

CELESTIAL PHYSICS. – *Relation between color and amplitude of variable stars and the ballistic theory.* Note by M. **La Rosa**, presented by M. Émile Borel.

Messrs Ch. Nordmann and C. Le Morvan <sup>(1)</sup> have attracted the attention of scientists on a fact which, in their opinion, would be inconsistent – or at least inexplicable – with my theory of variable stars, inferred from the premise of Ritz about the speed of light.

They recall that the variations of the light intensity of some stars do not

---

<sup>(1)</sup> *Comptes Rendus*, **179**, 1924, p. 1139

have the same amplitude in all the areas of the spectrum. Thus  $\beta$  Lyrae presents the following changes in its apparent size: 0.66 in the red; 0.94 in the green; 1.34 in blue. The change of size of  $\delta$  Cephei takes the same form. And they add: "If the brightness fluctuation of stars with continuous variation were due to the mechanism invoked by Mr. La Rosa, the amplitude of the variation would be necessarily the same one in all the areas of the luminous spectrum."

I will show that by taking account of all the elements, my theory explains these interesting facts in the most natural way, while I would be well embarrassed to give an explanation differently of it, for example by the theory of eclipses.

In fact, my theory supposes initially that all the variables must be double stars (or more generally multiple) <sup>(1)</sup> and consequently it is necessary to take into account either the light emitted by the revolving star, the companion, or the light emitted by main star.

Neglecting the brightness fluctuations that this star can give because of its small movement, and calling  $I_r, I_g, I_b$  the constant intensities of the radiation of red, green, blue by this star and  $i_r, i_g, i_b$  the intensities corresponding given by the companion at the time of the minimum, the changes of the total of the light (of two stars) will be given to us by the relationship

$$(1) \quad \frac{I_r + mi_r}{I_r + i_r}, \quad \frac{I_g + mi_g}{I_g + i_g}, \quad \frac{I_b + mi_b}{I_b + i_b},$$

where  $m$  is the amplitude of the variation of the light due to the movement of the companion and must be *constant throughout the spectrum*.

These relationships (1) will be in general different; they can become equal only if

$$\frac{I_r}{i_r} = \frac{I_g}{i_g} = \frac{I_b}{i_b},$$

that is to say, if the two stars have similar *spectral distributions*, and this case is very unlikely, because it requires that the central star and its companion have *the same temperature*.

---

<sup>(1)</sup> This assumption, in the case of the variables in question here is data from the observations. For the variables of long period, it has been received very recently, a very beautiful confirmation by the discovery of one companion of "Mira Ceti" made at the Observatory of Mount Wilson.

In general, according to my theory, the contribution between the maximum and the minimum of apparent size of a variable will thus depend on the color of the light used for the observations, or more exactly it will be a function of the frequency of this light.

The above considerations lead us to also provide that these “variables” must present to us periodic changes in the law of distribution of radiant energy in the spectrum. Here thus we are permitted, in this way, to explain the changes of the spectrum which has been observed, accompanied, for certain variables, changes in light intensity.

Finally, I can then affirm that the fact announced per MM Nordmann and Morvan, and that of the change of the spectrum <sup>(1)</sup> added to the other evidence of my theory, that is to say, with the other facts on the “variables” already so many, that my theory gives a very simple and very natural explanation <sup>(2)</sup>.

These facts are very solid evidence of the ballistic postulate and entitle it to the attentive consideration of the scientific circles.

---

<sup>(1)</sup> The study of the periodic changes of the light intensity in the various areas of the spectrum will be able to lead us to the knowledge of the temperatures of the two stars. This is why the discovery of Mr. Nordmann seems to me intended for interesting applications.

<sup>(2)</sup> I would like to recall that for the other confirmations of my theory it is necessary to add the discovery of the periodic changes the radial speed of Mira.