ON THE ABERRATION, DEFLECTION, DRIFT AND DRAG EFFECTS OF TERRESTRIAL AND STELLAR LIGHT

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Abstract:- For the law of reflection of stellar and terrestrial light to hold at the earth's surface, especially when the reflection is from the surface of a prism inside a bent instrument, the following effects have to be taken into account: the aberrational effect, the deflection effect, lateral drift (before and after reflection) and transverse dragging by the prism. All these effects must be functions of, or the consequences of the absolute speeds of the Sun and of the Earth in space through the Universe. The aberration and transverse dragging take place only when the difference between these speeds is not zero. When the terrestrial source is not comoving with the instrument, its light behaves similarly to starlight with aberration and transverse drag. Certain experiments to test all these effects are proposed.

1. Introduction.

We have recently presented a new explanation [1] of the Michelson & Morley, the Marinov and the Silvertooth-Jacobs experiments. The deflection effect and the drift effect were used to give one common explanation to these experiments. In [2] when considering the deflection effect at reflection of starlight from a moving prism in the Klinkerfues experiment [3] we assumed that the prism did not influence the path of starlight when the latter emerged from the prism. We took into account only the transverse drag. Now we must consider it in full detail. As yet, only the aberration of starlight has been discussed. It is necessary to show why this effect does not occur with terrestrial light, or if it occurs, and when it does how it might be observed.

We base our discussions on our own model of light [4], as well as on experimental facts. The photon is a double chain of dimagrans or elementary photons. The source's speed, or rather its component parallel to the direction of emission adds to the micro- speed of the photon to change its energy, but the macro-speed which is measurable by an observer, is constant, e.g., in the Earth's predominant gravitational field, which is identical with the Earth's predominant aether; that is, between two marks fixed relative to this aether, in all directions independently of the Earth's motion in the space of the Universe and about its own axis. The above is confirmed [5] in the experiments of Beckmann [6] and of Byl et al. [7]. Whereas in the direction perpendicular to the direction of emission, the source's speed, or rather the component of it, changes the direction of the photon's motion in the form of lateral drift. That is to say, this speed adds to the emitted photon in some way similar to the

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addition of a bowman's speed to an arrow shot perpendicularly to his motion. The arrow, as well as the photon, is then drifting and does not change its orientation. In this case the photon's path deviates by an angle δ from the direction of emission. Here δ is qualitatively equal to the aberrational angle α. It is clear and evident that the change of the direction of the photon's path due to the lateral drift does not influence the refraction when the photon enters matter.

The reflection of stellar and terrestrial light from a moving mirror, but first of all from a moving prism, is considered. The prism can be alone or inside a bent instrument. A point source of terrestrial light is assumed to be comoving with the prism; the light beam from a laser is also included. Three situations are assumed and considered: (A), source's speed does not add to the direction of emission; (B), this speed changes the direction of emission; and (C), this speed adds in the form of lateral drift. In all our considerations the law of reflection from a surface fixed on the surface of the moving Earth is assumed to be fulfilled.

2. Dragging of Light Inside Matter.

Inside the prism, or any matter with the refractive index $n > 1$, the photon is not dragged longitudinally if the matter is not moving relative to the Earth's predominant aether; there is no experiment that denies this. The photon is not dragged transversally when the lateral drift is assumed, or exists, but only if the source is comoving with the matter. The lateral drift causes the photon emitted along the line perpendicular to the entering prism surface to travel down the transversally moving line outside and inside the prism to the point where reflection occurs; inside the matter $c_n = c/n$. Whereas, when the source's speed does not change or changes the direction of emission only - situations (A) and (B) - the drag must be taken into account. But which? Is it proportional to the Fresnel coefficient $k_1 = 1 - 1/n^2$, or is it proportional to $k_2 = 1 - 1/n$, [2, 8], or is it still some other value?

All the experiments performed on the Earth's surface take place in the Earth's predominant aether. When the matter is moving transversally as well as longitudinally relative to this aether, the experiments with terrestrial light confirm k_1 [9, 10]. But when the matter is not moving, the experiments with starlight confirm k_2 [2, 8]. When matter is not moving and terrestrial light is used, any transverse shift of the light path due to drag has as yet not been observed.

When the source's speed does not add to the direction of emission, one ought to observe the aberrational effect but for a single terrestrial photon in an empty telescope when the source rests on the Earth's surface. Then, in the matter inside the telescope, or in the prism up to the point of reflection at least, the drag ought to be observed and be the same as for starlight; that is, with k_2. However, when the source's speed adds, the direction of emission of a single photon is bent by an angle equal to the angle of aberration, and the image arises at the focus of an empty lunette. * But then the photon path is refracted when entering matter filling the barrel, or the prism, and the drag ought to be proportional to k_1 [2]. However, for starlight, in such a situation, as in the Klinkerfues experiment [3], the drag was proportional to k_2 [8].

The two situations above, (A) and (B), ought to refer also to the whole light beam coming from a laser if the latter emits a parallel beam. Whereas, in the case of a point source, the beam is divergent and there is always a photon or ray with

Author's Footnote: In [2, 8] we have classified telescopic instruments into lunettes and other telescopes when considering the dragging of starlight. In the empty lunette the image is always and exclusively at the focus and the starlight beam must form an aberrational angle with the extension outside the instrument.

the direction of emission bent by an angle equal to the angle of aberration measured from the extension of the lunette axis at the moment of emission. This photon then passes through the center of the objective and gives the image at the focus. The above is independent of whether the source's speed adds or not. But here, this photon or ray refracts when entering matter or the prism inside the barrel and the drag ought to be proportional to k_1 if the image is to arise at the focus. Remember, there is no transverse drag and the image is also at the focus when lateral drift exists.

3. Starlight Reflected from a Moving Prism.

We take here the situation in Klinkerfues' experiment in which the level axis of a bent lunette was almost parallel to the Earth's speed v down the orbit [2, 8]. The motion of the Earth's surface due to its rotary motion is neglected here and in the whole paper. Therefore, we assume that there was no aberrational effect or transverse dragging relative to this axis. The part of the aberrational effect that is lacking was compensated for by the deflection effect angularly equal to

$$\beta = \arctan\left(2\frac{v}{c}.\sin\lambda \cos i\right) \quad (1)$$

where c is the speed of light, λ is the angle between the reflecting prism surface and the direction of the speed v, and i is the angle between this surface and the direction of the starlight beam. The deflection is in the direction of the speed v. In that experiment, say, $\lambda = i = 45°$, so that $\beta = \alpha$ for half a focal length (level axis).

A question arises as to what takes place in the deflection effect. Such a question is not essential in the case of the Loewy-Puiseux [11] and Comstock [12] experiments because the reflections were in those experiments from the prism or mirror surface placed outside the empty instrument. We can assume that there exists: either an additional change, equal to the angle β of the direction of the pure, ordinary reflection, or some deflection of the path. In the latter case the beam has a lateral drift, the same as that received from the source, and angularly equal to β. One can say that there exists a drift reflection of angle β.

3.1 When there is a mirror XY, Fig. 1, inside a bent lunette the starlight beam, as represented by the ray s passing through the objective center A, forms the aberrational angle α_v with the vertical axis AF, then reflects from F moved to F', and is changed by angle α_v from the level axis FC moved to F'C". In this case where $\lambda = i = 45°$ the deflection effect raises the ray path by the angle $\beta = \alpha_v$, and the ray s travels down F'C' and gives the image B_m at the focus at C'. But when the mirror is replaced by the prism XYZ, the ray s refracts at D moved to D' with $\gamma = \alpha_v/n$. Transverse dragging shifts this ray so that it reflects at F moved to F" if the drag coefficient is k_1. The angle of the pure reflection, of course, is also γ since the ray s refracts as if it travels down HF" parallel to D'G. Note here, to liquidate the angle γ, the deflection effect ought to be equal to just $\gamma = \beta/n$. Then the image B_k is made at the focus C". However, in that experiment the dragging was proportional to $k_2 < k_1$. Then the ray s must reflect elsewhere at L; the angles γ and ε remain the same and the image arises at B_p in the focal plane.

In the two cases the emerging ray s is perpendicular to the prism surface from which it emerges, i.e., is parallel to the level axis. There is no refraction and we can, or rather must, assume here the existence of the change of direction of the pure reflection by the angle ε. There is no drift reflection equal to ε or β. The lateral drift in the deflection effect, angularly equal to ε moreover, cannot be taken into account, because the ray s reflected at F" would emerge from the prism at N with the inverse refraction equal to γ.n, so the image would not arise at the focus.

3.2 Let us consider another situation, Fig. 2. The ray s is perpendicular to the plane of the telescope objective, reflects at K from the mirror, the center of which has

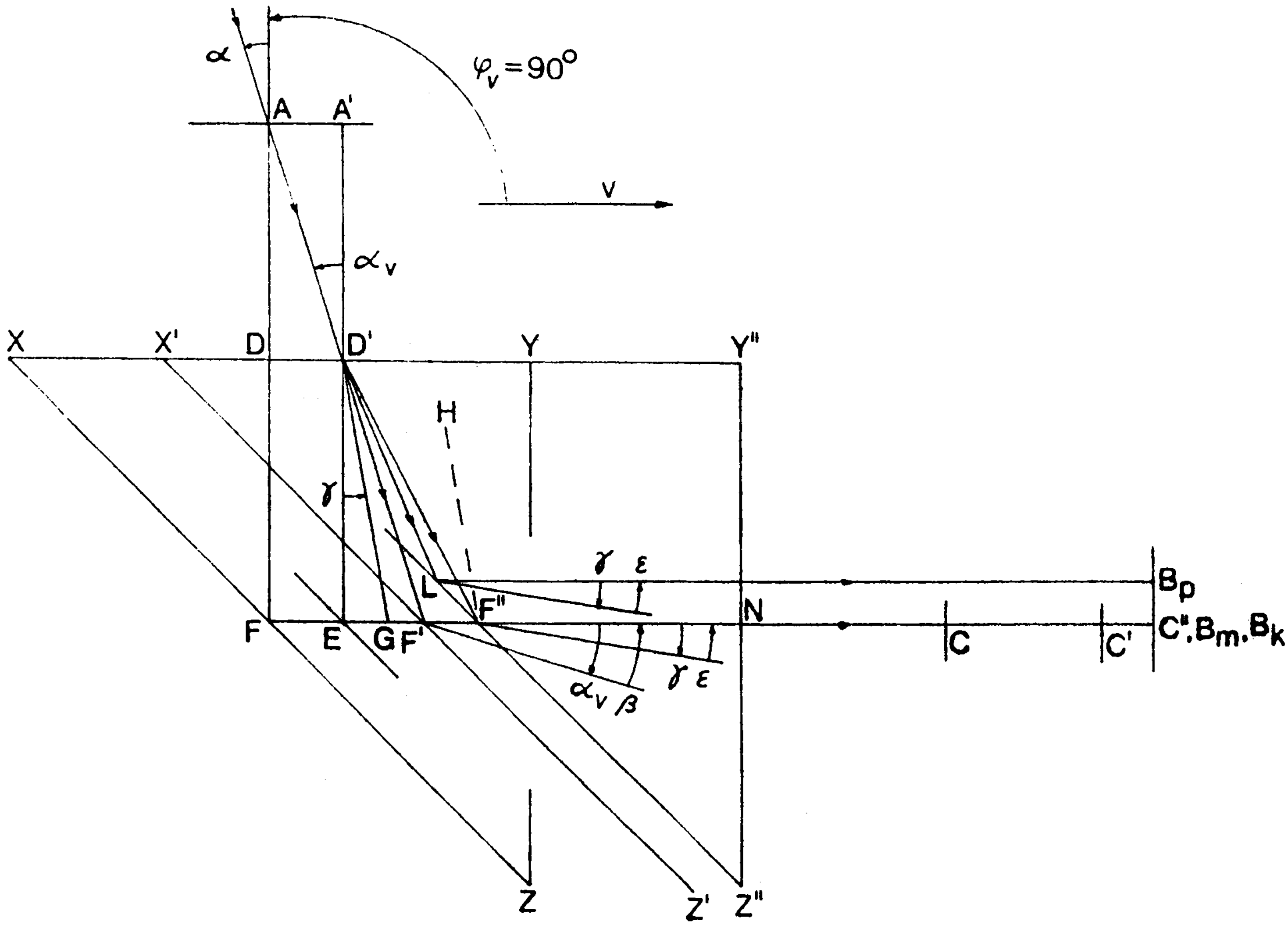

Fig. 1. Vertical axis AF of lunette telescope is perpendicular to speed v. Starlight ray s forms angle α with AF, reflects at F' from mirror moved to X'Y'; deflection effect, angle β (= α_v), raises the ray path upwards and image B_m is at the focus at C". When prism XYZ is present, ray s refracts at D', angle γ, transverse dragging proportional to k_1 shifts reflection to F", and deflection effect must be $\varepsilon = \beta/n$ if image B_k is to be at the focus at C". Image is at B_p when dragging is proportional to k_2.

moved to F', and the ray travels down KM' in order to produce the image at M', if the deflection effect did not exist. This is half the aberration effect, C'M'. The latter, angularly equal to β, causes a shifting of the image to B', where B'M' = M'C'. Whereas, when the prism is used instead of the mirror, the ray is not refracted when entering the prism but is dragged proportionately to k_2, if dragging is not to influence the aberrational effect, and reflects at L down LM' parallel to the level axis F"C" perpendicular to the emerging prism surface. Then the telescope axis AFC is in the position A"F"C". Here, we must assume that there is a lateral drift in the deflection effect, angularly equal to β, if the image is to occur at the same distance from the focus as in the case of the mirror; that is, at B", with C"B" = C"B". Whereas, if we accept the change of the direction of the pure reflection by the angle $\varepsilon = \beta/n$, as had to be in Fig. 1, the image would be made at B_p, after inverse refraction at N on leaving the prism.

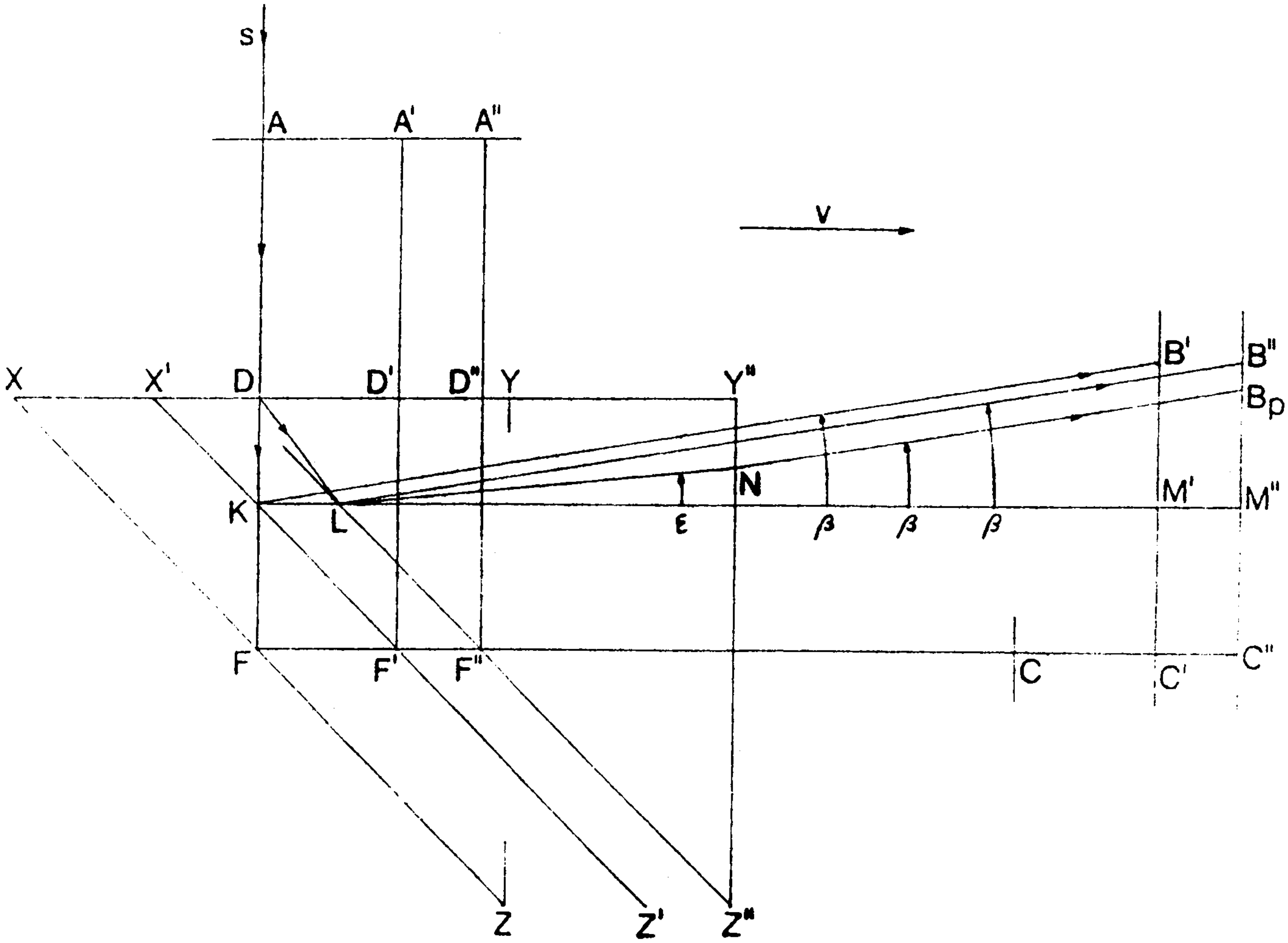

Fig. 2. The same situation as in Fig. [illegible] but only with k_2 and when $\alpha = 0$. Image is made at B' when reflection is from mirror and at B" when reflection is from prism (C'B' = C"B"). Image is at B_p if lateral drift is not in deflection effect.

To sum up, we have here an essential divergence in explaining these two observationally possible situations with starlight when the prism is inside a bent instrument. The description is still more complicated when the level axis forms the angle $\varphi_\ell \neq 0$ with the Earth's motion. But let us first pass to the terrestrial light before resolving the above problem. Note, in the case of a mirror what takes place in the deflection effect at reflection of starlight from a moving surface is not important; whether it be lateral drift or an additional change of the angle of pure reflection.

4. Terrestrial Light Reflected from a Moving Prism.

The situation (C), that is, the source's speed causes a lateral drift of light, is first to be considered. This drift is angularly equal to

$$\delta_e = \arctan \left(\frac{V_e}{c} \sin \varphi_v \right) \qquad (2)$$

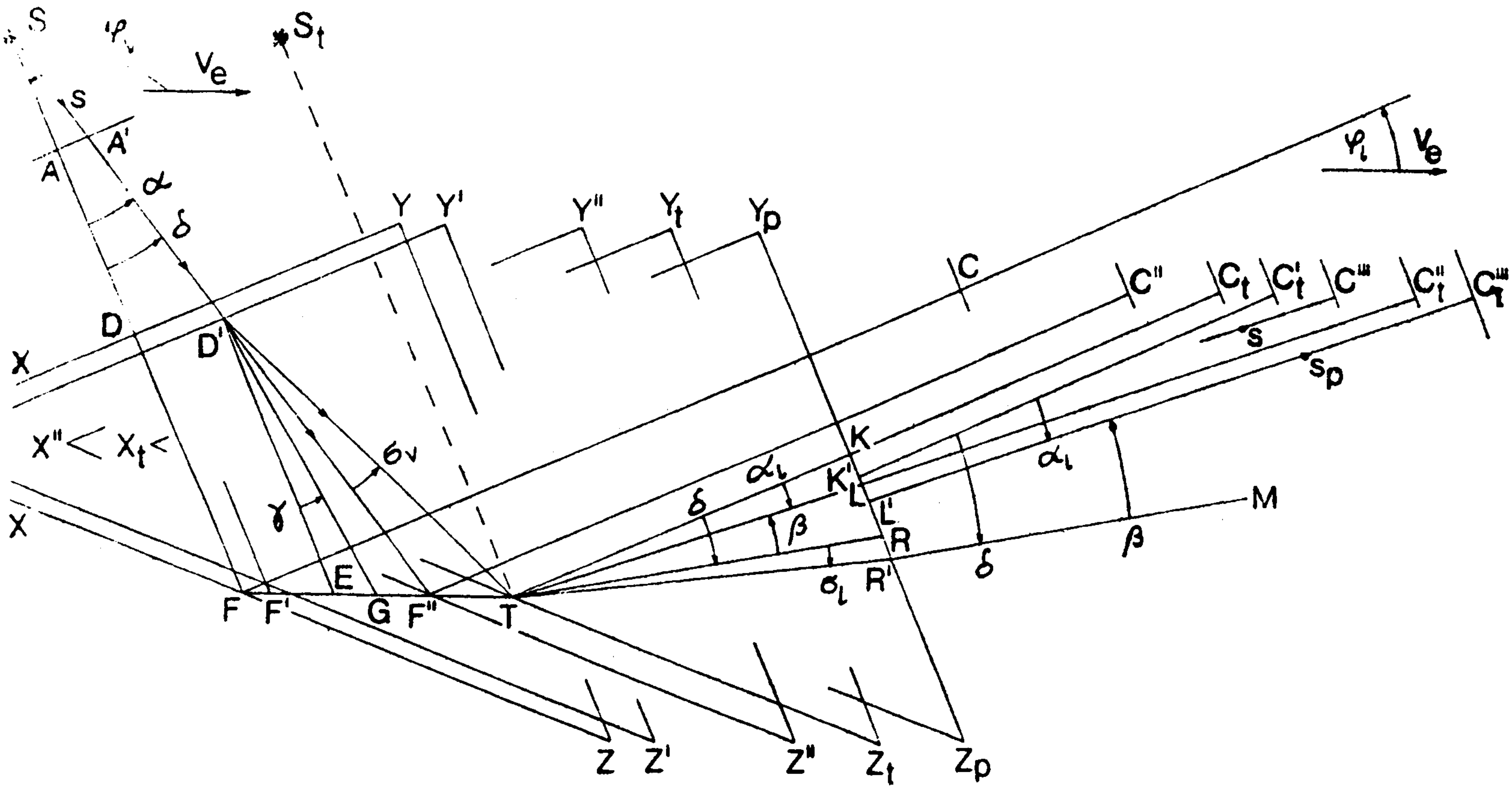

Fig. 3. Vertical axis AF of telescope forms angle α_v with Earth's speed V_e. Lateral drift deviates the path of ray s (from point source S) by angle α_v. Ray s reflects at F'' from mirror and at T from prism. Algebraic sum of deflection effect, angle β, lateral drift, angle δ, and aberrational drift of level axis, angle α_l, cause the image to arise at focus: at C''' (mirror) and at C_t''' (prism). σ_v and σ_l - angular shifts of the ray path when the ray passes through prism.

where V_e is the Earth's speed in the ecliptic plane; δ_e is equal to α_{ve} in Fig. 1 when v is replaced by V_e. Let us first take the case as that of Fig. 1:- the level axis is parrallel to the speed V_e. If the ray s is emitted, say, at A along AF, its path is along AF', deviating by the angle δ_e from the vertical axis which is in the position AF at the moment of emission; and it reflects from the mirror at F'. The pure reflection is down F'C'. But the deflection effect raises this path by the angle

$$\beta_e = \arctan\left(\frac{2V_e}{c} \sin \lambda \cos i\right) \qquad (3)$$

and the law of reflection is not fulfilled. To lower the path or to neutralize the angle β_e, we must assume that the angle δ_e also takes part in the reflection at F', but in a drift reflection. That is to say, the lateral drift received from the source remains after reflection. Then, $\delta_e - \beta_e = 0$ and the ray s will travel down F'C''. To be sure, in the case of a mirror, it is not essential whether there exists a lateral drift or a change of the pure reflection in the deflection effect, but in the case of a prism the lateral drift will, after all, have to be included.

Let us consider a general case when a ray s is emitted from source S, Fig. 3, down the vertical **lunette** axis AF, that is, perpendicular to the objective plane. The lunette contains first, a mirror, and second, a prism. The level axis FC forms the angle φ_ℓ with speed V_e, and the vertical axis AF forms the angle φ_v. The ray s passes through the objective center A moved to A' and reflects from the mirror at F". The pure reflection is down F"C". The deflection effect raises the path by the angle

$$\beta_e = \arctan[\frac{2V_e}{c} \sin (\varphi_v + 45°) \cos 45°] \tag{4}$$

where $\varphi_v = \varphi_\ell + 90°$ relative to the level axis F"C". The lateral drift, angle δ_e, lowers the path relative to F"C". However, $\delta_e - \beta_e \neq 0$ when $\varphi_\ell \neq 0$. But when $\varphi_\ell \neq 0$, there must exist the aberrational effect relative to the level axis with an angle equal to

$$\alpha_{\ell e} = \arctan (\frac{V_e}{c} \sin \varphi_\ell) \tag{5}$$

When the ray s travels the distance from F" to the focal plane, the focus C is moved from C' to C"; the angle $\alpha_{\ell e}$ is between F"C" and F'''. Only when

$$\delta_e = \alpha_{\ell e} + \beta_e \tag{6}$$

is the law of reflection of terrestrial light fulfilled. Here, in the case of a mirror, it is not essential whether the lateral drift takes place after reflection or change of the angle of pure reflection in the case of the angles β_e and δ_e. But there is always the drift or shift of the telescope's level axis relative to the ray path in the case of the aberrational effect.

Now, let us take the case of a prism XYZ. The ray s enters the prism at D'. Its lateral drift is down D'T, angularly deviated by the angle σ_v from D'F", because the speed of ray s is less by n in the prism. Here, there is no transverse dragging such as takes place in Figs. 1, 2 that shifts the point of the pure reflection from G to F" or L, because the prism and the source are comoving. The ray s reflects at F moved to T; note, the source is then at S_t. To the pure reflection down TC_t which is the focus C moved to C_t, then are added:- the aberrational effect, angle $\alpha_{\ell e}$; the deflection effect, angle β_e; and the lateral drift, angle δ_e. Of course, here too, we have still the shift of the axis TC_t (TK) and of the path TR by the angle σ_ℓ; they are due to the same effect as that in the case of angle σ_v where the focus is shifted off F"T and the path DF" also off F"T. So when the ray s leaves the prism, the level axis is shifted or drifts from KC_t to $K'C'_t$ and the ray s, as ray s_p, travels down L'B: B'M is parallel to TR. Thus, the real path of the ray s, as ray s_p, reaches this focal plane at B and the focus is moved from C_t' to $C_t''' \equiv$ B. Therefore, the relationship (6) is also valid in the case of the prism. The ray s does not undergo any inverse refraction when leaving the prism; all the algebraically summing effects are drifting, except the pure reflection.

To sum up, in the case of terrestrial light, the law of reflection from a moving prism is also fulfilled when we take into account: lateral drift received from the source, keeping this drift after reflection, lateral drift in the deflection effect, and the aberrational effect related to the level axis. The aberrational effect related to the vertical axis is neutralized by the lateral drift. When we take any other ray, emitted by source S, that forms any angle with SAD to the left or right of SAD, at the moment of emission, we shall obtain the same results. All the drifts, together with the aberrational effect related to the level axis, remain. Note, such a ray does not pass through the objective center and must be refracted when passing through the focusing objective. Therefore, this ray will not reflect at F" from the mirror or at T from the prism; it will refract when entering and leaving the prism, and these angles will be the same respectively. This ray will also reach the focus at C_t''', and the law of reflection will be preserved.

In the (A) and (B) situations there is always a ray, emitted by source S, the path of which deviates from SA, Fig. 3, by an angle α_{ve}, independently of the value of the speed V_e. The lateral drift, of course, does not exist in these situations, outside and inside the prism. This ray passes through the objective center A moved to A' and is refracted when entering the prism since $\gamma = \alpha_{ve}/n$. To be sure, it must behave as a ray of starlight with transverse dragging related to both half axes, when $\omega_\ell \neq 0$. Then the situations considered in §3 which refers to Klinkerfues' experiment, together with the results we have obtained, are also valid for the terrestrial ray if this forms the angle α or α_{ve} with the extension of the telescope axis as in Fig. 1, or is parallel to the telescope axis, both at the moment of emission. Therefore, these discrepancies in Figs. 1, 2 must be referred to both lights and we shall consider and resolve them in the next section. Note, the transverse drag is also a lateral drift but with speed v_{k1}, or, if one prefers, v_{k2}.

5. Reflection of Light from a Moving Surface.

5.1 The differences and discrepancies revealed in the previous sections must find one common explanation for stellar and terrestrial light. In our model [4] the photons receive the lateral drift from every source, that is to say from a star, too. When the photons are transiting the predominant gravitational field of another star, the action of this field causes the lateral drift received from the source to gradually liquidate; finally the photons receive such a lateral drift as if they were emitted by a source fixed to this new star; and so, in turn with every new star till they reach the Sun. This is why, in the solar system, the starlight beams from all the stars have the same lateral drift, that being a function of the Sun's speed in the space of the Universe. For us, for the aberrational effect, it is substantially such a speed V_s of the Sun in the ecliptic plane. Thus, the starlight reaching the Earth's surface drifts with speed V_s. But then the Earth's surface has the speed $V_e = V_s \pm v$ in the same plane. The instrumental axis, e.g., in the aberrational effect, is moving or drifting with this speed laterally. Angularly, this drift is equal to

$$\alpha_{ve} = \arctan\left(\frac{V_e}{c} \sin \varphi_v\right) \tag{7}$$

in relation to the vertical axis when the light travels from the objective to the focal plane. Then the angular drift of the starlight beam is equal to

$$\delta_s = \arctan\left(\frac{V_s}{c} \sin \varphi_v\right) \tag{8}$$

The subscripts s and e denote clearly that the magnitude is a function of speed V_s and V_e respectively.

In our considerations, initially, we assume that the starlight beam is perpendicular to the objective plane of the instrument, as it is in Figs. 2, 3. Let us designate the difference of angles δ_s and α_{ve} by

$$\phi = \alpha_{ve} - \delta_s = \alpha_v \tag{9}$$

where

$$\alpha_v = \arctan\left(\frac{v}{c} \sin \varphi_v\right) \tag{10}$$

and $v = V_e - V_s$. If $\phi = 0$, the light and the instrument axis must have the same lateral speed, that is to say as if the source were comoving with the instrument. This case can refer only to terrestrial light. Here, the aberrational effect related to the vertical axis cannot be expected to be observed. The ray s in Fig. 3 reflects at F", that is, where the axis is broken. Whereas when $\phi \neq 0$ the path of the light or ray s falls behind the axis and the ray s must reflect higher up at F" in Figs. 3, 2. In this case ϕ α_v; that part of the aberrational effect would give the image at K'. Of course, in our circumstances, the case with $\phi \neq 0$ can refer only to starlight.

Let us test mathematically the formula (9) for starlight when $V_s = 300$ km/s, $V_e = 300 + 30$ km/s, $c = 3 \times 10^5$ km/s, $n = 1.5$ and $\varphi_v = 125°$. Then α_{ve} 185.858", $\delta_s = 168.962"$ and $\phi = 15.896" = \alpha_v$ all in seconds of arc. If the vertical part of the instrument was an ordinary instrument, a telescope, the image would arise at the angular distance α_v behind the focus.

5.2 Let us pass to the second part of our consideration, that is, from the moment of reflection. First we take the mirror. To pure reflection we must add the deflection effect in the form of lateral drift, α_e, that being a function of V_e; and the effect of light drift, δ_s, that being a function of V_s. The light drift, angularly equal to δ_s before reflection, is not liquidated by the reflection. If $\varphi_\ell \neq 0$, that is if the level axis is not parallel to speed V_e, the aberrational effect related to this axis, being a function of speed V_e, formula (5), must still be joined. The drift effect lowers the path of ray s. The deflection effect raises this path. The aberrational effect lowers the level axis. Therefore, we have the relationship

$$\psi = \beta_e + \alpha_{\ell e} - \delta_s = \alpha_v \tag{11}$$

where β_e is defined in (4). Here, we can expect the second part or half of the aberrational effect.

For $\phi = 0$, δ_s must be replaced by δ_e. This means that the lateral drift of the ray s is as if the source were comoving with the axis, and the image is made at the focus. In our circumstances it can refer to terrestrial light only. Note, when α 0, the ray s reflects at the break of the axis, i.e., at F" in Fig. 3.

When $\phi \neq 0$, we have $\phi = \alpha_v$. The path of the ray s is raised and forms the angle α_v with the level axis or with the line parrallel to this axis. Compare formula (11) with formula (6). In this case, δ_s tells us that the ray s travels as if it were emitted by a source not comoving with the instrument. In our circumstances it can refer only to starlight. Here we have the second half of the aberrational effect of starlight; and finally the image is angularly distant by α_v from the telescope focus when the whole focal length is and must be taken into account.

5.3 To sum up, when the ray s is perpendicular to the objective plane of the telescope, the image arises:

(i) at the focus if the source is comoving with the telescope; or

(ii) beyond the focus if there is a difference between the lateral drifting of the ray s and of the vertical telescope axis. In the case of starlight this difference is a function of the Earth's speed v around the Sun, and the image arises behind the focus at every point of the orbit. However, there can be such situations that the image will be in front of the focus. The above will take place when the terrestrial source is moving with speed v_s in the direction of speed V_e.

5.4 Let us take other rays from the terrestrial point source. They form different angles with the ray s at the moment of emission. But they all have the same lateral drift. They transit the objective at different points and at different distances from the center. They must be refracted respectively when the objective is focusing. Then, of course, their reflections from the mirror will be at a different point, respectively, from the break of the axis. All these rays give the image at the focus if the source is comoving. The same is with the laser light if the objective is focusing. Of course, the starlight beam also gives the image at the point at which the image is made by the ray s.

5.5 Let us now take the starlight beam that forms an angle $\pm\mu > 0$ with the normal to the objective plane, or with the extension of the instument's axis, at the moment of falling into the objective. There exists a ray which will pass through the objective center. This ray, as ray s, marks the position of the image. All the previous considerations and effects are also valid here. But the reflection of this ray s from the mirror is shifted by the angle μ respectively, and the image, too, will be shifted by the same angle μ with respect to the position when $\mu = 0$. In the peculiar case, when $\mu = \alpha_V$, the image arises at the focus of the instrument, now a lunette, The same also refers to a (parallel) laser light beam, of course without aberration. In the case of a terrestrial point source we can register a shifting of the image only when: (i) the comoving source does not lie on the extension of the instrument's axis; and (ii) this source is not comoving with the instrument. In the former case the ray passing through the center of the objective is not perpendicular to the objective plane at the moment of emission. In the latter case the lateral drift of the photons is another one than that of the vertical axis. It is interesting that the aberration of starlight would also be measurable if the beam of this light were divergent; the measurement then is more complicated.

5.6 Let us pass to the situation when the prism is inside the instrument. All the previous considerations are valid. But three new elements supervene: (i) transverse dragging by the prism; (ii) refractions of the ray s at entering and leaving the prism if the ray s is not perpendicular to the objective plane; and (iii) the image does not occur in the focal plane but behind the plane. Of course, the transverse dragging exists only when the light beam is emitted by an uncomoving terrestrial source or for starlight, i.e., $\delta_S - \alpha_{Ve} = \alpha_V \neq 0$. When the instrument and the prism are fixed relative to the Earth's surface, the transverse dragging can be proportional only to k_2 as it was for starlight in Airy's and Klinkerfues' experiments [2, 8]. Both pure refractions on the prism surfaces are symmetrical, that is to say, the angles γ inside and α_V or α_{Ve} outside the prism are equal.

For the image to be in the focal plane when the mirror is replaced by the prism, we must diminish the focal length of objective or enlarge both half axes, respectively. Let us assume a situation when the source or star is fixed to the instrument and both are unmoving, i.e., $V_S = V_e = 0$. Then the deviation of the ray s by the angle μ from the extension of the vertical axis changes the position of the image from the focus also by the same angle μ. The symmetrical pure refractions in the prism do not change anything here. If now we pass to the real situation with stellar and terrestrial light, all the effects considered in the case of a mirror will join to these symmetrical pure refractions. We shall have all the same as in the case of a mirror; if $\mu = \alpha_V$, the image of starlight is made at the focus, but with one reservation that the transverse drag in the prism does not generate any additional changes or effects.

As it follows from Airy's and Klinkerfues' experiments [2, 8], the transverse dragging for starlight was proportional to k_2. Then shifting the image due to a dragging which takes place during the interval of time $t_n = nt$, is equal to the additional motion of the focus in the time $t_n - t = (n - 1)t$; t is the time required for the transiting of ray s at velocity c through the vertical part of the empty prism, n = 1. Only when $\mu = 0$, is the measured aberrational effect the same as in the case of a mirror; the ray s reflects at K moved to L in Fig. 2; KL = F'F" = vt_n. It travels the distance DL = DK in time t_n because its velocity is c/n inside the prism. The transverse drag is angularly equal to

$$\chi_V = \arctan(n.\frac{v}{c}.k_2 \sin \omega_V) \tag{13}$$

and

$$\chi_\ell \quad \arctan(n.\frac{v}{c}.k_2 \sin \omega_\ell) \tag{14}$$

But when $\mu \neq 0$, say, $\mu = \alpha_v$ as in Fig. 1, the ray s is refracted to the back by the angle $\alpha_v - \gamma$ and does not reach the point F" at the moment of reflection since GF" > F'F". It reflects at L which causes the image to be made at B_p instead of at B_m in the case of the mirror, as in Fig. 1. Along the level axis the additional drift of this axis in time $(t_n - t)$ is compensated for by the transverse dragging of formula (14), and this part does not cause an additional shift of the image relative to the focus even if $\varphi_\ell = 0$.

To sum up, when the prism is inside the instrument, the law of reflection is kept also for any angle μ when terrestrial light is considered. But in the case of starlight this law is not fulfilled when $\mu \neq 0$, because the transverse drag does not compensate for the refractive bending of the ray s to the back by an angle μ/n, and the image B_p does not coincide with the image B_m for the same angle $\mu = \alpha_v$ with the focal length AF. If an ordinary refracting telescope with the focal length equal to AF were used, the image would arise at the distance GF" - F'F", that is at the distance GF' behind the focus at F", Fig. 1. Here, the law of refraction is fulfilled for starlight.

6. Discussion and Conclusion.

How the speed of the source adds to the emitted photons can be tested [13] when the aberrational effect of laser light is measured in a lunette as the second measure after turning the telescope through 180°. The aberrational effect must be measured when the condition (A) subsists. But there exist quite a few experiments which deny this situation. If the condition of (B) prevails, the photons must undergo inverse refraction when they leave the exit plate of the laser and the effect ought to be n times greater than in situation (A). The image is always observed at the focus when condition (C) takes place which involves lateral drift.

What takes place in the deflection effect, the lateral drift or the additional change of the pure reflection, can be tested when a terrestrial or stellar light beam, parallel to speed v, reflects perpendicularly from a mirror and falls into a filled refracting telescope. In the former case the image is made at the focus. In the latter case the beam reflects to the back and the shift of the image due to this refraction will not be compensated for by a transverse drag proportional to k_2.

When the two experiments are performed, we can test what happens with the lateral drift received from the source after reflection. Is this drift preserved or not? An arrangement such as Fig. 3 will be able to give us the answer.

The aberration, but first of all the coefficient k_2, can also be tested in an experiment with terrestrial light. The beam from a source fixed on a rotating table falls into alternately an empty and a filled lunette. Note, the source and the lunette are not comoving here. Such an experiment will be, for instance, a significant one against those who assume that the aberrational effect of starlight takes place far, or very far, from the instrument [14, 15]; although some experiments already deny this postulate, e.g., the aberrational effect due to the linear speed of the Earth's surface (vide, the footnotes in [16]). When matter is comoving with the Earth's predominant gravitational field, only the transverse drag proportional to k_2 can take place. But when matter is moving relative to this field, and the source is comoving with the field, both transverse and longitudinal dragging proportional to k_1 take place. It would be interesting if a starlight beam passed through matter moving transversally on the Earth's surface.

As follows from our considerations, we must use the absolute speeds in the space of the Universe if we are to treat identically the stellar and terrestrial light and if the law of reflection is to be fulfilled on the Earth's surface. They are the speeds V_S of the Sun and the speeds V_E of the Earth. The speeds V_S and V_E are the same but different in different directions. Only in the ecliptic plane is the Earth's speed $V_e = V_s \pm v$ (in simplification). The effects considered are linear functions of all these speeds. Therefore, it is not essential what the values are of V_S or V_E, contrary, e.g., to the transverse Doppler effect [17]. The speeds V_e and V_s are the components of speeds V_E and V_S. The second components are perpendicular to the ecliptic plane; they are always equal to one another, $V_{e\perp} = V_{s\perp}$, and the effects of aberration and transverse dragging of starlight do not exist here.

The following effects must be taken into account at reflection:

(i) lateral drift (received from the source);
(ii) transmission of this drift after reflection (in a drift reflection, contrary to pure reflection);
(iii) the deflection effect (in a form of lateral drift);
(iv) the aberrational effect (related to both axes of a bent instrument) as a lateral drift of the half-axes;
(v) transverse dragging in the prism (related to both axes).

The two latter effects are functions of the speed v. The transverse drag related to the level axis does not change the position of the image from the focus; only the dragging related to the vertical axis can change (or changes if $\mu \neq 0$) this position. In the case of starlight reaching the Earth's surface the lateral drift received from a star is replaced by the lateral motion (drift) received from the Sun's gravitational field, equal to speed V_S (V_s in the ecliptic plane).

The aberrational effect of starlight is a function of the speed v. It is the absolute effect, it is not a difference of a greater effect. This effect is measurable even in a one-day or one observation [2, 8], because the transverse dragging of this light is proportional to k_2 and generally not to k_1. That effect was measured in a one day observation by Klinkerfues. Thus, making use of speed v is warranted, but only in the case of an instrument with an ordinary tube or with the mirror inside a bent tube. When the prism is used, we must take into account the absolute speeds.

The aberrational effect of terrestrial light, related to the vertical axis, does not exist except when the source is comoving with the instrument. However, this effect must exist and be taken into account when related to the level axis and if $\mu_g \neq 0$. When the source is not comoving, we have the situation similar to that for starlight. Then $v \neq 0$ and the aberrational effect must exist and be measurable relative to both axes. The same refers to transverse dragging. In the case of a moving source the aberrational effect can be positive as well as negative.

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