measured by two observers—for example, a January observer and a July observer. These observers differ only in their velocities V_1 and V_2 relative to the frame of reference; Dr. Silberstein neglects any effects of the short interval of time and of space between the two observations and of the distortion of the waves by the local gravitational field.

There exist well-known formulæ for transforming the frequency of a wave-train for an observer with velocity V_1 to the frequency for an observer with velocity V_2, namely, the Lorentz transformation. Dr. Silberstein's formulæ disagree with these, and introduce data referring not to the wave-train but to the particular circumstances of the star originating it, which must clearly be irrelevant to the transformation. If he were right it would be possible to have two trains of plane waves in the same region identical with one another in one system of reference but not identical in another system of reference. I do not know whether Dr. Silberstein's theory intentionally deviates from orthodox relativity; but I think he can scarcely have wished to throw over the fundamental principle that the change of frequency of light-waves due to a change of velocity of the observer depends on a local transformation independent of the origin of the light.

It is not possible to indicate the precise cause of the fallacy, since Dr. Silberstein gives only the results of his calculation; but the error apparently occurs in passing from his formula (2), which gives the Doppler effect referred to the sun

$$D^2 = \frac{r^2}{R^2} + \frac{v_0^2}{c^2}$$

to the Doppler effect referred to the earth, formula (3),

$$D_1^2 = \frac{r^2}{R^2} + \frac{(v_0 - V_1)^2}{c^2}.$$

It may be well to remind the reader that v_0 (if it is real) is the velocity of the star at some epoch in the very remote past or future, so that $(v_0 - V_1)$ has no *obvious* relevance to the problem. If the star-constant v_0 is imaginary, as will happen in many cases, Dr. Silberstein's formula makes the Doppler effect a complex quantity; this in itself seems sufficient ground for distrusting the formula.

A. S. EDDINGTON.

Observatory, Cambridge,
May 3, 1924.

Sense of Direction in Mathematics.

THE question of right- or left-handedness is always with us in mathematical physics. In this connexion the symbol V is used in one sense by Maxwell, in the other sense by some of his followers, and indeterminately elsewhere in work of growing importance.

I would therefore suggest a simple way out by using the three variants of the Greek character upsilon: for general use υ, for the right-handed (say) ὐ, and for the left-handed case the aspirated ὑ. The latter would serve excellently as a temporary sense-contradiction (for example, in "boiling down" expressions by applying a nil-sum), without recourse to that computer's inferno, the sign of minus.

The same convention would be welcome in respect of three pairs of directivities mutually at right angles. For example, if one draws a regular hexagon and assigns the letters ἀ ἠ ὠ, ἁ ἡ ὡ (ah ee oh, ha he ho) to the six sides, and joins three alternate points to the centre, so as to represent a cube, then the whole trouble with the inherent sense-ambiguity of the binormal is simply wiped out, both for beginner and for expert. In fact, with the aid of the well-known two-colour stereo effect (by the use of the green and red perspective and green and red glasses) it would be quite possible for any one to get a clear notion, at first sight, of what the three-space radian is, the code of operation (say, on ἠ, if υαη is ω) being

120(1 + υα(1 + ½υἠ(1 + ⅓υω(1 + ¼υα(1 + ⅕υἠ(1 + ⅙υω(. . .).

In the case of the most ivied of the sciences, the economy would, of course, not immediately be realised, but it would be quite practicable in this way to banish the sign of subtraction not only from gravitational statements but also from their meritorious translation into the blue-book.

T. C. HUDSON.

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April 11.

Sunlight and Glass: an Inquiry for Hygiene.

FOLLOWING upon several communications from me to NATURE in recent years regarding sunlight and health, may I ask a question which can perhaps be answered instantly and completely by many of your readers, but which I am too unfamiliar with physics to answer for myself?

We have found high antiseptic powers and even more valuable powers of blood-enrichment and of stimulating vital resistance to disease, in ultra-violet light, to which glass is opaque. Thus, as I saw in the Home for Hebrew Infants in New York in 1922, infants who are living in glass cubicles on a balcony (to prevent infection) must be moved out into the open to receive the best value from sunlight. Inquiring the cost of quartz windows, I learnt that even Jewish philanthropy in New York would "scarcely run to that."

Celluloid, I am informed, has an absorption band in the ultra-violet.

What cheap substitute for glass is available, such that the ultra-violet rays may serve us through it, both for therapy and for hygiene? If there be none, can the physicists make one for us? I appeal to them, if you will let me.

C. W. SALEEBY.

Royal Institution,
April 28.

The Language (if any) of Insects.

AN abstract of a paper by C. F. Elwell in Journ. Inst. Electrical Eng., vol. 62, p. 231, briefly describes Dr. de Forest's methods of producing talking-motion-pictures. Telephonic currents are received in a two-electrode valve emitting highly actinic light. This is focussed on a slit, and a record is made on the edge of an ordinary film travelling at the usual rate of 12 to 18 inches per second. To reproduce the sounds, light passing through the developed film is received on a photoelectric cell, and weak currents are obtained and are amplified and passed to a telephone. Sound vibrations as high as 3000 per second are said to have been obtained.

Lord Avebury and others have suggested that insects and other small creatures may communicate with each other by sounds of supersonic frequency. The forms of gas flame and hot wire microphones employed by Dr. de Forest would not be applicable, but the only other modification necessary to look for high frequency sounds is the speeding up of a specially sensitive film, and this, of course, has already been done.

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