that gamma-rays are emitted in the D-D reaction and that the neutron electron interaction postulated by us is not necessary to account for their results.

Recently, we repeated our experiments using the coincidence method of two counters instead of a single counter method. We constructed a pair of thin-walled, semi-cylindrical counters placed close side by side, and only simultaneous discharges taking place in both counters were recorded. In this way we could get rid of many ambiguities with which one inevitably meets in experiments with a single counter. For example, the effect of recoil atoms is completely avoided, and the complete protection of the counters from the X-rays excited in the discharge tubes becomes unnecessary, because the double counter system is insensitive to low-energy electrons. The latter circumstance was a decisive advantage in that it reduced the effect of the secondary gamma-rays excited in matter in the direct neighbourhood of the counter.

With this arrangement we confirmed in the first place that, when carbon was used as the secondary electron emitter, the radiations coming from the target and sensitive to the double counter system consisted chiefly of gamma-rays, in agreement with the result of Kallmann and Kuhn. But, in the second place, when lead was used as the electron emitter, a definite indication was observed that the electrons are emitted by the direct action of fast neutrons. As we have already stated, the postulation of the new effect is only necessary when the effect is observed in the case of light elements (see also Seaborg and Grahame³). Our present results can be accounted for by the existence of gamma-rays from the target together with the internal conversion of the lead nucleus excited by the neutrons. The disagreement with our former result seems to have come from the error involved in the estimation of the effect of the secondary gamma-rays excited in the walls of the counter and that of the recoil atoms in the counter. We should like to express our regret for this error.

As to the origin of the gamma-rays coming from the target, their intensity is of the same order of magnitude as would be expected from gamma-rays excited in the substance constituting the target (glass) and the Dewar vessel for liquid air cooling the target. It is, however, probable that they are inherent in the D-D reaction. But their intensity is too low to relate them directly with the low-energy neutron group found by Bonner⁴. The quantum energy of the gamma-rays was estimated by the method of Bothe and Becker and it was found to be about 2 Mev. The value is that to be expected from Bonner's result, but it is indistinguishable from the quantum energy of the gamma-rays excited in most of the substance by the D-D neutrons.

Details of this work will be published shortly in the *Proc. Phys.-Math. Soc. Japan*.

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¹ See, for example, *NATURE*, **141**, 328, 645 (1938).

² *Naturwiss.*, **26**, 106 (1938).

³ *NATURE*, **141**, 1053 (1938).

⁴ *Phys. Rev.*, **53**, 711 (1938).

A New Method of Measuring the Velocity of Light

IN determining the velocity of light by Fizeau's toothed wheel, the number of eclipses per second cannot be made more than about half a megacycle. Thus the method requires great distances. In two modern determinations, that of Karolus and Mittelstaedt at Leipzig in 1926, and that of Wilmer C. Anderson at Harvard in 1937, the toothed wheel was replaced by a modulated Kerr cell, and the frequency varied in the one case from 3 to 7 megacycles per second, and in the other case from 7 to 56 megacycles per second. I have recently replaced the Kerr cell by a piezo-electric quartz oscillator working at 115 megacycles per second, and have thus been able to use Fizeau's method with a very short base line.

The accompanying diagram represents the arrangement. *Q* is the quartz. The periodic electric field is applied in the direction of the arrow, and under its influence stationary ultrasonic waves are formed. At the rarefactions and condensations the density of the quartz is altered; thus its refractive index varies periodically, and if parallel light is incident in the direction of the axis of the telescope, the quartz acts on it like an intermittent diffraction grating. This intermittent grating takes the place of Fizeau's toothed wheel. The first-order spectrum is as bright as the direct image.

Monochromatic light from the source *S* is reflected down the telescope by a Gauss eyepiece. The aperture *A* is placed in such a position that only a first-order spectrum gets through. The light then travels along an optical bench *AL* and is reflected back on its path by the lens mirror combination *LM*. If, when it returns to *Q*, the grating is in action, the first-order spectrum is diffracted along the telescope to the eye of the observer at *E*; if, on the contrary, the quartz atoms are momentarily in their mean positions, there is no diffraction. Thus when the lens mirror combination is drawn back along the bench, the image undergoes a periodic change in intensity. As the grating forms twice in each period of the oscillator and the light has to traverse the path both going and returning, the positions of the mirror which give minima are only about 65 cm. apart. The first position at 32 cm. from the quartz cannot be obtained owing to the aperture *A* getting in the way, but the others which lie within the range of the bench, at 97 cm., 162 cm., 227 cm., 292 cm. and 357 cm., are all easily visible.

The method is still in process of development, and will later be described in full. It is too soon to estimate its possibilities, but at present it seems better than the other methods for measuring the velocity of light in liquids.

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