Optical deviation of stars light by Sun

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Abstract

We consider the sun and its atmosphere as a spherical lens causing deviation of stars light and also decrease of its speed in the lens. Such a lens can probably make a multiple image of a star. It is also shown that the sun, because of its atmosphere, is in fact smaller than what an observer measures. We show that the above-mentioned spherical lens is non-dispersive practically.

1 Optical justification

Prediction of deviation of the stars light when passing by the sun is one of the most important works done by the general relativity which afterwards was confirmed by practical measurements. The performed experiments also showed that the speed of an electromagnetic wave passing beside the sun was decreased, while the general relativity was not able to justify it yet. At last Shapiro could obtain this time delay as a result of the general relativity.

In this article we present optical justification of the above two observed phenomena. This justification in a very simple manner covers both the deviation and speed reduction of the light together. The basis of this justification is considering the sun and the atmosphere around it, which totally form a gaseous spherical volume, as an optical spherical lens (of course one that its refractive index increases going toward the center) causing the deviation of light and also decrease of its speed inside the lens.

The sun, up to a high height from its surface, has an atmosphere which becomes more rarefied regularly as this height is increased. For simplicity suppose that this atmosphere consists of two layers with refractive indices n_1 and n_2, as shown in Fig. 1, such that $n_2 > n_1 > n_0$. It is natural that the light ray in its passing across the surface S_1 will be refracted inward, and in passing across the surface S_2 will be again refracted inward, and this ray after passing from its minimum distance from the sun will be refracted outward in its next passing across the surfaces S_2 and S_1. The result of these successive refractions, because of the spherical shape of the surfaces, is the deflection of the ray in passing through the sun atmosphere as if the ray has been attracted by the sun. It is obvious that this simple model furthermore predicts that the speed of the light ray decreases in the vicinity of the sun surface because of its positioning in optical denser mediums.

We made use of two known physical subjects implicitly in the above analysis:

The first, this fact that the distribution of the density of gas molecules in a gravitational field is such that approaching the center of the gravitational attraction, density of the gas increases. A similar analysis for the gaseous molecules of the earth atmosphere yields the relation $n = n_0 e^{(-mgh/(kt))}$ for the density of the molecules of the earth atmosphere relative to the height from the ground in a one molar column of the gas. This relation in which n is the number of molecules in the unit volume at the height h from the ground and n_0 is this number on the ground and m is the mass of each gas molecule, indicates very well that approaching the center of the gravitation attraction the density of the gaseous molecules increases. Therefore, it is quite obvious that the gradient of the density of the gaseous atmosphere of the sun is such that the density increases approaching the center of the sun.

The second subject being that we made use of the law of Gladstone and Dale too. This law gives the relation $(n-1)/\rho = constant$ for the variations of the refractive index, n, with the density of the gas, ρ. It is clear from this relation that for a gas, the more the density of the gas is, the more the refractive index related to it will be. Therefore, according to the first subject we conclude that there exists the same centerward gradient for the refractive index as predicted for the density of the molecules of the sun atmosphere, ie, approaching the center of the sun the refractive index increases.

It is clear that study on the observed deviations and measured time delays can be a useful aid in order to investigate the quality and quantity of the atmosphere around any celestial body under consideration.

Attention to some other points related to the discussion is useful. As we can see in Fig. 2 it is probable that the celestial lens a focuses the real (inverted) image of the star b in the position c, and an earthy observer in d indeed observes this image in c.

But of course according to Fig. 3 it is more probable that the image of a far star is focused on a line rather than a point.

The situation is exactly the same referred to as gravitational lens with multiple image.

Another point being that as we see in Fig. 4, i and j are the limit rays and then an observer in b measures the angular magnitude of the sphere a equal to q not p (in other words he or she observes a part of the back of the sphere too).

Therefore, eg certainly the observed angular magnitude of the sun is larger than the real one, regardless of the effect of the atmosphere of the earth which is a compensating one.

Supposing that the sphere a is not radiant but has yet the above mentioned centerward condensing atmosphere n, if the angular magnitude of the sphere a is to be obtained by measuring its apparent cover on the background far stars, then the rays only outside the angle q will be observable by b, and in fact b measures the angular magnitude of the sphere equal to q again. It is obvious that this angular magnitude can be as large as r (ie the angular magnitude of the atmosphere around the sphere a) at most. Therefore, if such a sphere exists, it will darken an area of the sky which its apparent angular magnitude is q (which is larger than the real angular magnitude p and smaller than the angular magnitude of the atmosphere, r). Since at the most q is equal to r, such a (dark) sphere is not distinguishable at very far distances (because at these distances r approaches zero).

POINT:

General Relativity predicts existence of black holes which according to it they attract any light of themselves or passing nearby. I think the scientists believing black holes don't notice that every one of such black holes must have such a huge volume as covering exactly the same (probably) observed dark extent around the center of the black hole (and if so, then the term hole, implying a relatively small space, will be unfit). My reason: Suppose that a in Fig. 5 is a small (point) black hole.

Suppose that every light beam passing through the column $2r$ will be attracted and absorbed by a. Since there are numerous columns of this kind in every direction from numerous stars in space, there will be numerous light beam of the kind l in Fig. 5, passing nearby, in every direction. It is clear that such light beams prevent the space around a being observed dark unless we suppose that the volume of a itself is very large.

But how can the solar atmosphere, as the observations show, be non-dispersive? Surely if we can consider the solar lens as a small lens or prism in an optical laboratory and allow a narrow beam of some non-monochromatic light to pass through it (not towards its center), then we must expect dispersion of the light passed through the (solar) lens due to its refraction in the lens. But that such a dispersion is not observable when observing the stars light passing beside the sun is because of this fact that it is not only a single narrow beam of the light of a star that reaches the sun but numerous beams of its light reach the sun parallel to one another. The reason of their parallelism is that the star is distant from the sun very much. In this manner instead of a single beam which may pass through a lens in an optical laboratory, we are here dealing with numerous parallel beams. According to the justification related to Fig. 1, these beams when passing through the sun's atmosphere (or in other words when passing beside the sun) are deflected into different directions in proportion to their distances from the sun's center. It is natural that each beam is also dispersed in the solar lens simultaneous with its deflection. Then, we shall have numerous differently oriented deflected beams each of which simultaneously dispersed, after passing of the beams through the sun's atmosphere. It is clear that different dispersions of different deflected beams (related to the primary parallel beams adjacent to each other) will be intermingled with each other, and consequently an earthy observer won't observe any dispersion but only the deflection of the beam will be observable for him or her; indeed this is just the same reason that why in an optical laboratory the phenomenon of separation of different wavelengths of a sufficiently thick beam of some non-monochromatic light is not observed in the middle part of the beam after its refraction in a prism (or a spherical lens).

In simpler words, supposing that in Fig. 6, a, b, and c are in turn the middle beams of the visible spectrum of the dispersions related to the primary parallel beams A, B, and C, while a', b' and c' and also a", b" and c" are in turn side beams of the visible spectrum of the dispersions related to these primary parallel beams, if the earthy observer is positioned along the beam b, he or she will observe this middle beams of the visible spectrum accompanied by the side beams of the spectrum, c' and a", which are parallel to the beam b. Since these parallel beams (ie b, c' and a") are close to each other (because are related to primary beams close to each other), he or she won't practically observe the dispersion but only the deviation of direction of the beam b relative to the direction of the primary beam (B) will be observed by him or her.

But what can we say about the deviation observed for the stars light passing far from the sun (to the extent of the radius of the rotation of earth about the sun)?

I am not certain that there is not any gaseous materials, even very rare, in the space between the earth and sun. It seems irrational to consider this space as a perfect vacuum. We can consider such a gaseous space, if there exists, as a kind of atmosphere for the sun.

But let's see the problem differently. In the 4th article of this book I have proven, at least as I think, the existence of very tiny particles playing role of the vehicle for propagation of electromagnetic waves. I named these particles as ether. There, it has been shown that this ether is attracted by celestial bodies (under the influence of gravitation). Ordinary matter (eg gas) is also attracted by these bodies. It is rational to consider the same gradient of density for this ether around the sun as the gradient of density of the gas (as stated above). Thus, we conclude that wherever we have dense ordinary matter we should also have dense ether.

Considering the law of Gladstone and Dale (mentioned above) this necessitates to conclude that the more the density of ether is, the more the refractive index related to it will be. And considering our previous conclusion (stating that the gradients of density of gas and ether around the sun are similar) we can conclude that if a celestial body has no atmosphere but only attracts the ether around itself (even to the extent as far as the distance between the earth and sun) the light passing near the body will be bent in the same manner as described in this article because the ether around the body has the same gradient of density as mentioned in the article. (In other words maybe a celestial body has an ethereal atmosphere without having ordinary atmosphere.)

Anyway, while astronomical researches and measurements have proven that the solar corona has indeed an expansion up to the earth (having a density of the order of 10 to 20 particles per cubic centimeter near the earth (while near the sun is of the order of one billion particles per cubic centimeter)), accepting the original model presented in this article, ie considering the atmosphere of the sun as expanded as reaching the earth is more reasonable.

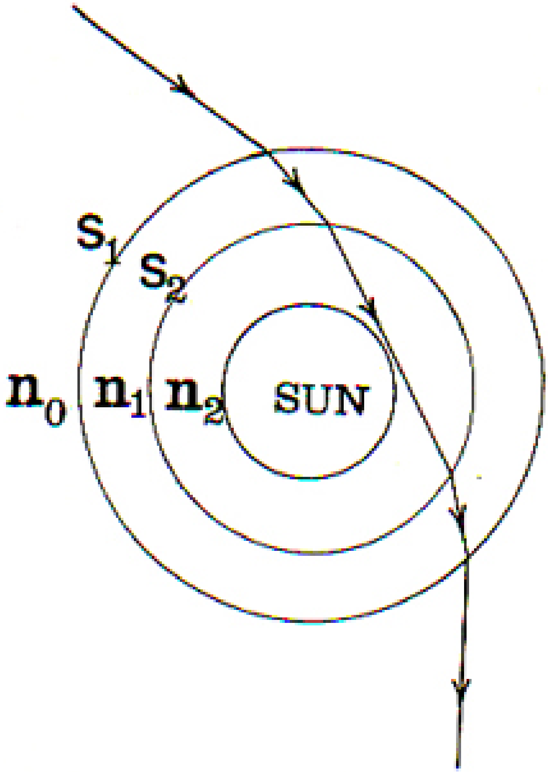

Fig. 1

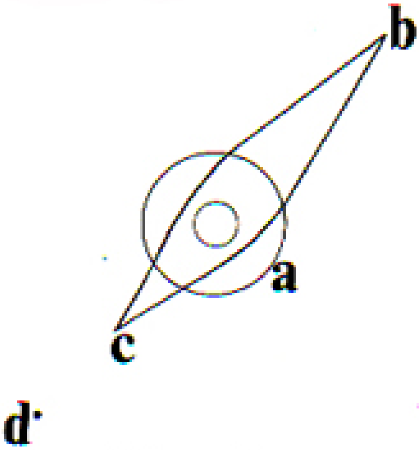

Fig. 2

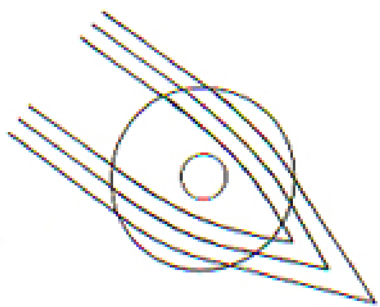

Fig. 3

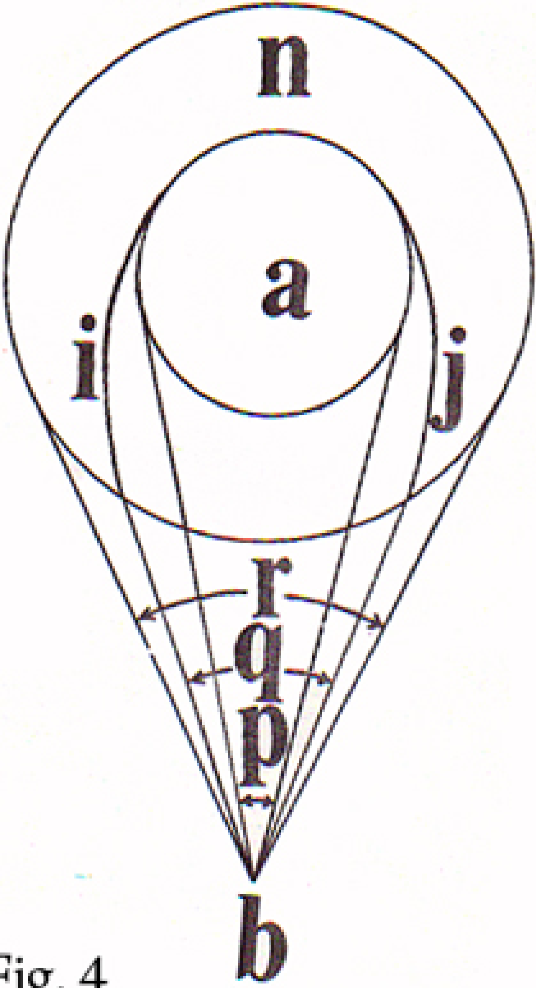

Fig. 4

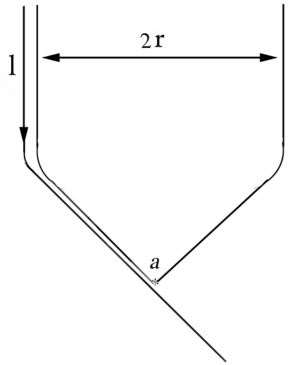

Fig. 5

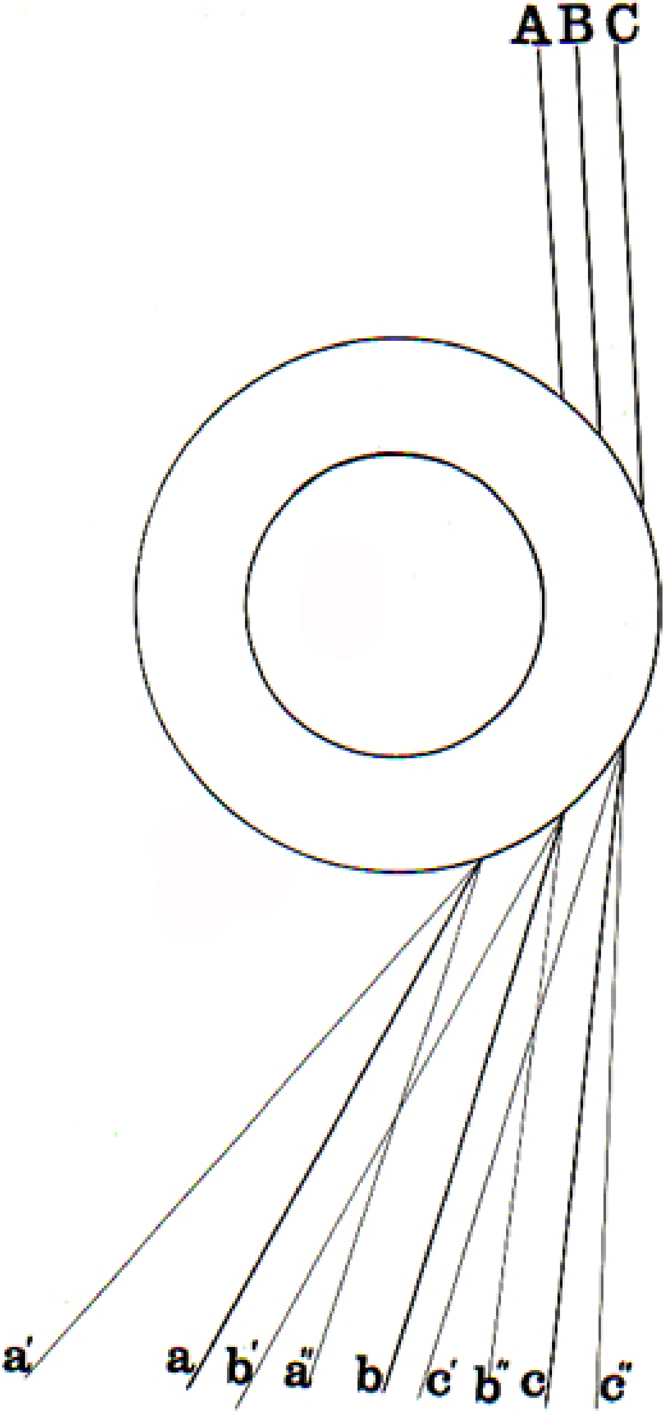

Fig. 6