a negligible amount (as an electrolytic impurity) and the excitation kept at a minimum did the structure of each of the lines appear as reported in this letter.

With a view toward interpreting this hyperfine structure on the basis of nuclear spin, the lines were studied in a magnetic field of 43,350 gauss. The Zeeman patterns of these lines have always been reported as simple D-types. Using very fine-grained plates and especial care in development, each of the Zeeman components appears to be doubled, even when using less than 1 per cent copper in the electrodes. But this doubling is considerably wider than the field-less separation, and we therefore reduced the copper in the alloy (<0.001 per cent) and the excitation to a minimum. Under these conditions, the Zeeman patterns of the lines consisted of extremely sharp single lines, showing that the former patterns were probably due to self-reversal.

The separation 0.41 cm^{-1} can be attributed to the hyperfine structure of the $^2S_{1/2}$ level of copper, since this level is common to both lines. The hyperfine structure of the 2P levels is apparently very much smaller and could not be determined in the present investigation.

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¹ *Proc. Roy. Soc.*, **107 A**, 360; 1925.
² *Ann. d. Phys.*, **70**, 369; 1923.

The Velocity of Light.

IN NATURE of April 4, p. 522, M. E. J. Gheury de Bray pointed out that the decrease of the velocity of light, if it exists at all, could be caused by the change of the earth's magnetic field. But such an explanation of a change in the velocity of light could not easily be accepted, because the immediate relation between the velocity of light and the intensity of magnetic field for Maxwell's theory is unknown.

Let us suppose that Maxwell's relation for the index of refraction for an insulator $n = \sqrt{\epsilon\mu}$ is correct, μ signifying the permeability and depending in ferromagnetic substances upon the intensity of the magnetic field. Then, because the discussion relates to measurements of the velocity of light carried out in air, the change of the velocity of light in the sense of Mr. Gheury de Bray's explanation would mean that the permeability, and accordingly the index of refraction of air, had changed (on account of the change of the earth's magnetic field). The index of refraction of air is 1.00029, and a simple calculation shows that within the last fifty years the index should have increased by some 6.7×10^{-4} in order to produce a decrease of 200 km./sec. According to Landolt-Börnstein ("Physikalisch-chemische Tabellen", vol. ii., 1923, p. 959, I. Ergänzungsband, 1927, p. 525) it can be seen that this index had not changed between 1865 and 1925, the difference between the various values being $\leq 3.6 \times 10^{-6}$; moreover, the values do not show any systematic variation during the time.

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DR. VRKLJAN's contribution to the subject is welcome as tending towards the elucidation of the causes, whatever they may be, which are operative in creating the curious, and possibly significant, refusal of the observational evidences to endorse the theoretical dogma of the constancy of the velocity of light.

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Dr. Vrkljan, however, has misunderstood me. I did not express the opinion that a decrease of this velocity could be caused by a variation of the earth's magnetic field. I pointed out that the latter no doubt affects the velocity of light and yet that, to my knowledge, no attempt has been made to investigate the relationship and allow for its effect on the observations, although the possible error has been reduced to 1 in 100,000 nearly. I further allude at the end of this note to the possible existence of other factors which may also affect the sought value. The only correcting factors applied are those for the pressure and temperature of the atmospheric air.

The velocity of light is undoubtedly the most important 'constant' in the realm of physical science. Theories are currently discussed which admit an expansion of the universe, soap bubble fashion; if the ether be material—and there are still physicists who hold this view—such an expansion implies a gradual decrease of density of the ether, and the decrease of velocity of light with time follows as a matter of course. To any unprejudiced mind, the observations conclusively put this decrease in evidence. If the ether is a mere abstraction, yet its virtual properties must be consistent with the theories which purport to describe the structure of the universe, and therefore there should be somewhere in the scaffolding with which de Sitter's theory has been erected, some mathematical counterpart of this particular result of the expansion of the universe, which causes the light to take longer, as time goes on, to travel between two points of space defined by their position with respect to the whole, since this whole is expanding, and therefore the distance between these two points increases.

I believe that in any other field of inquiry such a discrepancy between observation and theory would be felt intolerable. Why it is suffered in the present case is not apparent. It is, however, certain that if a decrease of the velocity of light were accepted on theoretical grounds, and if some misguided physicist attempted to demonstrate that it is constant, the present observations would be called to witness to silence him conclusively! Such is the strength of the observational evidence on which this corner-stone of physics is actually resting!

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The Conditions on Schrödinger's ψ .

THE energy levels of an atomic system are found in wave mechanics by selecting the 'characteristic' solutions of a Schrödinger differential equation, and the conditions defining these solutions are usually stated as an arbitrary mathematical postulate chosen so as to secure agreement with experiment.¹ This additional postulate seems to be unnecessary, however; the conditions follow naturally as a consequence of the physical foundations of the theory.

Wave mechanics rest upon the following two fundamental laws:

(1) ψ has the usual significance of a probability amplitude;

(2) When completely expressed, ψ satisfies always Schrödinger's time equation (or its relativistic substitute).

Characteristic-value problems arise as a special case in which the experimental conditions serve to select a system in a 'pure state' as regards some variable, such as energy or angular momentum, which can be 'measured' physically. To follow such a measuring process theoretically, one expresses ψ as a series in terms of that complete set of orthogonal character-