LETTERS TO THE EDITORS

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IN THE PRESENT CIRCUMSTANCES, PROOFS OF "LETTERS" WILL NOT BE SUBMITTED TO CORRESPONDENTS OUTSIDE GREAT BRITAIN.

Stationary Electric and Magnetic Fields in Beams of Light

ACCORDING to the electromagnetic theory of light (Maxwell, Hertz) the electric light vector and the magnetic light vector oscillate perpendicularly to the direction of propagation. The energy of the wave is given by Poynting's vector.

It is shown below, on the basis of experimental findings, that every wave of light possesses likewise a stationary field intensity E in its direction of propagation and also the stationary magnetic field of intensity H. That means there is a potential difference between two points on the ray of light. Accordingly, it should be possible to collect electricity from the ray under suitable conditions. A beam of light therefore constitutes a source of electricity; furthermore, light has magnetizing effects.

Experimental proof of this generalization was obtained from my investigations of the interaction between light and small particles of matter[1]. This permits of the measurement of forces of the order of 10^{-9} to 10^{-10} dynes. The sensitivity of measurements of forces is thus increased by my methods by a factor of 1,000–10,000.

When particles of matter are irradiated by sufficiently intense light of sufficiently small wave-length, regardless of the direction of the wave front normal, then positive or negative electric charges, or north or south magnetic poles, are induced on these particles. Particles of otherwise identical properties move in a homogeneous electric or in a homogeneous magnetic field in or against the direction of the electric field (electro-photophoresis), or in or against the direction of the magnetic field (magneto-photophoresis). These induced temporary electric or magnetic ions exist as long as the particles are irradiated by sufficiently intense light. Furthermore, it can be observed that some particles stay at rest and that their motion commences suddenly, or that moving particles appear to change their velocity and even reverse it. These are due to changes of charge. The movement of magnetic ions in a homogeneous magnetic field is a 'magnetic current'.

These phenomena are best observed when *two* fully symmetrical beams of light are directed against each other and when the fields act perpendicularly, are reversible and free from residual magnetism and electricity, and are also homogeneous. The intensity of this motion depends upon the frequency of the light wave. It increases with increasing frequency and is also dependent on the material. I have also found that, when using just *one* concentrated beam of light, without any field, small particles of matter of magnitude 10^{-4} to 10^{-5} cm. of the same kind as before moved in clean gases either away from the source of light (light-positive, longitudinal photophoresis) or towards the source of light (light-negative, longitudinal photophoresis). This force increases with the intensity of the light and likewise depends upon frequency and material.

There are particles which do not show longitudinal photophoresis at first, but only after a certain time, and some which gradually lose it. I have shown in another paper also that radiometer forces cannot account for these effects[2]. Longitudinal photophoresis has also been found in liquids with particles of the same material. These particles moved in opposite directions (Satiendranat Ray, Lucknow; W. Barkas, London).

Since light makes particles of matter unipolar with respect to homogeneous electric fields, and since, when no such fields act, it makes them move in or against the direction of its wave front normal, there must be an electric field E coincident with the direction of the wave front normal. This means that electromagnetic waves possess longitudinal stationary components of E, and therefore potential differences between different points along the beam. The magnitude of those fields can be calculated from actual measurements.

These facts have been confirmed by further experiments by myself and by some of my pupils. An electric field suitably arranged *parallel* to the wave front normal permits the acceleration or retardation or even reversal of positive or negative photophoresis. The superposed field alters the component of the electromotive force in the direction of the beam.

From similar experiments it can be concluded that stationary magnetic fields exist in the beam of light, since superposed magnetic fields accelerate or retard the magneto-photophoresis. Those stationary magnetic fields in the beam of light have a magnetizing effect on the material as above mentioned.

In conclusion, I find that light beams have electric stationary components in the direction of the wave front normal, and that consequently there must be stationary electric potential differences between different points along the beam. There must also be a stationary magnetic field in the beam of light with potential differences.

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New York City,
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[1] *Ann. Phys.*, **13**, 151 (1940).
[2] *J. Franklin Inst.*, **230**, 381 (1940).

The ε-Galactan of Larch Wood

THE occurrence of this material, which is of considerable interest in connexion with the chemistry of wood formation, has been recognized for some time and it has been shown to contain *d*-galactose and *l*-arabinose residues[1]. In a recent article[2] descriptions are given of esters of this galactan and of its methyl ether, and the authors tentatively conclude that the substance hitherto designated ε-galactan is probably a mixture of a galactan and an araban. As the outcome of experiments carried out before the outbreak of war we had reached a similar conclusion, arrived at from a study of the hydrolysis products obtained