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The Doppler effect in the molecular scattering of radiation

In connection with the recent work of Prof. Strutt and of Lord Rayleigh on the molecular scattering of light, Sir Joseph Larmor has put forward the interesting suggestion (*Philos. Mag.*, January 1919, p. 162) that the additive property of the energy elements scattered by the individual molecules is secured by the irregular alterations in the wavelength of the scattered radiation produced (in accordance with Doppler's principle) by the thermal movements of the molecules. There is one interesting feature of the Doppler effect in the scattered radiation to which Sir Joseph Larmor does not specifically direct attention in his paper, and which it seems important to emphasise, namely, that the magnitude of the Doppler effect would depend on the *angle* between the primary and the scattered radiation, and would, in fact, practically vanish in directions nearly the same as that of the primary waves. This follows from the fact that the movement of an individual molecule would alter the effective frequency of the radiation *received* by it, and this has to be taken into account in calculating the effective frequency of the *emitted* radiation as received by the observer. In directions nearly the same as that of the primary radiation there would be practically a complete compensation, and the Doppler effect would vanish.

The importance of the considerations set out above becomes evident when we attempt to explain refractivity on the basis of molecular scattering. This appears possible only if the energy effects due to the individual molecules are *not* additive in directions nearly the same as that of the primary wave, and the vanishing of the Doppler effect in the scattered radiation would seem to be a necessary condition for mutual interference of the radiations from individual molecules to be possible.

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