Huygens Institute - Royal Netherlands Academy of Arts and Sciences (KNAW)

Citation:

W. de Sitter, A proof of the constancy of the velocity of light, in:
KNAW, Proceedings, 15 II, 1912-1913, Amsterdam, 1913, pp. 1297-1298

This PDF was made on 24 September 2010, from the 'Digital Library' of the Dutch History of Science Web Center (www.dwc.knaw.nl) > 'Digital Library > Proceedings of the Royal Netherlands Academy of Arts and Sciences (KNAW), http://www.digitallibrary.nl'

roform 1:500000, Propionic acid 1:10000000) they restrict their action to the lipoid surface, which they weaken thus facilitating the amoeboid motion.

When applied in somewhat greater quantities a second factor becomes of importance viz. the noxious effect of these substances on the protoplasm. All these substances indeed penetrate easily into the cells, thus causing paralysis.

3. *Soaps,* such as propionate, butyrate and formiate. These substances, unlike the fat dissolving substances, do *not* enter into the phagocytes. Their action upon the phagocytes is therefore entirely different from that of the fat-dissolving substances, for even when applied in high concentrations (1:250), in concentrations in which the fat dissolving substances would inevitably kill the cells, *they have a very favourable effect upon phagocytosis.*

When applied in still greater quantities their action is a pernicious one, but this may be due to the solution being too hyperisotonic.

Further it is a remarkable fact — and in this respect the soaps are distinguished from calcium as well as from the fat dissolving substances — that within rather wide limits, the degree to which phagocytosis is promoted is independent of the amount of soap, found in the solution. (Cf. Tables II and IV.)

The researches, described above, have given rise to different questions, which, owing to the present circumstances we cannot enter into now.

Physiological Laboratory. *Groningen,* January, 1913

Astronomy. — *"A proof of the constancy of the velocity of light".* By Prof. W. DE SITTER.

(Communicated in the meeting of February 22, 1913)

In the theory of RITZ light emitted by a source moving with velocity u is propagated through space in the direction of the motion of the source with the velocity $c+u$, c being the velocity of light emitted by a motionless source. In other theories (LORENTZ, EINSTEIN) the velocity of light in always c, independent of the motion of the source. Now it is easily seen that the hypothesis of RITZ leads to results which are absolutely inadmissible.

Consider one of the components of a double star, and an observer situated at a great distance Δ. Let at the time t, the projection of the star's velocity in the direction towards the observer be u. Then from the law of motion of the star we can derive an equation:

$$u = f(t - t_0) \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

The light emitted by the star at the time t reaches the observer at the time $\tau = t + \Delta/c - \alpha u$. In RITZ's theory we have, neglecting the second and higher powers of u/c, $\alpha = \Delta/c^2$. In other theories we have $\alpha = 0$. If now we put $\tau_0 = t_0 + \Delta/c$, we have

$$u = f(\tau - \tau_0 + \alpha u) \qquad \text{or} \qquad u = \varphi(\tau - \tau_0) \quad . \quad . \quad (2)$$

The function φ will differ from f, unless αu be immeasurably small. Therefore if one of the two equations (1) and (2) is in agreement with the laws of mechanics, the other is not. Now α is far from small. In the case of spectroscopic doubles u also is not small, and consequently αu can reach considerable amounts. Taking e.g. $u = 100 \frac{KM}{sec}$, and assuming a parallax of 0''.1, from which $\Delta/c = 33$ years, we find approximately $\alpha u = 4$ days, i. e. entirely of the order of magnitude of the periodic time of the best known spectroscopic doubles.

Now the observed velocities of spectroscopic doubles, i. e. the equation (2), are as a matter of fact satisfactorily represented by a Keplerian motion. Moreover in many cases the orbit derived from the radial velocities is confirmed by visual observations (as for δ Equulei, ζ Herculis, etc.) or by eclipse-observations (as in Algol-variables). We can thus not avoid the conclusion $\alpha = 0$, i. e. the velocity of light is independent of the motion of the source. RITZ's theory would force us to assume that the motion of the double stars is governed not by NEWTON's law, but by a much more complicated law, depending on the star's distance from the earth, which is evidently absurd.

Chemistry. — "*Equilibria in ternary systems*". VI. By Prof. F. A. H. SCHREINEMAKERS.

In a manner similar to that in which, in the previous communications, we considered the saturation line under its own vapour pressure we can also consider the conjugated vapour line. Instead of the two-phase complex $F + L$ we now, however, take, the complex $F + G$ and if in the three-phase equilibrium $F + L + G$ no phase reaction occurs, we must in the conversion of $F + G$ again distinguish three cases.