

or with the simple gun harpoon usually die at the surface and float, while those killed with the bomb harpoon, as is well known, usually do so under water and sink. The latter appear to do so because death is seldom instantaneous enough to prevent them leaving the surface, yet the injury done them is usually so serious that they are unable to regain it and consequently die under water from asphyxia.

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The Optical Analogue of the Compton Effect.

THE presence in the light scattered by fluids, of wave-lengths different from those present in the incident light, is shown very clearly by the accompanying photographs (Fig. 1). In the illustration (1)

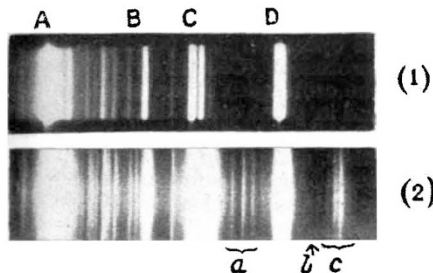


FIG. 1.—(1) Spectrum of incident light; (2) spectrum of scattered light.

represents the spectrum of the light from a quartz mercury vapour lamp, from which all wave-lengths greater than that of the indigo line have been filtered out. This line (4358 Å.) is marked D in the spectrogram, and C is the group of lines 4047, 4078, and 4109 Å. Spectrogram (2) shows the spectrum of the scattered light, the fluid used being toluene in this case. It will be seen that besides the lines present in the incident spectrum, there are several other lines present in the scattered spectrum. These are marked *a*, *b*, *c* in the figure, and in addition there is seen visually another group of lines which is of still greater wave-length and lies in a region outside that photographed. When a suitable filter was put in the incident light to cut off the 4358 line, this latter group also disappeared, showing that it derived its origin from the 4358 line in the incident radiation. Similarly, the group marked *c* in spectrogram (2) disappeared when the group of lines 4047, 4078 and 4109 was filtered out from the incident radiation by quinine solution, while the group due to 4358 Å. continued to be seen. Thus the analogy with the Compton effect becomes clear, except that we are dealing with shifts of wave-length far larger than those met with in the X-ray region.

As a tentative explanation of the new spectral lines thus produced by light-scattering, it may be assumed that an incident quantum of radiation may be scattered by the molecules of a fluid either as a whole or in part, in the former case giving the original wave-length, and in the latter case an increased wave-length. This explanation is supported by the fact that the diminution in frequency is of the same order of magnitude as the frequency of the molecular infra-red absorption line. Further, it is found that the shift of wave-length is not quite the same for different molecules, and this supports the explanation suggested.

Careful measurements of wave-length now being made should settle this point definitely at an early date.

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Excitation of the Auroral Green Line in Active Nitrogen.

THE auroral green line, which is now thought to be an arc line of oxygen, has been excited with considerable intensity in active nitrogen that was produced by a condensed discharge in a mixture of nitrogen and about 4 per cent. oxygen. Under the most favourable conditions for its excitation, the line was as intense as the afterglow band at 5442 Å. Eastman astronomical plates were used because of their great sensitivity in the green. The spectrum was photographed on a small Hilger visible spectrograph. Because of the small dispersion of the instrument, the wave-length of the line could be measured only to within 0.1 Å. Using helium standards the wave-length was found to be 5577.5 Å. The measurements of Babcock and of others give this wave-length as 5577.35 Å. It was shown definitely that with decreasing amounts of oxygen the line gradually disappeared. This and the fact that the wave-lengths agree fairly well, give sufficient proof that the line in question is the auroral green line.

Besides the green line, a red line having a wave-length of 6654.8 Å. was observed in the afterglow under the same conditions as the green line. There is an unclassified line of oxygen at 6654.8 Å. and it is thought that these two lines are identical. Amounts of oxygen too small to bring out the green line were found to be sufficient to bring out the red line. This observation is based on the fact that the red line was as intense as one of the afterglow bands in the red (6185 Å.), the intensity of which was given by Lord Rayleigh as the same as the band 5442 Å. mentioned in connexion with the green line.

Too little is known about the energy levels of the oxygen atom and about the spectroscopic origin of the green line for any hypothesis as to the process of excitation in this experiment to be of any value. The excitation of the line with an intensity comparable with that of one of the afterglow bands does, however, seem to indicate that the dissociation of the oxygen molecule and the excitation of the atom occur in a single act. Since no green line afterglow has ever been observed in oxygen discharge tubes, it is certain that the excitation in this experiment is due to the active nitrogen. It is interesting that the green line has been excited without the simultaneous excitation of the other strong arc lines of oxygen, a phenomenon that occurs in the night sky, where the green line alone has been observed.

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April 13.

Stellar Radiation and the Nature of the Universe.

REFERRING very briefly to NATURE of April 28, p. 674, the reason Dr. Jeans and I agree to differ in our estimate of the possibilities of the universe is because he is dependent on matter for all energy, the rest being empty space; whereas I postulate a vast store of energy in a rotational ether, which only or mainly manifests itself in localised portions apprehended by us as particles or waves.

Similarly, a cyclically permanent universe would seem to him dull or dead; whereas to me it furnishes the mechanism apparently needed for the continued evolution of an entity known to us as life or mind, which, unlike its inorganic counterpart, is progressive.

OLIVER LODGE.