A CRITICISM OF ZAPFFE'S MODEL OF STELLAR ABERRATION

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Abstract:- In Zapffe's model for explaining starlight aberration with the use of the magnetosheath there are many errors and inconsistencies. When these are corrected, his model cannot explain the starlight aberration effect, even if there were a deviation or aberration of starlight when transiting the magnetosheath or entering into the geosphere. Experiments that negate this model are presented.

1. Introduction.

A new approach to the explanation of the effect of aberration of starlight has been presented by Zapffe [1, 2]. This explanation has been cited by other authors and accepted more or less fully. This approach is to be distinguished from that of Durie [3]. We claim that Bradley's method of explaining this effect is the only correct one. § Thus, it is the present task to demonstrate the errors in Zapffe's approach and that it is fallacious in general and cannot be accepted in physics. Besides, Zapffe's demonstrations seem to be incoherent if not mistaken.

2. Zapffe's Acoustic and Ballistic Demonstration.

On p. 1164 of [2], Zapffe writes:

We can specifically define our subject as the deflection or aberration which occurs when the electromagnetic signals pass from one Maxwellian field or reference frame into another, thereby generating first-order of v/c as observed in stellar aberration. Validation for this approach lies rather simply in the fact that stellar aberration is, by universal admission, the result of the planetary orbital velocity v = 29.8 km/s relative to the heliosphere, ...

It follows from the above that a starlight beam, when transiting the magnetosheath between heliosphere and geosphere, deviates backwards, relative to the velocity v, from its path in the heliosphere. Backwards, if the image of a star is to be observed at the focus of a telescope tilted forwards by an angle arcsin v/c or arctan v/c, as it is in real observations. But what produces this deviation?

Zapffe makes use of acoustics in the wave and of ballistics in the photon or emission theory of light. In the former, a submarine range-finder buoy B emits an underwater continuous tone sonic beam in the N-S direction. A submarine, running in the E-W direction or W-E direction, has two detectors: one outside, detector H, and

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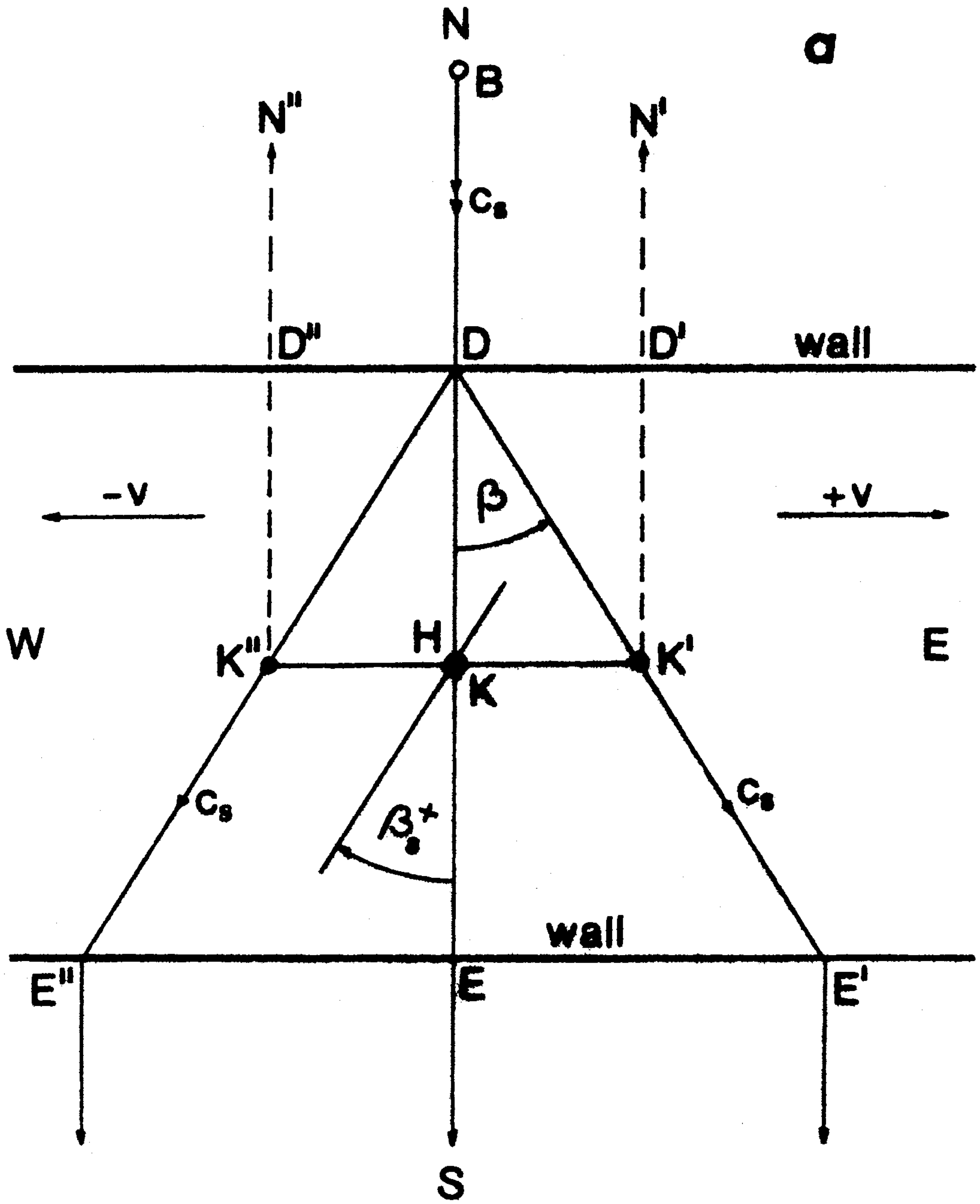

Figure 1.

(a) - Underwater sonic beam from B reaches detector H outside and detector K inside the submarine moving with speed +v (-v).

the other inside the submarine, detector K; Fig. 1 (a). Say both detectors are attached to the periscope. For both directions, detector H intercepts the beam at precisely the same hydrographic coordinates as where it passes in the ocean. But in the case of detector K, Zapffe writes:

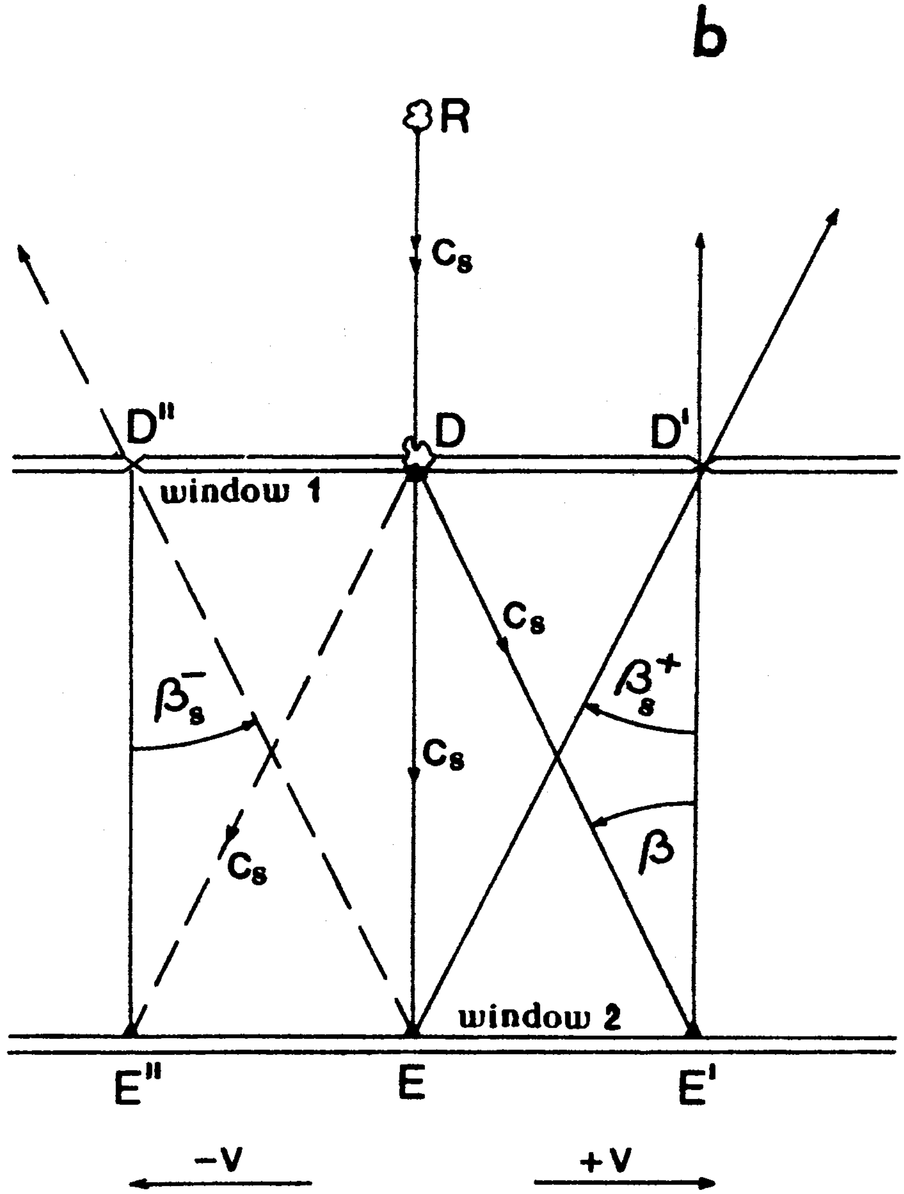

Figure 1.

(b) - Rock from R strikes the car window I at D and produces a conical shard that strikes either at E or at E' in window II.

The sonic signal impinging upon the wall would subsequently have to traverse intrasubmarine air over whatever distance separated the instrument from the wall. The resulting observation or 'ping' would accordingly be displaced from the true N-S by an angle in terms of $\beta = v/c_s$, where v is the velocity of the submarine and c_s is the velocity of sound in air. This is the aberration angle, ...

The above example is in no way congruent with starlight aberration even though the sonic beam behaved as a light beam. Note, passing a light beam through a moving transparent matter does not change its direction after emerging from this matter, only the path is shifted. The same must be with the sonic beam when passing the wall and next transiting through the air inside the submarine. Thus, one part of the sonic beam reaches H, and the other one that impinges the wall at D, reaches detector K moved to K' in time t of passing this beam from D to K, then D has moved to D' Therefore, line K'D' is parallel to line HB. The inner beam leaves the submarine wall at E' and is therefater parallel to the outer beam but shifted by EE'.

To catch, say, a narrow sonic beam inside the submarine, the detector barrel must be parallel to line KD; then the beam travels along DK' but only with respect to the outer frame B attached to the buoy. Thus, angle is not the angle of aberration; inside the submarine the sonic beam path and the detector barrel are collinear and parallel to KD and K'D". Inside the submarine there is no angle β to be measured. Reversing the direction of speed v changes nothing inside the submarine.

But it is otherwise outside the submarine. To catch the outer sonic beam the barrel of detector H must be tilted in the direction of speed v by angle arctan $v/c_s = \beta_s^+$. And when reversing the direction of speed v the telescope must be tilted again but now by angle $2\beta_s = \beta_s^+ - (-\beta_s^-)$. Thus, angle β_s is really the angle of aberration and measurable.

The outer beam is sensed always at H for both directions of speed v and the angle β_s is then measurable. Although the inner beam is sensed at two different places K and K' (K'H = HK"), relative to frame B, angle β cannot be measured in any way. The sonic beam does not deviate backwards by angle β, as Zapffe would want, relative to the submarine frame, when enetering into the wall and air. Inside the submarine are only two marks: D moved to D' and K' (DD' = KK').

Now Zapffe's ballistic demonstration. A rock strikes the car window at D (Fig. 1 (b)) and produces a conical shard which moves with the same speed v_s as that of the rock and, say, sticks in the opposite window. Zapffe writes:

We need only presume for this ballistic model that the velocity of the rock was fully transmitted to the glass fragment; ...

But what is transmitted? Its value and direction, or only its value? In the former case the shard catches the opposite window at E, then D is moved to D' and we really get the aberration angle β_s^+; there are two visible marks: D moved to D' (when the shard reaches E) and E.

But is such a situation possible physically? The shard when falling off has the car's speed v, so it ought to stick at E'. Then, therefore, we have the same situation as that inside the submarine; and angle β is not the angle of aberration. It is not measurable inside the car even for both directions of speed v.

In conclusion, Zapffe's acoustic and ballistic examples do not explain the aberration effect of starlight. They do not give a deviation of the sonic beam or shard backwards relative to speed v. Inside the submarine or car the angle β cannot be measured even reversing speed v. The speed of the submarine or car cannot be measured inside them. But such a measurement is a normal procedure in the case of starlight and gives a speed of about 30 km/s.

3. Zapffe's M-Space Model for Stellar Aberration Presented in his Figures.

Each of Zapffe's Figures 2, our Fig. 2 (a), and 3, our Fig. 3 (a), fails to be consistent. Besides they are not coherent with one another. These descriptions are from the viewpoint of the wave theory of light but based upon his acoustic and ballistic demonstrations.

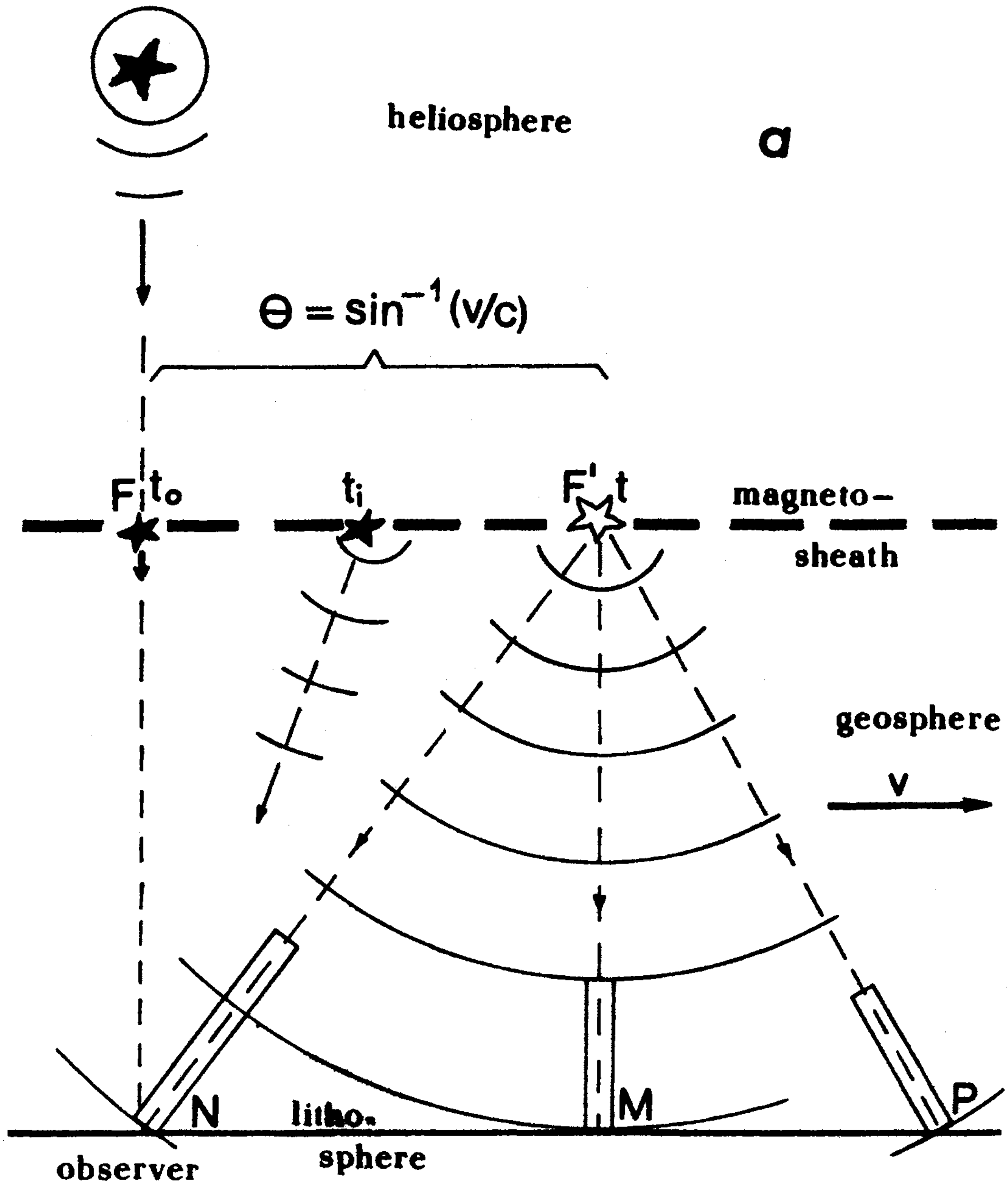

Figure 2.

(a) - Zapffe's figure (Fig. 2) of stellar aberration.

A star is very, very distant from the geosphere magnetosheath. Only a minute part of its radiation that falls into the telescope reaches the magnetosheath, and we call it the starlight beam. Therefore, the magnetosheath cannot *generate a new spreading center or 'pseudostar' in the Huygenian manner, ...* . We think the magnetosheath can only diffuse this beam at most, if it can do that. But in the case of the pseudostar the light of this beam can be observed at different points on the earth's surface, say, even at M or P in Fig. 2 (a) and not just at N. And if we really assume the pseudostar in the Huygenian manner, that is to say, this light generates light wavefronts similar to those of a sonic signal in air, then it is

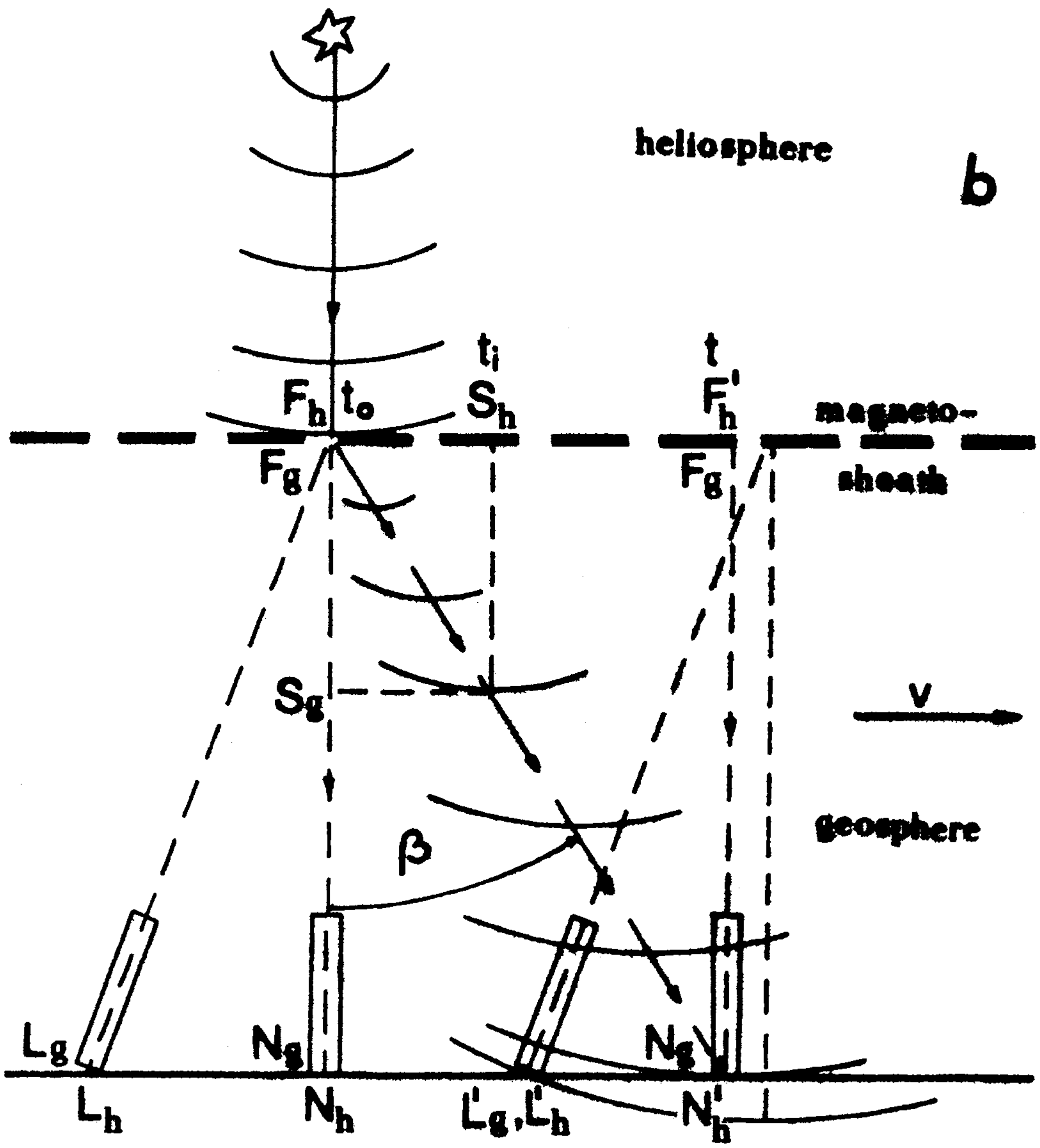

Figure 2.

(b) - Corrected picture of stellar aberration in Zapffe's model.

impossible for the aberrational angle to be measurable on the earth's surface, even for $v = 30$ km/s down the orbit. For then every longitudinal beam or ray orthogonal to the newly spreading wavefront will be collinear with the telescope barrel placed at different points on the earth's surface. One will measure different values of the star's po ition, values even much greater than 20.5" and also positive as well as negative, e.g., at points N, M and P in Fig. 2 (a); points N, M and P are at rest relative to the geosphere but points F and F' are imprinted relative to the heliosphere.

However, Zapffe's Fig. 2 (our Fig. 2 (a)) is in error. The starlight beam impinges the geosphere magnetosheath at $F_h \equiv F_g$, Fig. 2 (b) and only here it produces the wavefront, and only here it imprints its passing through this sheath. In Fig. 2 (b) the letters with subscript g are fixed in the geosphere and moving with speed v, together with the geosphere on the background of the heliosphere frame, but the letters with subscript h are imprinted in the heliosphere frame. Thus, the ray of the wavefront falling into the telescope at N_g, propagates down F_gN_g in the geosphere but down F_hN_h' in the heliosphere frame; all the wavefronts are related to the heliosphere front and they must then be shifting transversally when propagating in the space filled by the geosphere.

When the wavefronts reach the earth's surface at N_g, if they be imprinted at N_h' in the heliosphere frame and point F_g be moved from F_h to F_h' in the heliosphere frame. The wavefront ray does not undergo any deviation when transiting through the magnetosheath and entering into the geosphere. This ray has no transversal motion relative to the geosphere; it is moving or shifting transversally but only with respect to the heliosphere frame. For example, at time t_i it will be at S_g in the geosphere but at S_h when viewed from the heliosphere frame. Thus, the telescope barrel at N_g must be perpendicular to speed v and collinear with ray F_gN_g so that this ray reaches the earth earlier. Therefore, we have here the same situation as that in the submarine. Placing the telescope for instance at L_g - if we accept a new spreading center or pseudostar in the Huygenian manner - changes nothing even if speed v is also reversed. The conclusion is that angle β in Fig. 2 (b) is not measurable on the Earth's surface even for v = 30 km/s down the orbit.

In Zapffe's Fig. 3, our Fig. 3(a), the atarlight beam behaves otherwise in the geosphere than in the galactosphere and heliosphere. Compare the directions of speeds with the dashed arrows. These arrows represent the path of the same ray, orthogonal to the wavefront, from the heliosphere, but in the geosphere when viewed from the heliosphere or the preceding sphere frame, as in Fig. 2 (b). The pictures in the galactosphere and heliosphere in Fig. 3 (a) are the same as in Fig. 2 (b). The corrections must be made in the geosphere, according to our Fig. 2 (b) and to what is traced by Zapffe in the preceding spheres; see fig. 3 (b).

As Figs. 2 (b) and 3 (b) show, the stars are observed at the zenith in every sphere, although thay are shifted to the true zenith fixed to the cosmosphere. Angles Θ'', Θ' and Θ or T and Ω are all not measurable even if the speeds v'', v'' and v could be reversed. These angles are not the angles of aberration of starlight. They define the angular shift of the telescope relative to the cosmosphere frame or the preceding sphere frame, in the time necessary to transit a given sphere by the beam. The speed of starlight along AB or BC or CD' (CD'') are not equal to c when defining the times of passing these segments by the beam. Inside these spheres the beam travels with speed c along or parallel to A'B (= AA_g), B'C (= A_gA_h) and C'D' (= A_hA_c) respectively. Note, angles Θ'', Θ' and Θ are not functions of arcsin as it is written in Fig. 3 (a) but of arctan; see Fig. 3 (b).

4. Discussion and Conclusion.

Zapffe has committed many mistakes in his demonstrations relative to starlight aberration, e.g., due to the Earth's motion in its orbit. After correction, his acoustic as well as ballistic pictures do not help us in understanding the observed starlight aberration. On the contrary, they tell us that such a measurement is impossible. The same conclusions follow from his Figs. 2 & 3 (our 2 (a) and 3(a)) with starlight and within the framework of the wave theory of light.

For the starlight aberration to be observed in Zapffe's theory and model, the starlight beam must be bent by the aberrational angle backwards relative to speed

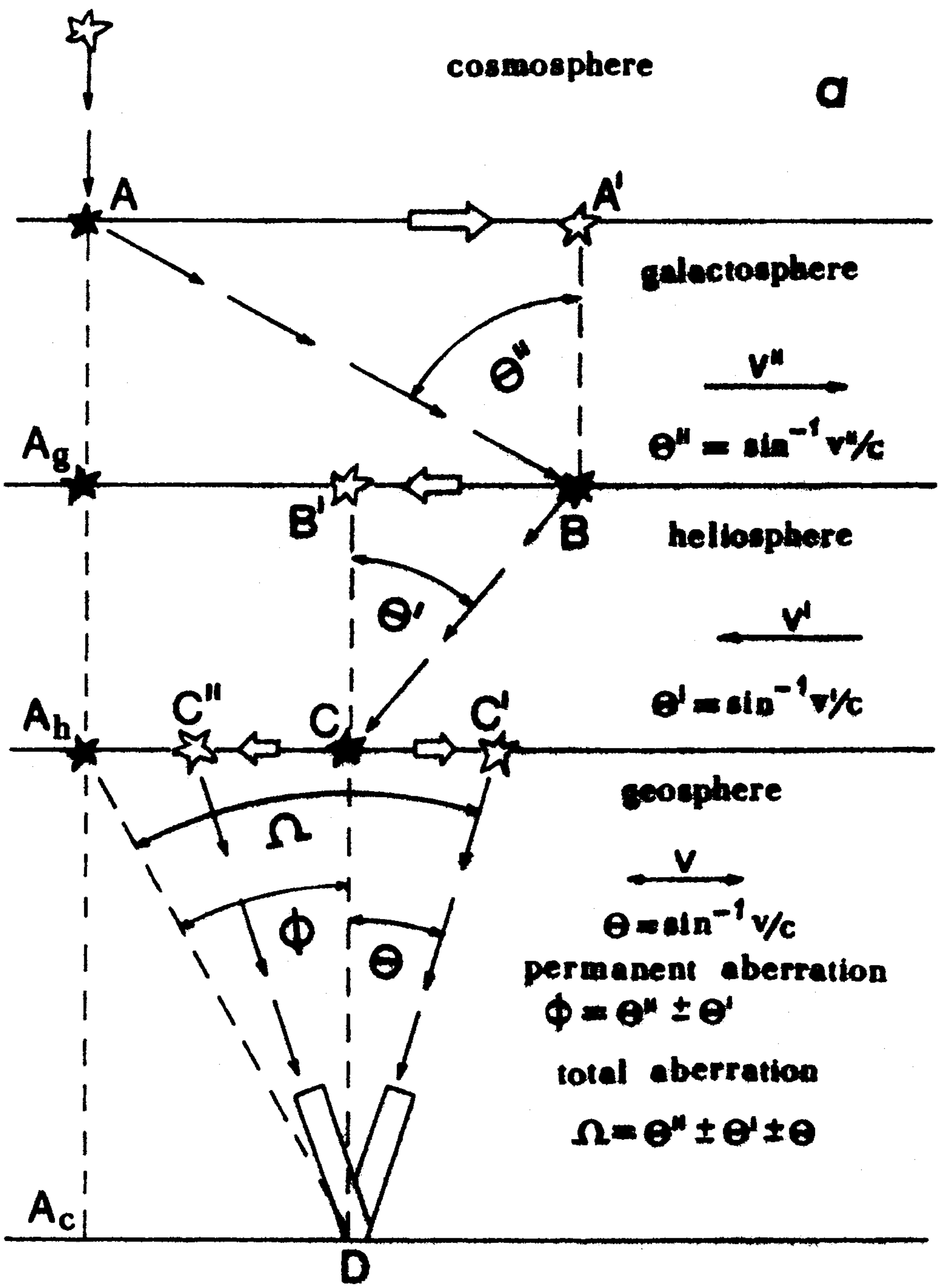

Figure 3.

(a) - Zapffe's figure (Fig. 3) of the aberrational displacements of the beam of starlight transiting through different spheres.

v when transiting through the magnetosheath or entering into the geosphere. But such a situation is impossible from the position of the wave theory of light especially when the beam is to generate *a new spreading center or 'pseudostar' in the Huygenian manner*.

Therefore, one must accept or assume the photon or emission-like theory of light. Then the necessary deviation to the back is physically possible in theory.

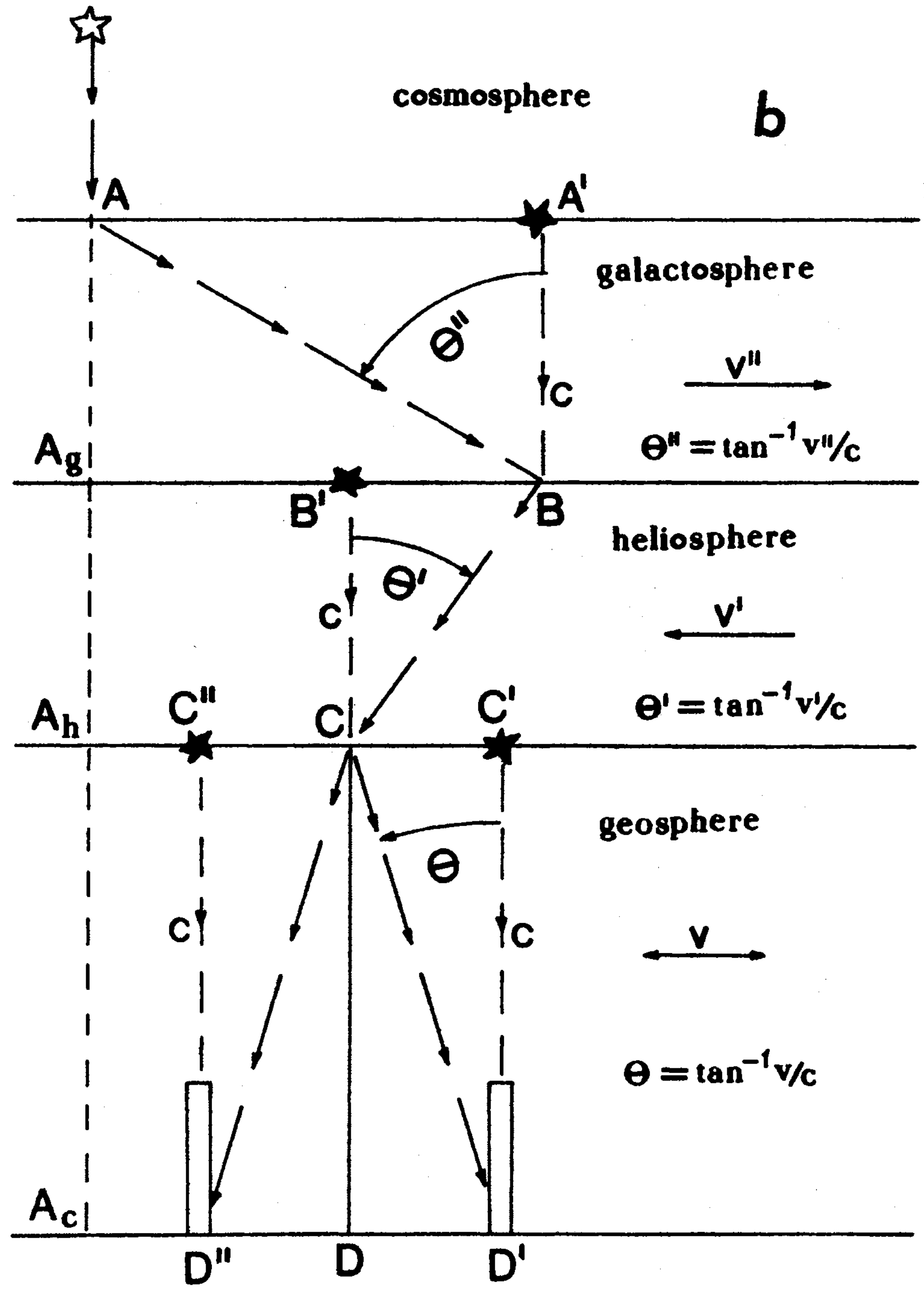

Figure 3.

(b) - Corrected, mainly in geosphere, picture of transiting stellar beam through different moving spheres.

But, in practice, what is to produce it? Note, the geosphere is similar to a falling raindrop and rotates through 360° in a year around the Earth's center. Thus, the starlight beams coming from different stars impinge the magnetosheath under different angles and even from opposite sides, after half a year for a given star. Therefore, any deviation or refraction ought to depend on such an angle of incidence. But the observations do not confirm the existence of such differences.

However, in spite of this, let us assume such a deviation or refraction or aberration exists when a starlight beam transits the magnetosheath or enters into the geosphere. But then we have the same situation as that in special relativity although that theory does not tell us where this refraction or deviation takes place. It must be somewhere between a star and the instrument; we have called it the 'relativistic aberrational refraction' [4, 5]. Then indeed the starlight beam is always collinear to the telescope axis when the image is observed at the focus. Filling the telescope barrel with matter does not change the aberrational effect and does not change the inclination of the telescope in order to observe the image also at the focus.

Unfortunately, the facts deny such an explanation of starlight aberration as Zapffe has presented. Firstly, the aberration due to the Earth's rotary motion has been measured (≈ 0.32"). This effect does not find any explanation in Zapffe's model because the geosphere and magnetosheath does not rotate diurnally. Secondly, in this model it is impossible to measure the aberrational effect in a one-day observation. But such a measurement was executed in the experiment performed by Klinkerfues [4 - 6] with two instruments, one emptly and the other filled. Thirdly, in Zapffe's model there can be no transverse dragging of starlight by matter filling the instrument as there is in the special theory of relativity. But the experiments by Klinkerfues [6] and Airy [7] tell us [4, 5] that such a dragging exists. More, it was proportional to the coefficient $k_2 = 1 - 1/n$, where n is the refractive index. Fourthly, in such a model there can be no so-called deflection effect of starlight when it first reflects from a mirror in front of the instrument. But such effects were observed with starlight, e.g., by Comstock [8], Loewy & Puiseux [9] and had to exist in Klinkerfues' experiment [4, 5].

Concluding, Zapffe's model is useless to explain the aberration effect of starlight, even with the deviation or refraction of starlight when passing through the magnetosheath. The only way to explain this effect is to assume that the telescope is transversally moving relative to the path of the starlight beam when the latter transits through the telescope; that is to say the Bradley method applies.

Zapffe's presentation of the aberration effect of starlight in his model in [2] is more comprehensive than in [1], so our objections in this paper are more complete than in [10].

References

[1] Zapffe, C. A.: Indian J. Theor. Phys., V. 30, p. 55 (1982).
[2] Zapffe, C. A.: Toth-Maatian Rev., V. 3, p. 1162 (1984).
[3] Durie, J. J.: T-M. R., V. 1, p. 375 (1983).
[4] Wilczyński, J.: Indian J. Theor. Phys., V. 34, p. 129 (1986).
[5] Wilczyński, J.: Indian J. Theor. Phys., V. 34, p. 193 (1986).
[6] Klinkerfues, W.: **Die Aberration der Fixsterne,** pp. 53 and 41. Leipzig, 1867.
[7] Airy, G. B.: Obsns R. Obs. Greenw., pp. CXIX, (9-13) & 60 (1871); p. 65 (1872).
[8] Comstock, G. C.: Nature, V. 46, p. 41 (1892); V. 48, p. 460 (1893).
[9] Loewy, M. & Puiseux, P.: C. r. hebd. Scéanc. Acad. Sci., V. 112, pp. 549 and 1089 (1891); Nature, V. 43, p. 498 (1892).
[10] Wilczyński, J.: Indian J. Theor. Phys., V. 33, #4 (1985).

¶. Editor's General Comment on this Paper: We hope Dr. Zapffe will avail himself of his right to respond in these pages to the criticism of his theory; the reader should suspend judgement until his rebuttal appears. Both he and our author are reasonable persons and by debate they should arrive at a common understanding of this question.

We remark only that time-dependent geometry is very difficult and can be confusing as the visualization of it is not static. It is complicated enough to confuse and befuddle even the clearest thinker. Also, there are differences in understandings of the aspects of the problems that arise. We have pointed out the many, many different forms of aberration that can occur: pp. 2769-800 & pp. 2743-6.

In the example of the submarine, for instance, suppose a bullet were fired from the buoy in the N-S direction and suffered no deflection at all in encountering the moving walls of the submarine but went straight on. On comparing the two holes in the skin of the submarine the commander of the submarine inside it would see an aberrational angle with the normal to the axis of the moving submarine. However, if a continuous train of bullets were being fired (a ray) at any one given instant if one compares the continuous train of bullets with the direction of the axis of the submarine, we find it to be perfectly normal to it.

There is a tendency in time-dependent geometry for one investigator to look at a problem one way and another a different way. We leave it to Zapffe and Wilczyński to thrash out this problem between them until Maat is rescued.

We ask, as another comment, is it reasonable to consider a photon as large as a football stadium? C.f. pp. 2348.