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The optical analogue of the Compton effect

The presence in the light scattered by fluids, of wavelengths different from those present in the incident light, is shown very clearly by the accompanying photographs (figure 1). In the illustration (1) represents the spectrum of the light from a quartz mercury vapour lamp, from which all wavelengths greater than that of the indigo line have been filtered out. This line (4358 A) is marked D in the spectrogram, and C is the group of lines 4047, 4078, and 4109 A. Spectrogram (2) shows the spectrum of the scattered light, the fluid used being toluene in this case.

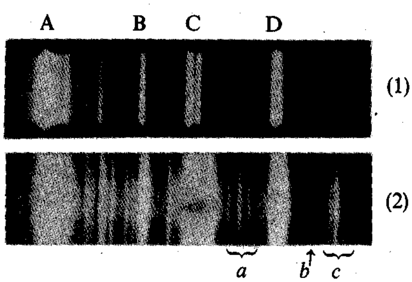

Figure 1. (1) Spectrum of incident light; (2) spectrum of scattered light.

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 wavelength 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 A continued to be seen. Thus the analogy with the Compton effect becomes clear, except that we are dealing with shifts of wavelength 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 wavelength, and in the latter case an increased wavelength. 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 wavelength is not quite the same for different molecules, and this supports the explanation suggested.

Careful measurements of wavelength now being made should settle this point denfinitely at an early date.

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