VELOCITY OF LIGHT AND MEASUREMENT OF DISTANCES BY HIGH-FREQUENCY LIGHT SIGNALLING*

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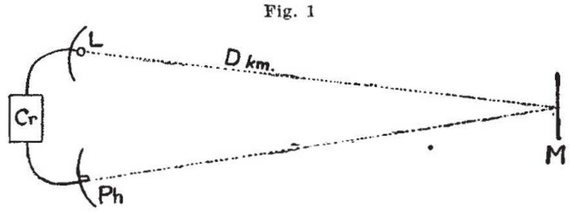
FIZEAU'S principle of determination of the velocity of light can be used for the measurements of lengths. In modern form an arrangement according to this principle is shown in Fig. 1.

L is the source of light, having a spherical mirror to collect the light in a beam. The source is influenced by high-frequency tension from the crystal-controlled oscillator *Cr*, and thus the intensity of the light emitted varies with the frequency of the oscillator. *M* is a plane mirror, which reflects back the light to the phototube *Ph*. The phototube gets its operating tension from the oscillator *Cr*. Accordingly, the sensitivity of the tube varies with the same frequency as the intensity of the emitted light. As the rapid blinks of light take a certain time to cover the distance to *M* and back again, the moments of high sensitivity of the tube will be more or less timed to the incoming blinks, depending on the distance *D*. Fig. 2 shows how the recording current directed by the phototube depends on the distance *D*.

Fig. 1



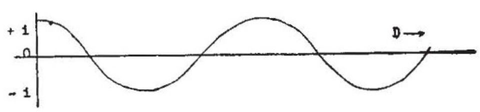


Fig. 2

A low-frequency alternating phase displacement of 180° of the high-frequency light variations makes the current exactly symmetrical with respect to the zero-line. By this means we get sharply marked positions of the mirror where the current is zero. The distance between the zero positions depends on the frequency of the oscillator *Cr*. In the actual apparatus, the frequency is 8·3 Mc./sec., corresponding to a wave-length λ of 36 metres. Thus the current becomes zero every ninth metre in accordance with the expression

$$D = K + \frac{2N - 1}{8} \cdot \lambda,$$

where *D* is the distance to be measured, *K* is a constant, depending on the apparatus used, λ is the wave-length, depending on the frequency and here being 36 metres, *N* is a whole number + 1, 2, 3, 4, ... Usually *N* is known from an approximate knowledge of *D*; if not, it may be determined by variation of λ. The values of *D* corresponding to *N* = 1, 2, 3, . . . are constant to the same degree as the frequency is constant, that is, to one part in ten millions; they depend also on the accuracy with which the atmospheric conditions are known. Thus the influence of temperature is 0·9 cm. per degree C. and 0·4 cm. per millibar air pressure, for a distance *D* of 10 kilometres.

In the field, the mirror *M* usually is not placed exactly at a zero-point. We then decrease the frequency slightly from its 'normal' value. The farthest zero-point glides out and passes the mirror. Just then the photo-current changes its direction and passes through zero. We now read off the change of frequency and get the distance of the mirror from the farthest 'normal' zero-point. In this way we get the extreme value of the distance to be determined. The other end is fixed in a similar way. Here we use the value of *D* for *N* = 1. This distance, about 1 metre, is very constant. By means of a variable loop of light, it can be determined or controlled. To get the main constant of the apparatus, the first determination is made on a known base-line.

At a value of *D* of 9 km., the sensibility of adjustment commonly was 0·4 cm. as a mean error of six determinations during a quarter of an hour. Measurements on different days showed a maximum divergence of 3 cm.

Knowing the frequency, we determined the velocity of light *in vacuo* to be 299·796 ± 2 km. per sec. We intend to make further measurements in March; therefore, the values given above should not be considered as definite.

A.G.A., Stockholm, intend to manufacture the 'geodimeter' for sale.

* From a paper presented at the International Union of Geodesy and Geophysics, Oslo, 1948.

REFERENCES

Bergstrand, K. *Vetenskapsakad. Arkiv, M.A.F.*, Nr. 30 (Stockholm, 1943); Nr. 20 (Stockholm, 1949); *Acta Com. Geod. Baltique* (Helsinki, 1948).

PHOTOMETRY OF THE CONTINUOUS SPECTRUM

PROF. W. M. H. GREAVES, president of the Royal Astronomical Society, delivered his presidential address on February 14, 1948, to the Society at Burlington House, selecting as his topic "The Photometry of the Continuous Spectrum". As Prof. Greaves pointed out at the beginning of his address, he was encouraged to make the attempt of presenting a survey of the subject by the consideration that it "can be used to illustrate the way in which Natural Knowledge is advanced by an interplay between observational and theoretical investigations". The address involves so many technical matters and is so comprehensive that no attempt can be made in this short notice to deal with it in detail; and those who are specially interested in the subject should study the paper itself (*Mon. Not. Roy. Astro. Soc.*, **108**, No. 1; 1948).

A general description is given of the kind of measurement which is undertaken in this comparatively new technique and also of the relation of this technique to that of classical photometry; after this there is a review of the theoretical work on spectral energy distribution which has taken place during the last two decades. The theory of the radiative equilibrium of stellar atmospheres had been independently developed by Lindblad and Milne, and, on the assumption that the stellar absorption coefficient did not vary with wave-length, Milne