Physics.- The speed of light is composed of that of: source? Evidence in favor offered by the phenomena of "variable stars" and "new" ones. Correspondence Note M. La Rosa.

Since around 1910 Comstock ([1]) and Castelnuovo ([2]) had taken over the possibility of obtaining, by means of observations on the "double stars" one decisive test between the opposing hypotheses made about the speed of light, in order to extend the principle of relativity of mechanics to phenomena optical and electro-magnetic ([3]).

These AAs stopped to consider the curious deformations they numbed had to show us the time intervals between successive passages of the revolving star for the quadrature points.

But while Comstock himself tried to get by not easy observations a direct check of the predicted deformations, De Sitter ([4]) published a brief analysis on the phenomena of the "doubles" which seemed and still seems clear and decisive against the hypothesis (*ballistics*) of Ritz ([5]), which admitted the composition of the speed of light with that of the source, and therefore indirectly in favor of the postulate on "constancy of speed of light" which is the very basis of Einstein's theory.

Now a more complete analysis of the consequences that arise from the hypothesis ballistics, demonstrates that De Sitter's conclusions are not exact; in what proves that even the *ballistic hypothesis allows ample possibility for observations on the "doubles" and on the laws of their movement*.

But there is more: the same analysis leads to explaining in a simple way and immediate a whole vast group of astronomical facts: those on the "*stars variables*"

([1]) Comstock, *Phys. Rev*., vol. XXX, p. 267, 1910.

([2]) Castelnuovo, *Scientia*, vol. 1X, p. 71, 1911.

([3]) One historical-critical news on this argument was given by myself in *Nuovo Cimento*, vol. 111, p. 345, 1912.

([4]) DeSitter, *Phys. Journal*, vol. XLV, p. 429, 1913.

([5]) Ritz, *Ann. for Chem. and Phys*., vol. X111, page 145, 1908.

and "*new*", which up to were *in small part* ([1]) and imperfectly explain yourself; *thus proving that the ballistic hypothesis is much more fruitful and much closer to natural facts than Einstein's*.

Reserving the right to publish a more extensive report of my research, I take the liberty of indicating the essential steps in this Note.

Let us therefore imagine a star S rotating along an orbit, for simplicity circular A, C, B, D in the direction of the arrow, with speed *v*; it's a observer M placed in the plane of the circle, along the DC direction, at a distance *d*

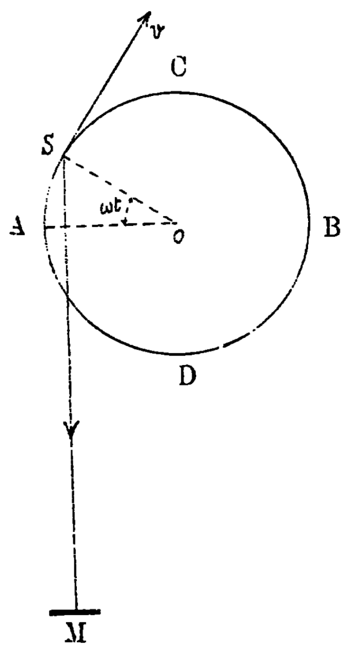


FIG. 1.

from the center O of the circle (where *d* is extremely large compared to the radius *r* of the club). If with *t* we indicate the departure time of the light rays from the star, and with T that of arrival at the observer, and we agree to choose as common origin the instant of a passage of the star through the position in our hypothesis, the observer will receive the rays emitted by the star. in any position S, at the instant T by

$$\text{(1)} \qquad T = t + \frac{d}{c - v\cos\omega t} = t + \frac{a}{1 - b\cos\omega t}$$

([1]) The "occultation" hypothesis may imperfectly explain the behavior of a few tens of "variables", those of type Algol or β Lyrae; while the number of variables known so far is a few thousand.

where $\omega = 2\pi/\tau_o$ is the angular speed of the star, c the speed of light, τ_o the time of one rotation, $a=d/c$; $b=v/c$.

Setting again $a = K\tau_o$ we will write (1') as follows:

$$\text{(1')} \qquad T = t + \tau_0 (K + Kb \cos \omega t - Kb^2 \cos^2 \omega t + \ldots)$$

and we will point out that since b is always small in reality (hardly reaches 10^{-3}) if K is not very large (1') can be limited, for the purposes concrete that we have in mind, to only the first three terms, i.e., we can put:

$$\text{(2)} \qquad T = t + \tau_0 (K + Kb \cos \omega t).$$

Indeed, whenever the product Kb is small (e.g., less of 10^{-2}) the conclusion of the same third term, the periodical, is very weak; the effect feared by De Sitter, i.e., the superimposition of light rays emitted by the rotating star in different positions of the trajectory (dependent by the coincidence of the T between rays departing at different instants t), can take place for distant positions of small arcs (less than a hundredth of the length of the trajectory).

This superimposition cannot cause practically appreciable disturbances to an observer who detects from time to time the successive positions of the star; in the case of a double "optics" this will be able to determine the projection of the orbit on the celestial sphere and recognize without drawbacks if the whether or not Kepler's 2nd law is applicable to the observed motion ([1]).

The effects of overlapping become conspicuous in cases where the Kb product is close to unity.

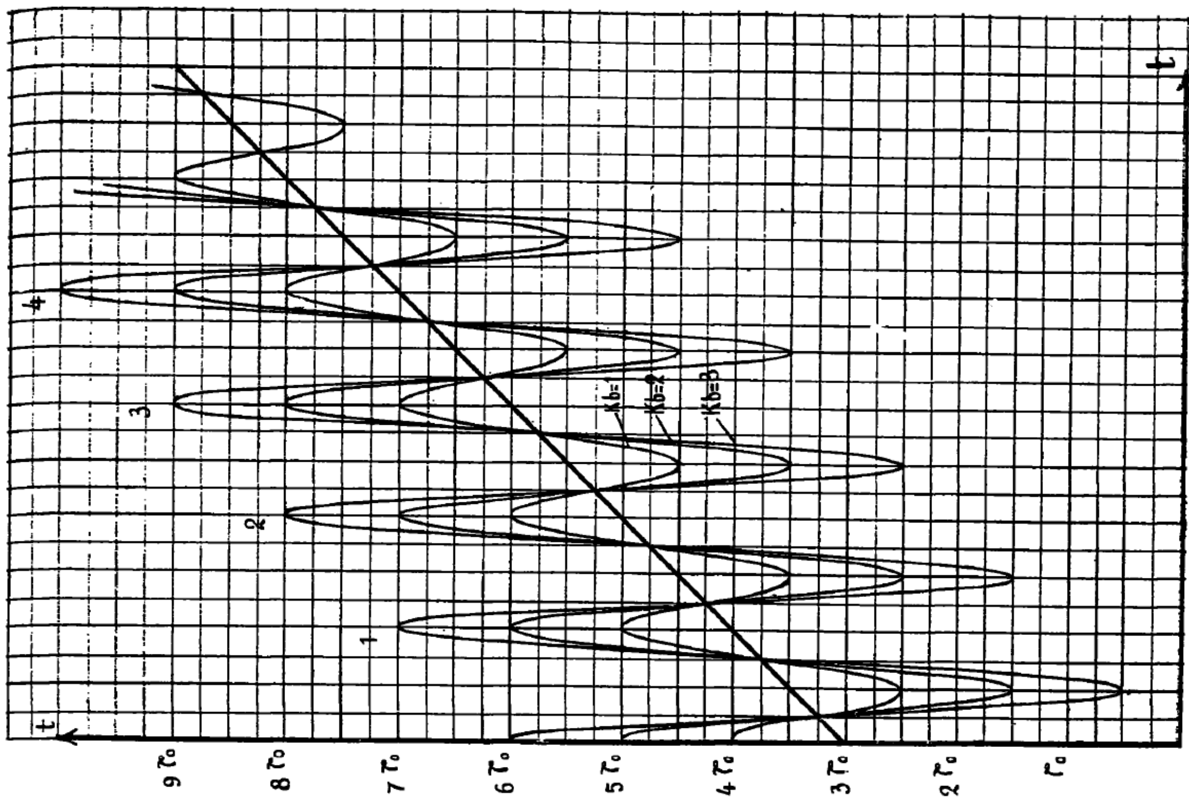
Even in the examination of these cases we can practically make use of the simpler formula (2), since being Kb close to 1, the amplitude of third term will be of the same order as τ_o; while that of the 4th term, due to the smallness of b, it is an order of magnitude much larger small (at least 1000 times) and yet leads to a secondary overlapping effect limited between rays emitted from very distant positions along the trajectory, i.e., not very noticeable.

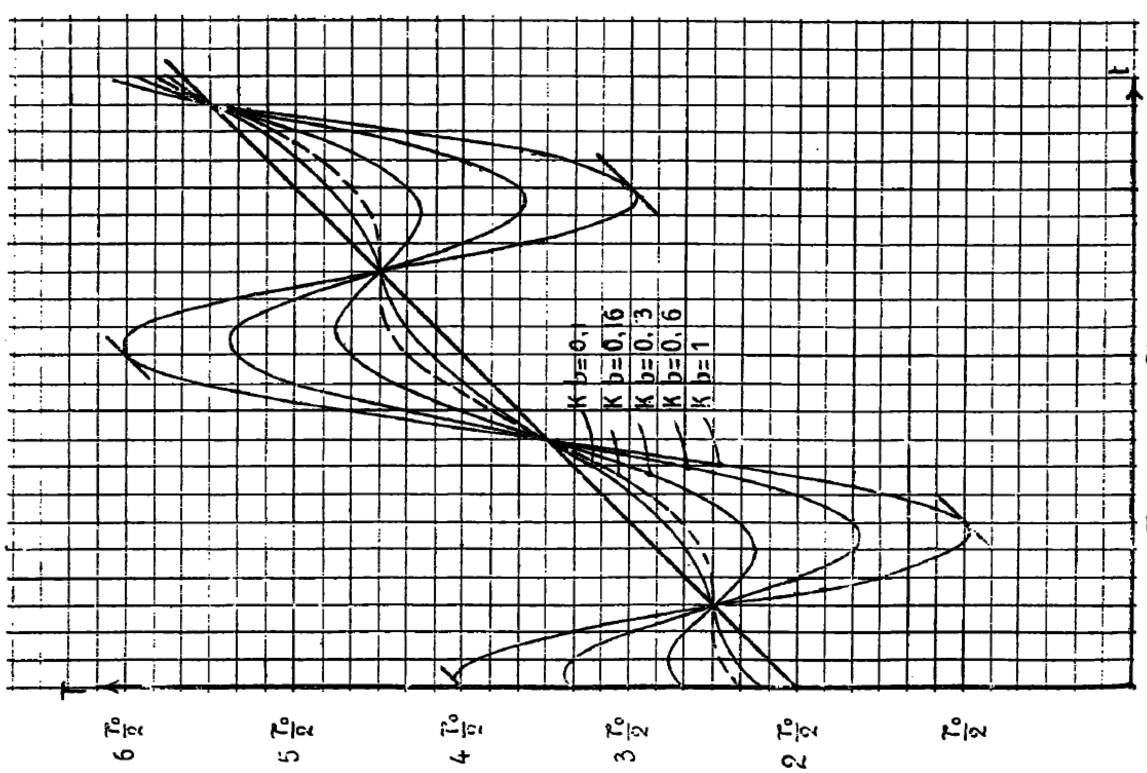
The curves of figs. 2[a] and 2[b] are graphical representations of the law (2), constructed for certain more interesting concrete cases, namely for the following ones Kb product values: 0.1; 0.16; 0.3; 0.6; 1; 2; 3 ([2]).

Let's take a close look at the trend of one of them, eg., of that defined by Kb = 0.6.

([1]) These conditions are widely applicable to dual optics, on which Kepler's 2nd law has been directly verified.

([2]) In these figures the abscissa axis is transported parallel to itself upwards: the ordinates must therefore all be increased by a constant quantity that the reader will find by itself for each curve.





Starting at. consider things in the moment when the observer receives the light from the star at time $t = 0$, we will detect the following important circumstances:

a) the luminosity of the star will appear tending towards a maximum (which we will clarify better now):

b) at that moment the observer has already received all the light that the star had emitted in the successive positions occupied along three quarters about the first round.

From this moment and for a short interval the observer simultaneously receives, at each instant, light emitted from three different positions taken from the star: two belonging to the beginning of the first lap, the third at the end, precisely to the arc that begins at ¾ of the trajectory (the 1st conjunction).

It should be noted that around the first two points the curve is slightly inclined with respect to the abscissa axis, i.e., the ratio $\Delta T/\Delta t$ is very small; what tells us that *while the departure times of the light rays vary within a rather large range, the arriving ones fall within a range very narrow*.

Consequently, *the light that the observer receives* from the mobile star for each unit of time in this interval must *be greater than that that he would have received if the star had remained stationary*, indeed *the intensity luminous apparent of the celestial body must quickly rise to a maximum*.

From this moment the curve, for an entire interval $\Delta T = \tau_o/2$ approximately is cut in a single point from the parallels to the axis *t*, and presents in this region a very large and nearly constant $\Delta T/\Delta t$ ratio. The brightness of the celestial body must therefore descend and remain in a minimum phase.

Shortly after the instant $T_o + \tau_o/2$ the luminosity quickly returns to the maximum, since in the light coming from the successive positions (to those already considered) taken from the star in the first round, and in which the $\Delta T/\Delta t$ is becoming smaller, the one issued at the time of the is added abruptly second quadrature of the 2nd round, in which $\Delta T/\Delta t$ is very small; still later light intensity decreases *to a new minimum, somewhat higher of the first*, and finally retraces for a new maximum equal to the first.vb

Overall, the observer will see the "variable" star; for about half of the period as of minimum intensity (maximum order of magnitude), for half the next one will see it pass through two consecutive highs, separated by a low - equidistant - somewhat higher than the initial one.

The figure attached here (fig. 3) gives the diagram of the apparent magnitude presented by the star ([1]).

([1]) The diagram of the observed luminosity for such a star coincides in the most minute details with the one detected above a beautiful variable star: β Lyrae, of which the nature of "double" is known.

It is easy to see that for increasingly smaller values of the product K*b* the influence of the periodic term is decreasing: the amplitude of variation of the apparent size will become smaller and smaller, until any change it will become priceless. In practice given the low sensitivity of the methods photomectic we soon fall back (for K*b* $<1/10$) in the previously examined condition of very small K*b*.

The curves corresponding to values are showing less and less interest of K*b* always bigger than l. The superimposition of light takes place for a

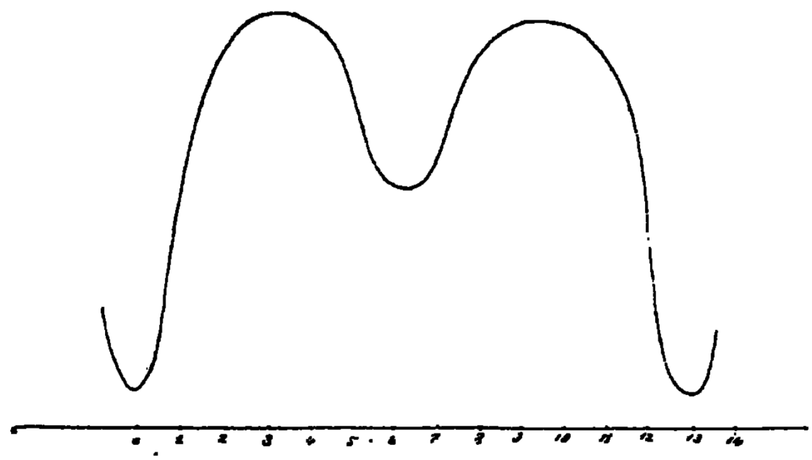


Fig. 3.

increasingly large number of positions, always belonging to periods and phases more diverse, and the observer will only be able to notice small oscillations of the light intensity which will occur for the passing values of T for the maxima and minima of the curve under examination.

Already for K*b* = 5 the number of points of intersection of the curve with a parallel to the *t*-axis (i.e., the light overlap positions) becomes 10; two of which at regular intervals merge, once into a maximum, the other in a minimum of our curve. The light sent by the celestial body in correspondence of these positions will undergo slight reinforcements with period τ_o/t what they will be diluted in the almost constant total light coming from numerous other locations.

It is therefore easily understood, as soon as possible, that is *for values of Kb not much greater than 10, any swing in light intensity will become priceless*.

In conclusion, the ballistic hypothesis leads us to state that:

1°) if the product K*b is small compared to 1* (practically $<10^{-1}$) *the superposition of light rays coming from different positions dictates star does not give appreciable effects, and however does not disturb observations telescopic*;

2°) *if the product* K*b is greater than 5 the overlap occurs from many different positions, and it will no longer be possible to distinguish on the telescope the successive positions taken by the star, nor observe variations appreciable brightness*;

3°) if the product K*b* is included within the limits already indicated, the star in motion it must present a*lternatives in luminosity, real changes periodicals of its apparent size*; i.e., *the star. needs to appear to us as "variable"* ([1]).

We will show amply on another occasion how fruitful this one is third conclusion, from which one emerges in the most spontaneous and direct way general explanation of all the phenomena offered by "variable" stars e from the "new stars"; very interesting phenomena and for the most part none the less shrouded in mystery. We will show amply on another occasion how fruitful this one is third conclusion, from which one emerges in the most spontaneous and direct way *general explanation* of all *the phenomena offered by "variable" stars and from the "new stars"*; very interesting phenomena and for the most part none the less shrouded in mystery.

Here we have to limit ourselves to looking at whether these conclusions *conflict with the results of spectroscopic research on the "doubles"* as well as De Sitter led us to believe.

Meanwhile let us assume that for the "doubles" only spectroscopically solvable the application of Kepler's 2nd law is not enforced directly from the measures; but it is made as a reasonable generalization, on the basis of the results acquired with direct observation on the "double optics"; for which the condition $Kb < I0^{-1}$ is very largely satisfied. Yes, you can therefore affirm that *the ballistic hypothesis does not at all collide with knowledge on the "double"*, as this also allows the possibility of observations aimed at verifying Kepler's 2nd law.

Nonetheless, it is good to closely examine any possible repercussions the ballistic hypothesis would lead to the field of spectroscopic observations. We have seen that as long as the product Kb is small there will be no overlap. position of light, if not from points of the trajectory not far away; what you mean that they will arrive at the spectroseope at the same time. traveling rays with slightly different speeds: we will therefore have - albeit to an extent. appreciable - a slight expansion of the spectral lines, variable expansion with the period of rotation of the celestial body, which is superimposed on the displacement periodic forecast on the basis of ordinary hypotheses. No inconvenience therefore by the measure of this displacement ([2]).

([1]) It is easy to see how this conclusion should be completed when one assumes that the fixed center is another star constituting a system rotating around it with the first one to the common center of gravity. If for one of the two stars our condition is fulfilled well K*b* close to 1, for the other it will not be; since in general, the two stars having direct masses, also have different tangential speeds, and therefore different values of *b*. There light coming from the system will vary over time according to a law which must be determined on the basis of the composition of two of the curves given by us, of which, however, only one will present. the influence of the periodic term is strong. We understand therefore that the appearance of *variable* must be conserved, albeit to an attenuated extent.

([2]) Reserving the right to deepen the investigation into the way of considering the phenomenon of Doppler in the ballistic hypothesis here we assume that the observed effect depends directly from the number of vibrations received in the unit of time.

The same conclusion still holds as the product K*b* approaches to l; and precisely until the curve T= *f*(*t*) is cut into only one point from the parallels to the abscissa axis, all that will be seen as it grows of K*b*, it will be *an increase in the expansion of the line, and greater evidence of its periodic variation*.

When K*b* reaches larger values the curve will be trimmed *three times* from the parallels, to the *t*-axis; we will have, in correspondence, rows always expanded whose width will present a perfectly regular periodicity character, so as to allow the determination of the period. If the speeds of the rays you overlap are sufficiently different we may also have the decomposition of the line and it will be possible by measuring the distance of the components (or of the width of the line if it is not decomposed) the determination of the speed instantaneous possessed by the rotating body in the two positions. They will be like this those elements that are needed for the deduction of the radius of the orbit and of the mass of the body, as it is done according to Kepler's laws (supposed already applicable) ([1]).

As the number of meeting points of the curve increases, T = *f*(*t*) with and parallel to the *t*-axis we will generally have expanded lines, which at some time can resolve and have *more than two distinct components* - such as has been observed in certain cases and has not been explained so far ([2]) – while when this number becomes large we will have superimpositions of incoming light from many different positions, with different speeds, and therefore rows strongly and *constantly expanded*, in which the width will not present what appreciable changes (many stars are known to have spectra of this type).

Only, therefore, when the product K*b* will have become somewhat larger of 10 spectroscopic observations based on the study of periodic changes lines no longer allows you to ascertain - as already the telescope - the nature of "doubles" of the stars.

Only for these cases would De Sitter's fears therefore have good foundation!

But there is nothing wrong with admitting that the astrophysics investigation fails has still managed to reveal the true nature of a certain number of stars complex (very far to be K*b* large). We will show indeed elsewhere occasion, with easy statistical considerations such opinion as you find impressive confirmation of the observed facts.

In conclusion we can state that *the 2nd postulate of the theory of relativity finds no support in the observations made around the double stars; that the* opposite hypothesis - *ballistics* - is not only not contrary to these observations but *finds a solid and clear basis of fact in the observations on the "variable stars" and on the "new ones"* ([3]).

([1]) An answer to the doubt advanced below by prof. Castelnuovo is already there in the extended report of my researches, which is under print among the "Memoirs of the Soc. Astr. Ital." Nonetheless I will take the liberty of presenting the arguments here shortly in favor of light curves, which also resolve the particular question on which the prof. Castelnuovo stops.

([2]) The only difference between our way of explaining the phenomena of "variables" and the currently accepted one for *some of them* (those of the Algol type) consists in this, that while our hypothesis makes us predict the doubling of the lines even if the light it comes from *a single star* (satellite) revolving around a central; the one in progress must admit that the light comes from two rotating centers, hence the need to imagine "doubles" made up of two almost equal stars.

([3]) The case of the simultaneous observation of the straight line in position is frequent normal and two lateral expanded components. It is immediately apparent that this case coincides perfectly with some of our curves.

Italian to English translation using Google Translate and Yandex Translate by Thomas E. Miles. Other Ritz & La Rosa related files located by Robert Fritzius at web site: http://shadetreephysics.com/ with other relating at Gen. Sci. Journal: https://gsjournal.net/