aproximarse por [14-3].

to be continued