THE LIGHT OF BINARY STARS

by: RUDOLF NEDVĚD,
Botanická 49,
CS-60200, Brno,
Czechoslovakia.

Abstract: The periodical shift of spectral lines in the light of binary stars as an evidence of the approach and recession of their components is known. The ballistic hypothesis of Ritz relative to light, incited the search for doubling of lines. DeSitter's authoritative attitude (1913, ***Physik. Zeitschrift****) which was that of an astronomer, was entirely overhasty and irresponsible. The analysis of Mathias (1939,* ***Ph. Z.****) of this phenomenon, although correct, led its author to entirely wrong conclusions. The negative finding became then one of the main pillars of Einstein's theory. The following analysis shows on which errors those conclusions were based.*

1. In [1] and in an abbreviated form in [4] the author gave a detailed analysis of the course of emissions from different parts of an orbit with respect to the simultaneous transit of emissions at different speeds. The author proceeded on the supposition of only one orbiting component, with the results being valid even in the case that both components of the doublet would not emit the same sort of light. Generally both of them orbit and each takes its share in the total relative speed, so that it is always $v_1 + v_2 = v$ and the result is the same.

Despite the wide variety of natural happenings, it is enough to limit oneself only to a circular orbit, the conclusios derived from which will be clear and lead best to understanding the implications for the more general elliptical motion. For the same reason we limit ourselves only to the case of maximum effect when the plane of the orbit coincides with the direction to the observer.

The author in the above mentioned works gave detailed evaluation of different authors' views on this problem as well as the specification of conditions on which the observation depends. For all that, we will not repeat here the detailed analysis of overtaking of emissions from different parts of the orbit but the discussion will be limited only to decisive phases of distinctive speed differences that he derives in a simplified and clear algebraic way.

2. First we present the exact solution at designated magnitudes according to Fig. 1 so that the reader will be able to check the results of algebraic derivation given further below. If we denote the time of a whole orbit U, the time taken for the path pertinent to a central angle α_X is

$$T = \frac{U}{2\pi}\,\alpha_X{}^r\,(\text{in radians}) = \frac{U}{360}\,\alpha_X{}^0\,(\text{in degrees}) \qquad (1)$$

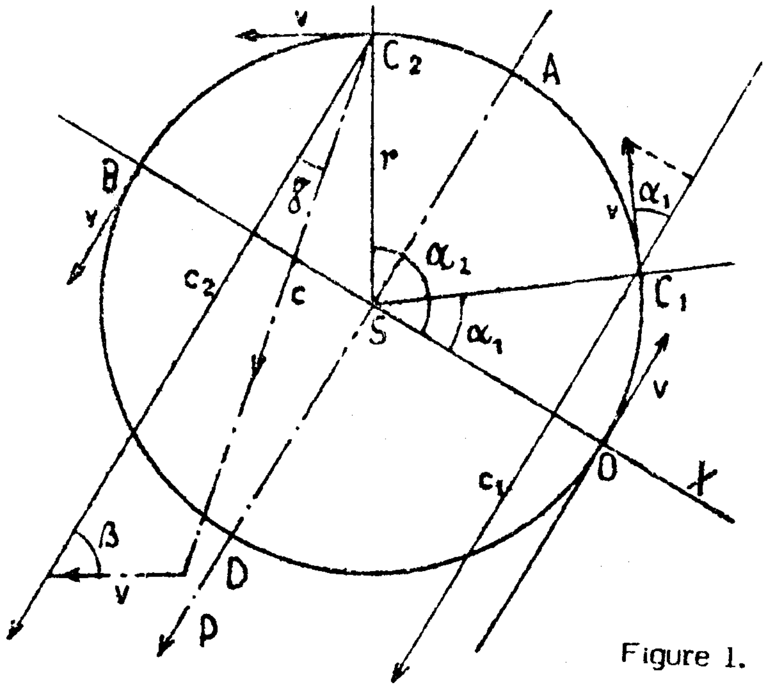

Figure 1.

where the angles and time are measured from the origin O on the x-axis which is perpendicular to SP, i.e., perpendicular to the line connecting the orbital center S with the observer P.

The emission velocity component from a general position α_x in the direction of SP is then

$$c_x = c - v\cos\alpha_x,$$

and thus for $\alpha_2 > \alpha_1$

$$c_1 = c - v\cos\alpha_1\,, \qquad c_2 = c - v\cos\alpha_2 \tag{2}$$

The condition for overtaking of emissions from C_1 and C_2 is given by the relation of the same path (distance) in time T (we neglect the orbital radius $r << L$)

$$L = c_1(T - t_1) = c_2(T - t_2) \tag{3}$$

where for t_1 and t_2 we insert according to (1) and for c_1, c_2 according to (2). The solution gives

$$T = \frac{U}{2\pi}\,\frac{\frac{c}{v}(\alpha_2 - \alpha_1) + (\alpha_1\cos\alpha_1 - \alpha_2\cos\alpha_2)}{\cos\alpha_1 - \cos\alpha_2} \tag{4}$$

The author, in his detailed analysis in [1, 4], went out also from this (abridged) relation.

3. For the purpose of giving evidence it is sufficient, however, to limit oneself only to distinctive differences of emission velocities from positions O, A and B. From the derived conclusions it will be then evident that we are fully justified in doing so. For the emissions in direction SP it holds namely that:

3.1: Emissions from the part BDO can never overtake mutually, since each successive emission is slower than the preceding ones, so that they are permanently attenuating.
3.2: Emissions from the part OAB will permanently overtake, since each successive emission is faster than the preceding ones, so that they permanently overtake one another and thus condense.

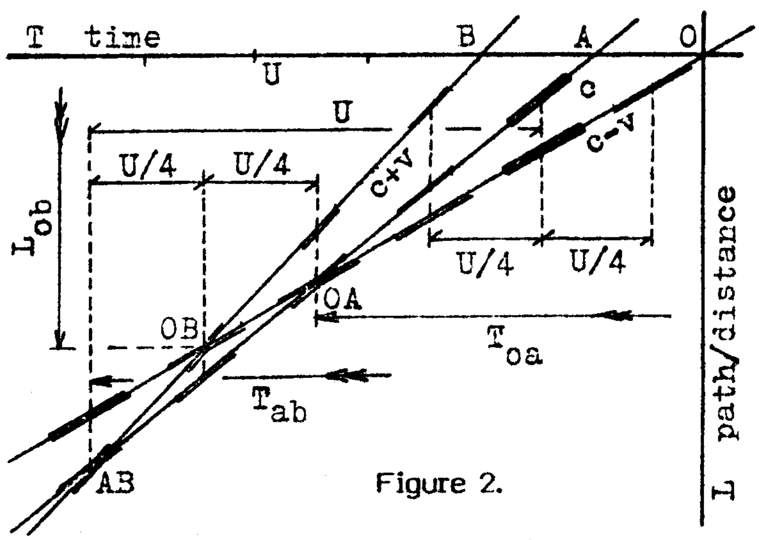

Figure 2.

3.3: For the observation of line doubling are thus distinctive only three mentioned positions of emission overtaking, the time and position (distance) of which we can determine simply from the following algebraic relations (the velocities can be checked according to rel. (2)):

a) Emission from A overtakes emission from O according to the relation of the same path

$$L = c(T - U/4) = (c - v)T \quad (5a)$$

$$T_{oa} = \frac{U}{4}\frac{c}{v} \quad (5b)$$

b) Emission from B overtakes emission from O according to the condition

$$(c + v)(T - U/2) = (c - v)T \quad (6a)$$

$$T_{ob} = \frac{U}{4}\left(\frac{c}{v} + 1\right) \quad (6b)$$

c) Emission from B overtakes emission from A according to the relation

$$(c + v)(T - U/2) = c(T - U/4) \quad (7a)$$

$$T_{ab} = \frac{U}{4}\left(\frac{c}{v} + 2\right) \quad (7b)$$

Distances L can be determined from these relations by inserting the respective T.

3.4: The time dependence of the process course between T_{oa} and T_{ab} is schematically demonstrated in Fig. 2. The course of emissions of the same beam is here decomposed into perpendicular coordinates of time T and distance L so that the slope of paths measured from axis T is in proportion to their velocities. The sequence of emission packets in period U is represented by the heavy line, their motion in spacing U/4 by a light line, their lengths expressing the proportional density according to par. 3.2.

The points of intersection OA, OB and AB correspond then to meeting (overtaking) of emissions in distances and times according to rel. (5, - 7); in these points the emissions change their sequence. It is obvious that the diagram must have a great shortening in length L and hence, the emissions are in the same time at enormous mutual distances.

3.5: For overtaking of emissions from the foregoing phases of orbit in further knots, it is sufficient to register only the knots OB. From rel. (4) for $\alpha_1 = 0$, $\alpha_2 = 2\pi n + \pi$ the same expression follows for T as from the ordinary equation

$$(c + v)\ (T - nU - L/2) = (c - v)T \qquad (8a)$$

$$T_n = \frac{U}{4}\left[(2n + 1)\left(\frac{c}{v} + 1\right)\right] \qquad (8b)$$

Here, it is suitable, perhaps, only to emphasize that the times T do not determine the time of the phenomenon's duration, but only the time when, i.e., after which time from the origin O of time measuring the phenomenon of overtaking takes place.

4. From the derived relations we can discover the following:

4.1: As far as the distance L_{oa}, according to rel. (4), overtaking of emissions of little velocity differences takes place; only in this distance the first distinctive overtaking sets in.
4.2: In the range $\Delta L = L_{oa} - L_{ab}$ the whole overtaking process of great velocity differences takes place, where (theoretically) locally even a tripling of lines could set in. Since, however, in this locality practically all emissions from the whole part OAB are accumulated, the lines could be blurred only. Sharp lines can thus indicate only that the observer does not find himself in this space (c.f., with shift of lines).
4.3: The orbit velocity v is always very small as against c, so that the times and distances of overtaking according to eqns. (5, - 7) differ mutually only slightly and the differences are negligible in comparison with the whole runs T, L. Then, it is possible to consider the whole process of overtaking to take place almost entirely in a locality which, of course, in all directions of space forms a circle concentric with orbit with thickness $\Delta L \to 0$.
4.4: The distinctive emissions from different parts of orbit, form, according to § 3.2, length-limited, here already very condensed and, hence, short packets that pass the locality of meeting at the light velocity and the single spots of section ΔL as a mere flash.
4.5: The most essential is, however, that in the locality ΔL the whole process of overtaking takes place, the emissions interchange their sequence in this way and in their further run they will permanently rarefy only. Only the rapid emissions from B (and partly from A) will overtake the slow, very attenuated emissions from O of the foregoing phases, so that they hardly become evident. These further overtakings take place again only in knots of odd multiples of L (vide (8)) i.e., in enormous distances where the very rarified emissions apparently become entirely extinct.
4.6: At an elliptical orbit the investigation would be more difficult and would give nothing substantial more. This would be mere mathematical exhibitions, the result of which would only show that and how here the eccentricity and position of ellipse matters and, as the orbit of both halves of ellipse - in symmetry to minor axis differs in velocity and thus even in time (like at Earth), all the phenomena would be periodically irregular for the observer P.

5. From the foregoing follows that:

a) In the part SL_{oa} the overtaking of emissions of distinctly differentiated velocities and, hence, even the doubling of lines never takes place.
b) The phenomenon of doubling could be observable apparently only in locality ΔL and its close vicinity and, perhaps, even in the multiple knots, but never and nowhere else. §
c) In space, the mentioned localities are, however, only sporadic and the phenomenon passes them only periodically and only as a short flash.
d) Outside these localities the phenomenon can come into existence only as a pulsation of shift and intensity of lines. This, however, also without doubling, surely sufficiently proves the relative light velocity, as well as the dependence on the motion of source which already by itself excludes c to be isotropic (c.f., [1, 3, 4, 5]).
e) From the given analysis, even without paying regard to all other conditions very limiting the finding possibility, we can see that the probability of finding of doublet phenomena is closely nearing zero or accident.

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§ Editorial Comment: 'Knots' = 'Nodes'.

In [1, 4] the author has given also a detailed analysis with respect to the reversed perception of orbit in consequence of the interchange of emission sequence. Let us take into account, however, that: in the first knot the sequence of all emissions has reversed, and the next overtaking occurs also only in regularly spaced local knots, in which, however, only reversed, and thus attenuating, emissions outrun the attenuated and reversed emissions from foregoing phases; there arise remarkable conditions for observation of doublets, changing from place to place on the way of rays. Many observers (not all) see then only the reversed direction of orbit.

Summary.

The consequent analysis of the propagation of light from double-stars shows that the overtaking of beams of different speeds occurs only in knots located sporadically in space at enormous distances. The packets of light from different parts of orbit pass these knots at light velocity, thus for each observer only as a mere flash. The probability of finding the doubling of spectral lines equals thus practically zero. Thereby even De Sitter's objection against the dependence of light velocity on the motion of source falls as entirely baseless.

Zusammenfassung.

Aus der folgerichtigen Analyse der Lichtfortpflanzung von Doppelsternen stellt sich heraus, dass die Uberholung der Strahlen von verschiedenen Geschwindigkeiten nur in Knoten erfolgt, die im Raum sporadisch in reisigen Entfernungen disloziert sind. Die Lichtpakete von verschiedenen Umlaufsteilen laufen über diese Knoten mit lichtgeschwindigkeit, also für jeden Beobachter nur als blosser Schimmer, fort. Die Feststellungswahrscheinlichkeit der Spektrallinienverdoppelung ist also praktisch gleich Null. Dadurch fällt auch De Sitter's Einspruch gegen die Abhängigkeit der Lichtgeschwindigkeit von der Quellenbewegung als durchaus grundlos.

References

[1] Nedvěd, R: **Relativitätstheorie auf der Basis der klassischen Physik,** 1A (1964). Unpublished manuscript.
[2] Ibid.: 1B (1966). Unpublished manuscript.
[3] Ibid.: **Classical Theory of Relativity,** Scientific Idea 14/15 (1978/9), Zagreb, Yugoslavia.
[4] Ibid.: **Physik der Bewegung - Physics of Motion.** Unpublished maunscript (1983).
[5] Ibid.: **Relativität der Bewegung,** T-M. R., V. 3, pp. 1544-61 (1985).
[6] Ibid.: **Die Gezeitendeformationen, mit Zusatz: Gezeitenphenomena** von Nedwed, R., Jr., T-M. R., V. 4, pp. 2263-86 (1986).
[7] Ibid.: **Die Aberrationstransformation, Registration und Interferenz,** T-M. R., V. 5, pp. 2421-30 (1986).
[8] Ibid.: **Die Merkuranomalie,** T-M. R., V. 5, pp. 2459-74 (1986).
[9] Ibid.: **Das 2v-Gesetz, Michelsons Experiment 1913 und das entscheidende Experiment,** T-M. R., V. 5, pp. 2681-96 (1986).