

THE SPECTROSCOPY OF BINARY STARS

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Rudolf Nedvěď's paper [1] on *The Light of Binary Stars* is an interesting approach to the subject, but it is fraught with difficulties. As this author understands the paper, Nedvěď uses the Ritz ballistic theory of light in order to prove that in the binary star spectrum

... the probability of finding the doubling of spectral lines equals practically zero.

Admittedly, if the Ritz theory is correct, light from one point in the binary star's orbit will overtake light from some other point, from which light is travelling more slowly. However, this is not the point. The doubling of spectral lines is an experimental fact [2], and secondly the Ritz theory is not generally accepted. § The only modern protagonist of the theory today, of whom we are aware, is Waldron.

As the case against Ritz cannot be expressed any better, we quote Edmund Whittaker [3]:

Now let us look into Poincaré's remark that the principle of relativity requires the creation of a new mechanics in which no velocity can exceed the velocity of light. ¶

*Suppose that an inertial system B is being translated relative to an inertial system A with velocity ω along the axis x . Let a point P moving along the axis of x have the coordinates $(t, x, 0, 0)$ in system A and $(t', x', 0, 0)$ in system B. Denote the components of velocity dx/dt and dx'/dt' by v_x , v_x' , respectively, and let $\omega = c \tanh \alpha$. Then the Lorentz transformation * gives at once*

$$v_x = dx/dt = \dots = (v_x' + \omega)/(1 + v_x' \omega/c^2)$$

Now, v_x being the velocity of P relative to A, v_x' the velocity of P relative to B, and ω the velocity of B relative to A, in Newtonian kinematics we should have $v_x = v_x'$

The denominator $(1 + v_x' \omega/c^2)$ in the relativist formula expresses the difference between Newtonian theory and relativity theory, so far as concerns the composition of velocities. We see that if $v_x' = c$, then $v_x = c$; that is to say any velocity compounded with c gives as the resultant c over again, and therefore that no velocity can exceed the velocity of light.

§. Editorial Comment: This is sophism. The general acceptance or non-acceptance of some principle has nothing to do with whether that principle is true or fallacious. After all, it was generally accepted by everybody from the beginning of the history of mankind until about the time of Columbus that the Earth was flat - therefore, the earth is flat, our author would claim. However, it is not flat.

¶. Ed. Com.: It seems that Whittaker is badly unaware of the precise conditions of the Poincaré-Einstein hypothesis relative to the constancy of the velocity of light, c . There are many instances where relativism acknowledges the physical occurrence of happenings that exceed the velocity of light, the phase velocity of electricity being only one of them.

* Author's Footnote: N. B.: This Lorentz transform is not rendered invalid by the fallacy of special relativity. Editor's Comment: The Lorentz transformation is rendered invalid by its own self-inconsistency.

This result enables us to solve a problem which had perplexed many generations of physicists. It has been supposed that if the correct theory of light is corpuscular theory, then the corpuscles emitted by a moving star should have a velocity which is compounded of the velocity of the star and the velocity of light relative to a source at rest, just as an object thrown from a carriage window in a moving railway train (the ballistic theory); whereas, if the correct theory of light is the wave theory, the velocity of the light emitted by the star should be unaffected by the velocity of the star, just as the waves created by throwing a stone into a pond move outwards from the point where the stone entered the water, without being affected by the velocity of the stone. The new relativist theory led to the surprising conclusion that the velocity of light would be unaffected by the velocity of its source even on the corpuscular theory.

An attempt to explain the Michelson-Morley experiment, and the other evidence which had given rise to relativity theory, without assuming that the velocity of light is independent of the velocity of its source, was made in 1908 by W. Ritz who postulated that the velocity of light and the velocity of the source are additive, as in the old physics. It is, however, not known certainly that the velocity of light is independent of the motion of the source. The astronomical evidence for this statement has been marshalled by several writers, and further confirmation has been furnished by Majorana by direct experiment. It should be remarked that since in purely terrestrial experiments the light rays always describe closed paths, the results to be expected from ballistic and non-ballistic theories can differ only by quantities of the second order, Δ but the performance of the Michelson-Morley experiment with light from astronomical sources by R. Tomaschek in 1924 definitely disproved the ballistic hypothesis.

This seems to demolish the basis of the author's arguments. However, further discussion of the Doppler effect, which causes the doubling of the spectral lines is warranted, especially as our knowledge of the structure of the photon is at present inadequate. The Doppler effect is an increase or decrease of frequency of sound or light waves as received by an observer due to the relative motion of the source and receiver. If the source and receiver are moving towards each other, the frequency of the cycles is increased and it is decreased, when they are moving away from each other. # There is a theoretical difference between the nature of the Doppler effect according to whether special relativity or Newton-Lorentz mechanics is accepted as correct. In special relativity, space may not act as a frame of reference. Thus, to state that a single particle is moving through space is meaningless. In this theory motion must be relative to some other material body. Therefore, the Doppler effect is caused only by the relative motion of source and receiver. In Newton-Lorentz kinematics either the source or the receiver may be moving independently in relation to the spatial frame of reference. This allows us to distinguish between passive and active Doppler effects. The passive Doppler effect arises when the receiver is moving and the source is stationary. In this instance the Doppler effect is apparent only, and the frequency of the light is the same as it moves through space as emitted by the stationary source. However, if the source is in motion and the receiver stationary, the effect is real and the frequency of the light as it travels through space is increased in the direction of motion.

Ritz considered that the motion of the source altered the velocity of the photon (i.e., light, as he then understood it to be). This is incorrect; what is altered is the momentum of the photon. Now, the photon obeys De Broglie's law

A. Id. Com.: This statement made by Whittaker is simply untrue.

#. Id. Com.: It is a significant question here as to whether it is the frequency that is altered in Doppler shifting or the wavelength, or both together; or for that matter, whether c remains constant in a single, designated inertial frame.

$$h = \lambda p,$$

where h is Planck's constant, λ is the wavelength of the photon and p is its momentum. Thus, in the direction of motion of the source, the momentum of the photon and its frequency is increased and the wavelength decreased - the velocity remaining the same. In other words, the increase of the momentum due to the motion of the source is shared by the emitted light either positively or negatively.

In view of these findings we must conclude that the doubling of the spectral lines is a physical reality and that, therefore, Ritz's ballistic theory is fallacious. If this be so, the overtaking of light from one source by light from another source as suggested by Nedvěď simply does not take place as the velocity of light is constant.

References

- [1] Nedvěď, R.: *The Light of Binary Stars*, T-M. R., V. 6, pp. 3355-9.
- [2] *The Cambridge Encyclopaedia of Astronomy*, p. 93, Avon Publishers Inc. (This appears to have some diagrams in a wrong order).
- [3] Whittaker, Edmund: *History of the Theories of Aether and Electricity*, V. 2, pp. 37-9, Thomas Nelson & Sons, Ltd., Edinburgh (1953).