contrary, invoking it the validity remained intact for the slow movements - means to deny it, to break down its fundamental postulates and those primitive concepts of time and space, what a ban on thinking and writing.

This reversal necessarily follows from an affirmation of Einstein, apparently lawful and believed to conform to experience, from the postulate of the "constancy of the speed of propagation of the light", which is the *true* basis of all theoretical construction.

This postulate states, that the *light* that comes to us from a star, of from any source, *you always travel with the same speed, whatever the movement conditions may be* (or more exactly the speed) *of the source itself, and of the observer*.

Ritz, on the contrary, tries to keep classical Mechanics intact, and it proposes to revise and adapt the electromagnetic theory in order to bring it under the dominion of the principle of relativity. He also achieves this end by means of a postulate on the velocity of the light, which is perfectly contradictory to Einstein's; because it supposes that the light that reaches us comes from a moving source (relative to us), you travel with a speed equal to the sum (*vectorial*) of the normal speed c of light (emitted by a source at rest) and of the speed v of the source.

Both schemes undoubtedly have strengths and weaknesses, advantages and drawbacks, brilliant synthetic views and obscure gaps; so that the choice between the two would require a delicate and diligent analysis and not easy.

But even before we can come to the examination of these two particular schemes, a more general and "prejudicial" character; that of testing goodness and safety of the two great ways glimpsed by the two brilliant theorists, to orient in safe way the search, to address it precisely or on the path attempted by Einstein: intact conservation of electrodynamics and revision of Mechanics through *the postulate of the constancy of the speed of light*; or on that indicated de Ritz: conservation of Mechanics and revision of electrodynamics through *the postulate of "composition" of the speed of light*.

After this first step has been taken under the guidance of *experience, the only one that has the right to decide the choice*, the work of the theories will be able to proceed safely in the elaboration of the scheme we need; and it will be possible to take up and adapt both of them already built, or rather devise from scratch one or more others, in the respondent.

Therefore, the need to search for a "fact" was soon felt physical, capable of providing us with the *decisive* element of proof, in favor of one or of the other, hypothesis on the speed of propagation of the light.

Now the *only* field of facts from which research could and can draw this element of proof was and is that of astronomical facts, for reasons which need not be stopped here; and since 1913 De Sitter, a Dutch astronomer, believed he had found it, based on certain observations on the "double stars" (1).

De Sitter's conclusions were precisely contrary to the postulate of the speed of light with that of the source - and since then onwards the motion of the "doubles" has been adduced as the strongest proof in favor of Einstein's fundamental postulate.

An easy analysis has recently led me to recognize that the argument by De Sitter was hiding an error; and picking up in examine the consequences to which the Ritz hypothesis can lead us when be applied to observations of the movement of the double are managed to *predict on my behalf a whole very important field of facts which find a magnificent confirmation in reality*; facts that despite being known for a long time were in the majority - after centuries - still remained obscure and unexplained.

This unexpected and very happy agreement between the theoretical prediction (made apart from any dangerous suggestion, because the facts were mine unknown) and the observations, constitutes on this element of proof that far outweighs the value of any *ad hoc* instituted experience, of any system of observations frantically, and not always dispassionately accumulated, to verify effects, which often are illusory, because at the limit of the observable quantity.

But I will set out the basic lines of my analysis in the second section part of this writing.

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(1) These are pairs of stars, close together and bound by mutual attraction, by virtue of which they revolve around each other, according to laws analogous to those discovered by Kepler for the motion of the planets around the Sun.

II

The task we have to carry out in these pages is twofold.

First of all we have to prove that the proofs invoked by De Sitter, against the hypothesis of the composition of the speed of light, with that of the source are not decisive.

Next we have to show that the consequences to which this hypothesis leads us pushes are painstakingly confirmed by the facts; rather than these facts, I which in this way find for the first time a general explanation and satisfactory, form a secure basis for the affirmation of that hypothesis.

We will assume, tentatively, that the ballistic hypothesis is correct: we will admit. that is, that the speed of propagation of light, when it comes to us from a *moving* source (for example a star) and the one obtained by adding to the normal speed of propagation *c* (that of light emitted by a source at rest) the speed *u* with which the source moves along the line of sight (l).

Let us then imagine that we turn our gaze towards a "double", made up of a large central star O, almost immobile, and of a "companion" S, who goes around it, in the direction of the arrow, long a circular orbit, placed in a plane that contains the "view" MO.

Let's sign in the figure the points C, D, A, B, in which the visual itself and the diameter perpendicular to it cut the circle, i.e., the four o'clock fundamental positions that astronomers call *conjunction* (C), *opposition* (D), *quadratures* (A, B).

When the star passes through A its velocity *v* is directed along la visual, but in the opposite direction with respect to the rays which depart at that moment S, which, therefore, travel with the speed *c* - *r*.

When the star passes through D, its velocity *v* is directed perpendicular to the view, and has no influence on the propagation of the stars rays that go towards the observer, who therefore travel with the normal speed *c*.

When the star passes through B, the *v* is directed Ia in the direction of

(1) If the source moves with speed v in any direction, the u *v* a certain part of r or as we say the "component" of *v* along the line of *mira*.

propagation, therefore, the rays travel at speed $c + v$.

Analogue considerations can be repeated for the rays emitted in the successive positions between B and A; they will have to travel with *decreasing* velocities from $c + v$ to $c - v$.

To clarify well the phenomena that we must expect, for the fact we take advantage of this propagation of light with "variable speed", we will make use of a concrete example.

Along a battlefront, the commander in chief at no large distance - issue orders and information, by means of couriers dispatched at constant intervals of time, for example, a hourly. If the couriers traveled all with at it *speed*, the fighting departments would receive orders, after more or less times shorter, depending on the their distance from the Command, but at constant hourly intervals each. If instead they run with variable speeds, the orders will come to the next ones departments at different intervals.

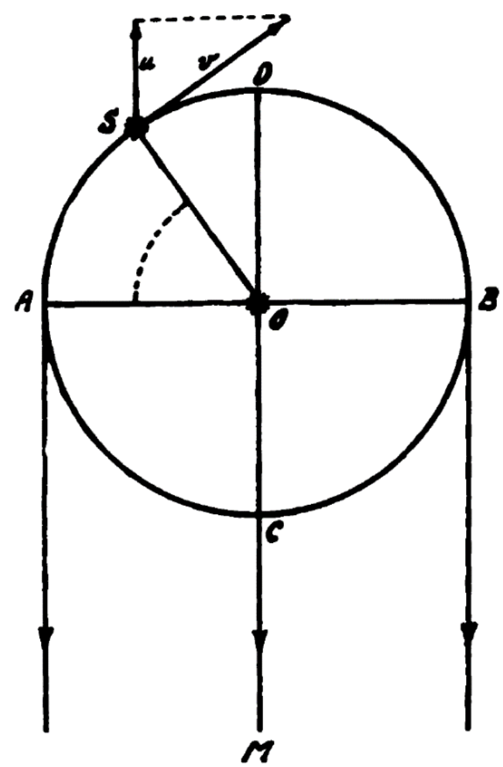

Figura 1

Let's stop for a moment to consider the journey of two consecutive couriers; supposed for example that the first one, shipped per hour Or, you travel at a speed of 10 kilometers per hour, while the second, sent at 1 hour, travels at a speed of 11 kilometers per hour.

It is evident that the advantage of 10 kilometers that the former possesses at the starting moment of the second, it will become smaller and smaller a measure the length (or more exactly the duration) of the path it goes growing up. In fact, at 2 o'clock, the first courier will have traveled 20 kilometers while the second will have traveled 11, so that their distance one hour has become 9 kilometers; at 3 o'clock it will become 8; and so the street. At 11 the second courier, who will have traveled 110 kilometres, will reach the first who will also have traveled 110, and from that moment onwards the second will precede the first by a much greater time the greater the further distance travelled.

Thinking therefore of all the couriers who left for example in a whole day (24 hours) and assuming that their speeds are all different first increasing and then decreasing, we can guess which big tangle of orders and ideas *may* arise on our battle front, assuming that the subsequent bulletins do not bring any indication of the time of departure, to any other element that can enlighten those who they receive them on the "true" order of their succession.

Precisely these dreadful "overlappings between rays departed from the mobile star, from positions and at different times, were the weapon with which De Sitter fights Ritz's hypothesis. Such overlaps could not allow us - observes De Sitter - to faithfully follow the motion of the revolving star and to discover its laws, contrary to what is from the observations on the "doubles", which have allowed us to study their laws.

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Now this conclusion of De Sitter's is too little thought out and *generally inaccurate*.

Before coming to the condemnation of Ritz's hypothesis, it was necessary try to unravel the "tangle", to establish the factors on which it depends, and persuade oneself well of the game that each of them can have in this or that.

Everyone sees immediately that if the speed differences between the successive couriers were only a few meters on the 10 km/hour, supposed as an average, we would have nothing more to fear from the small alterations of the arrival intervals. They would be quite incapable of produce shifts in the succession of the orders of our command, when - of course - the total journey times are not too big.

Now, the speed differences we can expect between the spokes luminous rays emitted by a moving star are always very small fractions of the average speed of propagation of light. According to what we know about the speed of celestial bodies these differences are between a few hundred thousandths and half a thousandths of the speed of light.

So for those stars for which the time taken by the rays to reach us is not too big, that is, for those stars that they are not very distant from us, we will be able to have no notable perturbation fear from overlapping rays.

Now the fact is that the astronomical observations that made us to know the laws of motion of the "doubles" they refer precisely to fairly close stars, for which the supposed overlapping, specially calculated, give rise to negligible effects: we can therefore conclude - contrary to De Sitter - that these observations prove nothing against Ritz's hypothesis.

Things change profoundly when we consider stars distant for the time θ, which the days it takes to reach us, is very big. Precisely we want to consider the case in which the ratio between the time τ_0 of a rotation of the "companion", and the time θ both of the same order of magnitude as the r/c ratio.

To make things clear, it is better to examine closely a concrete example. The mobile companion employs, for example 100 days to complete its revolution around the central star, and its speed v is 30 kilometers per second (the one with which the Earth moves along the orbit), so that the ratio v/c (c=300,000 km/sec.) is equal to 1/10,000. The distance of this "double" from the Earth is 138 light years, i.e., 500,000 days, so that the relationship between the rotation time 100 days and the average time taken by light in the trip is 1/5000, i.e., double v/c.

The rays departing from position A (fig. 1) at the initial moment, then travel with the speed c- c/10,000; those starting from B with the velocity c+c/10,000, which exceeds the speed of the former by 2c/10,000, so, along any path, the rays starting from B with 50 days of delay earn 2'10,000 of the time taken, i.e., 2 days out of every 10,000 days of travel: and therefore 100 on our journey total, which is 50 times 10,000 days. Consequently, the rays departing from B they will reach us 50 days before the arrival of those from A; and it is clear that they will arrive overlapping with others rays, departing from certain intermediate positions, between A and B, and therefore traveling with intermediate speeds.

In order to acquire a very clear idea of the effects of these overlappings, it is indispensable to establish, in a precise way, the law of correspondence between the departure times of the light rays from the star, which we will indicate with t, and the times of arrival to our eye, which we will denote by T.

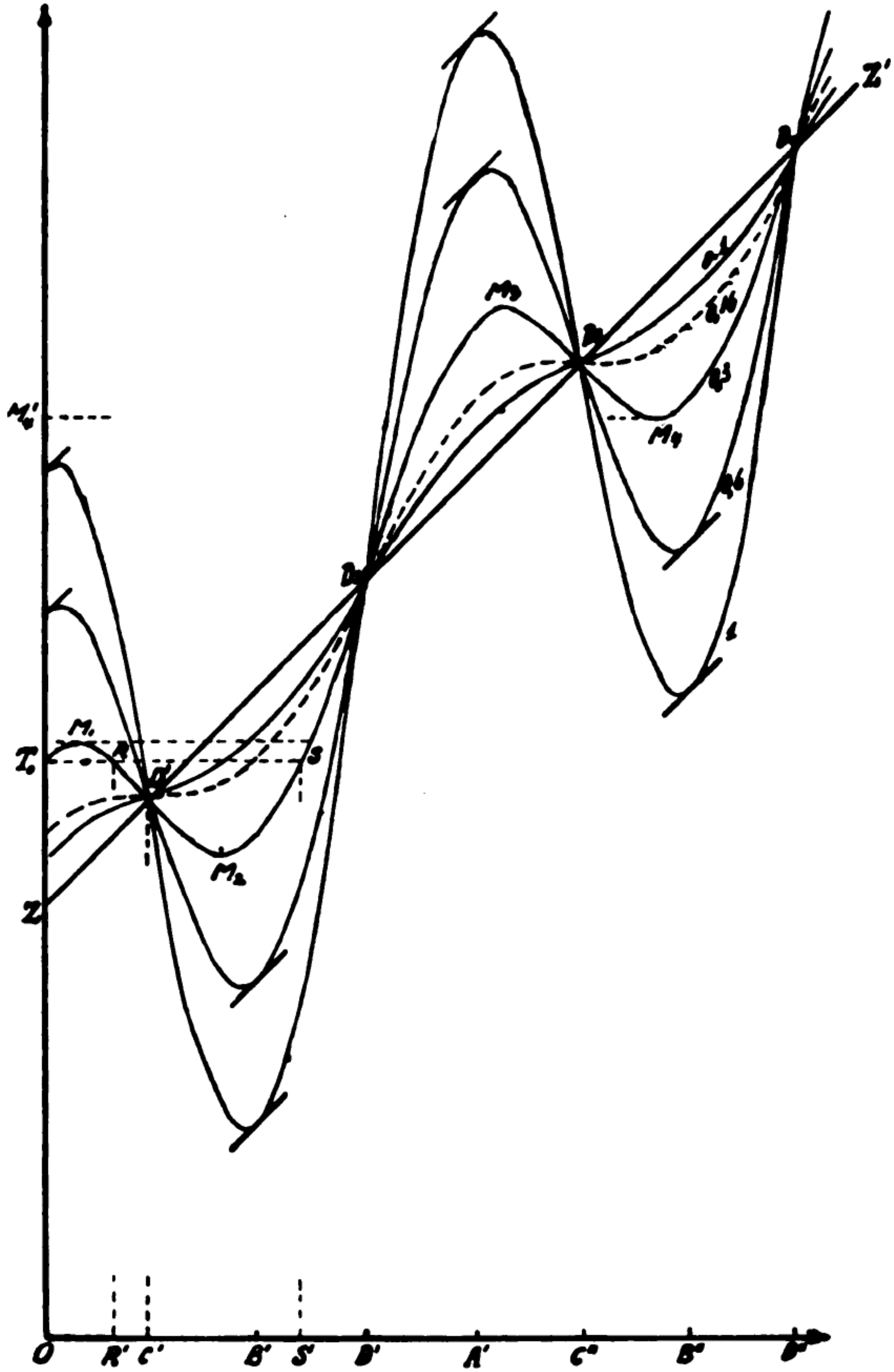

Figura 2

To avoid getting entangled in a discussion of a mathematical nature (however simple and elementary) let us refer to the attached diagram (fig. 2) which gives the graphic representation of this law in certain remarkable particular situations.

On the straight line OX the starting times are represented, in a clear way point O corresponds to the initial instant (t = o) in which the rotating star S passes through position A (fig. 1); at point A' corresponds the time it takes for the star to go full circle; at points C', B', D' which divide OA' into four equal parts, correspond respectively to the moments in which the star passes through the positions C (opposition), B (2nd quadrature), D (conjunction); at points A', C'', B'', D'' and moments of the new passes (2nd round) for the same positions A, B, C, D; and so on.

In an analogous abstract way the points of the straight line OY represent I arrival times T(1).

In Einstein's hypothesis, in which the rays departed from one location whatever always traveled at the *same* speed, the times of arrival would grow regularly, as the starting ones grow, and would be represented in our drawing by the points of the straight line ZZ' equally inclined with respect to OX and OY. In the ballistics hypothesis, on the other hand, due to changes in speed, the arrival times undergo real fluctuations, and to the poet of the straight line ZZ' we will have, in the drawing, an undulating curve, which deviates more and more from the straight line itself, to the extent that the ratio τ_o/θ approaches the *c/v* ratio, equals it, or exceeds it.

The designated curves show this very clearly: they correspond in order to cases where the first ratio is 0.1 del second; or 0.16; 0.3; 0.6; l (i.e., equal).

To clearly see the effects of overlapping, let's analyze one of our curves in detail; let's choose, for example, the one for which the ratio τ_o/θ is 0.3 of the second.

The phenomenon must be considered from the moment in which the rays departing from the star arrive at the time of the 1st quadrature (that is, when they pass through A), that is, they started at time $t = 0$.

(l) In reality, for the needs of the drawing, the values of T are all decreased by a fixed number; that which in no way alters the *shape* of the unequal curve, on which *only* the consequences that will be examined depend.

This moment is represented by the point T_0 of our curve. Conducting from T_0 a straight line parallel to the axis OX we observe that it cuts the curve backwards at points R and S. This means that I rays departed from the star in the instants t_1= OR'; t_2= OS', they arrive at we *also at the teapo* T_0, i.e., they arrive together with those who left at the time t=o. In other words, the rays emitted by *three* reach us "crossed" different positions: from the first quadrature A, from a position belonging to the first quarter of a turn (OR'= 1/6 OA'), and from one belonging to the third quarter.

It also means that at the moment T_0 the rays departing from the positions have already arrived, the star takes the entire in period running from the instant t_1 =OR', to the instant t_2= OS', because, as the curve shows, the arrival times T for the rays that departed in depart to interval are all *smaller* than T_0.

The light emitted by the star in so much of the circle, had to therefore overlapping the light emitted in the previous round.

In times following T_0 (i.e., greater than T_0) and for a short time interval we will still collect light coming from three diatinte positions - always consider the figure - of which the 1st and 2nd positions are they keep getting closer until they get confused in a single point M_1. Then well T grows further, our parallel to OX cuts the curve *only once*, i.e., the overlap disappears. And it disappears until T reaches the OM'_1 value, since from that moment on the rays emitted in the last part of the circle overlap with those emitted in about half of the second (the parallel cuts again in three points the curve).

But in addition to this overlapping phenomenon, it is worth noting further the following important fact: in the vicinity of points M_1, M_2, M_3, etc... the observer must receive a much greater amount of light than it would have collected if the speed of propagation of the light had remained constant (or the star stationary), while nearby of the dimensions D_1, D_2, etc., must receive a somewhat smaller quantity, due to the effect of a second "fluctuation factor" of the luminous intensity, which is much more important than the overlap already view. The diagram will serve us very well to clarify the matter.

At points D_1, D_2, ... , our curve, as everyone sees, is very steep with respect to esse OX; while at correspondence of bridges M_1, M_2, ... , is very slightly inclined (indeed small arcs taken in the immediate vicinity of these points are even parallel to OX). This indicates that in correspondence with the former, the light emitted by the star in a certain time interval k reaches the observer in a time interval k, somewhat longer; and that means that the lnce issued in the first half arrives in a somewhat greater duration and, therefore it *dilutes* - allow me the word - in a somewhat longer time, so that *for each unit of time we get a much smaller quantity than normal*.

In the other moments the opposite happens: the light emitted in a certain interval $k1$ is received in a $k1$ somewhat smaller than $k1$, so *we will have strong concentrations of light*.

In total, and due to the simultaneous arrival of rays emitted from several positions, and *much more due to these periodic* thickenings and thinnings of light, we must expect the star to present us with periodic changes in luminous intensity, i.e., *periodic changes in apparent size*.

All that we have said for the case under examination, still stands- with the appropriate variants - for the other cases in which the two usual ratios are slightly different, so that we are authorized to conclude that *all the double stars (or more complex) for which the distance, the speed and the period are such as to satisfy the given condition* (i.e., τ/θ of the same online by magnitude of v/c) *they must appear to us as "variable stars"*.

Our analysis therefore leads us to *predict* the existence of "variable stars", and indeed leads us to predict in a *complete way* the extremely varied details which in their behavior may appear, at the change in the value of the aforementioned ratios.

Well, astronomers have long known of the existence of "stars variables" (which was unknown to me until I developed the considerations that I have sketched here); the first observations are anxiety very old, if among the "variables" we include - as is natural do - the "new stars", as we find news of them in times prior to the birth of Christ. But astronomy was not up to now managed to give an explanation of the mysterious and complicated phenomena that these stars present!

Only, following the discovery of the constitution of "doubles", of some of these stars, the variability of their light has been attributed to an eclipse phenomenon. But this explanation, which is not exempt from difficulties and objections, fits only a few of the three thousand and more are "variables" known today.

The ballistic hypothesis on the propagation speed of light leads us, etcetera, in the most direct way, 1) simpler 6 more natural to like this, in the most direct, a *general* insight into these facts, which *proves to be in perfect harmony* with the observations.

We cannot linger here in the exposition of the facts and in the comparison with theoretical predictions; we must content ourselves with indicating the following salient points of the agreement between theory and observation:

1º The *light curves* - i.e., those that represent the law of periodic variation of the star's light - to which they immediately lead the theoretical considerations mentioned, they find perfect reflected in the light curves drawn on the basis of astronomical observations on eclipse variables (type β Persei);

2º The light curves can be predicted assuming that the orbit on which the "companion" rotates both an ellipse instead of a circle give a faithful image of the phenomena presented by the less simple "variables" (type γ_1 Aquilae and ζ Cephei) to which the "explanation of the eclipse" cannot fit;

3º The light curves that can be predicted assuming that the star has two companions, explain the mysterious and complex phenomena of variables of the type Mira Ceti (1); which have variable periods and also variable maxima and minima of light;

4º Admitting that certain stars, due to the attraction of others, manage to move with respect to these, just as comets move with respect to the Sun (that is, according to parabolic orbits, or according to gigantic hugely squashed ellipses), we could easily give a very simple explanation of the phenomena of the "new"; that is, of those mysterious stars, which arise almost suddenly from the darkness of the celestial abysses, have shone for a few months, or have darkened then quickly, until total disappearance, or reduced to one smallness, observable only with the most powerful telescopes.

It is worth having a look at the curve of figure 3 in which are represented the curves which give the law of arrival times T as a function of those of departure *t* for two of these cases.

Each curve is initially tangent to the usual straight line ZZ', slowly detaches from it so as to present an inclination gradually smaller than the CX axis, it becomes parallel to this axis, for finally, bend very slowly in the opposite direction.

The quantity of light that must reach us in each second must, however, this

(1) After the hypothesis of nature had been formulated by me for the *first turn* complex of the variables of this species, the discovery of a was made Mira Ceti's "first" "companion".

at first going growing, must soon take on forms very and very large in correspondence with the very flat section of the curve (1), and return less rapidly to decrease, also valid smaller than the unequal ones.

Finally, it was possible for us to explain the following fact which so far is been regarded as an impenetrable enigma.

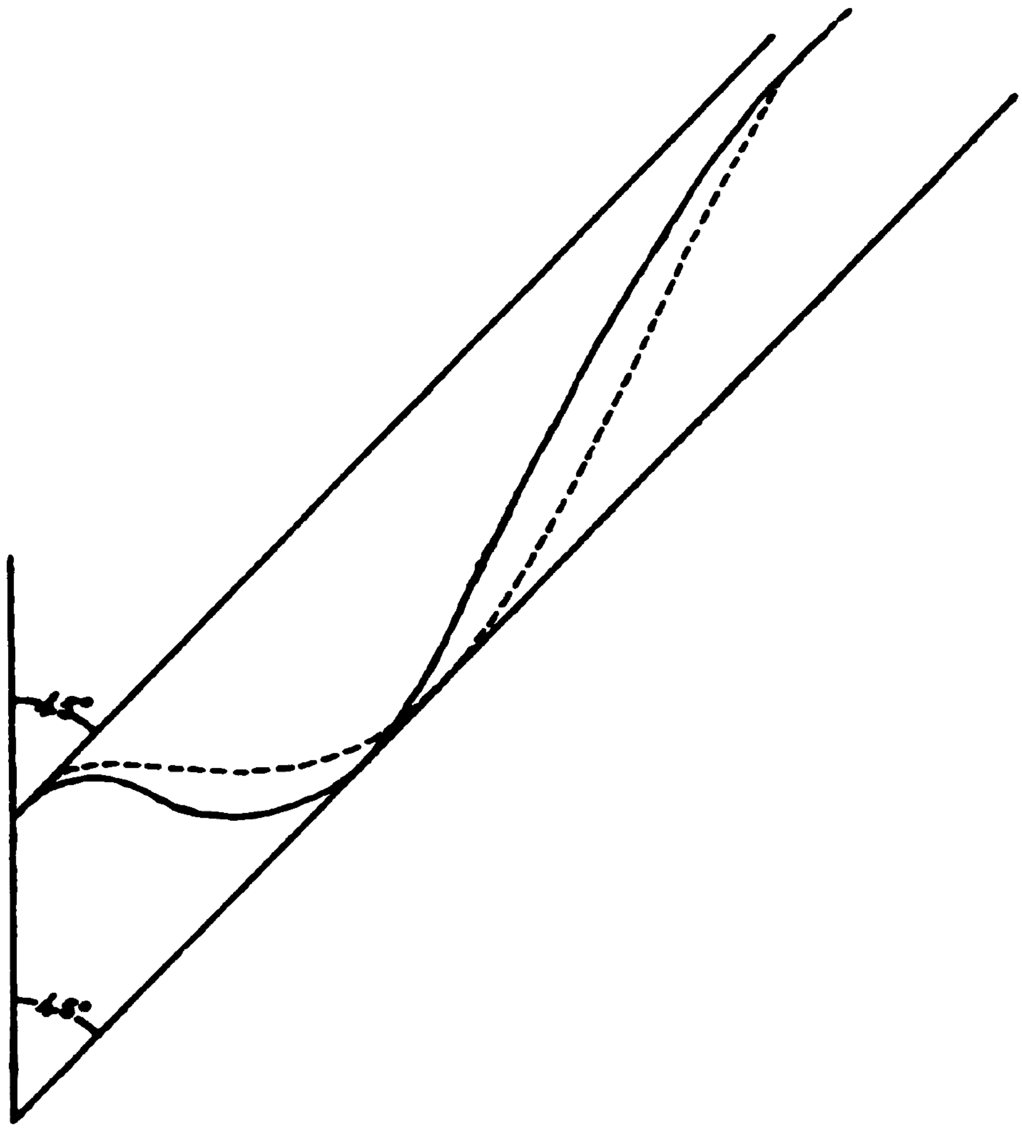

Figura 3

The number of short-term "variables", i.e., those whose entire change takes place in a few days, is very small, in pa equal to the number of the remaining ones. Indeed, by undulating the known variables in groups, with the criterion of increasing period, it was found that the number of stars that are included in each

(1) It is in fact to indicate that the light emitted over a very long time which could be of many months, reaches us in a much narrower interval, for example, a few weeks.

group grows rapidly with the length of the period, reaches a maximum for periods between 350 and 400 days, and decreases immediately, so that very few have periods close to 450 days, and only a few close to 500 days.

No longer being able to abuse the kind attention of the reader, we were hasten to conclude, not without having noticed that not only to these facts, the down payment between new provisions and old observations is limited. It is a broader and deeper agreement, which came in completely spontaneous way, and therefore free from any pollution for part of *dangerous suggestions*, constitutes the best proof in favor of the ballistic postulate, proof of its fecundity, proof of its "truth", understood in the sense in which science usually uses this word.

"Truth" that shines even clearer and more beautiful than it does a comparison between the simplicity and "docility" with which the ballistic hypothesis lays down on scientific ground, and the upheaval that Einstein's hypothesis determines; among the very impressive concrete fruits that the first of a single blow has given us, and the extreme infertility of the other, who *still* seeks a foothold in the confirmation of his very modest predictions.

And they will close by entrusting the examination of these astronomical tests, and of the new theory of "variable stars", which the postulate of Ritz has us *spontaneously* suggested.

The judgment that will come sooner or later will bring light and simplicity back to the scientific horizon; he will still point out - it should be believed - the old woman and glorious route to our thinking, that route which has been so fruitful and on which it will still have a long way to go, before new and "well-needed facts" they can force us to abandon her forever.

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