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Disappearance and reversal of the Kerr effect

A beautiful confirmation of recent theories of the electric birefringence in liquids (C V Raman and K S Krishnan, *Philos. Mag.* April 1927) is furnished by observations of the phenomenon in electric fields oscillating with radio-frequency such as may readily be obtained with thermionic valves. The Kerr effect arises from the orienting action of the field on the molecules, and the time taken by the latter to adjust themselves to a state of statistical equilibrium has naturally to be taken into account. It may be pointed out here that the orienting couple acting on the *permanent* electric moment of the molecule (assumed to be chemically polar) stands on a different footing from the couple acting on the oscillating *induced* moment in it. The couple acting on the permanent moment is purely periodic, and its effect must tend to disappear at sufficiently high frequencies. The couple on the induced moment, on the other hand, has a quasi-static part and tends to persist even at optical frequencies.

The Kerr effect expressly due to the polarity of the molecule must thus disappear at high frequencies, while the non-polar part will continue. In certain polar liquids, for example, chloroform or the higher alcohols, the Kerr effect is negative and may be considered as the resultant of a *negative polar*, and a *positive non-polar* Kerr effect. In all such cases we should expect the Kerr effect to *diminish and vanish as the frequency is increased*, and then to *reappear* at still higher frequencies.

Observations with octyl alcohol made by us confirm this remarkable prediction, the Kerr effect disappearing at 32 metres frequency and reappearing at still shorter wavelengths. Cooling the liquid with a freezing mixture shifts the frequency of disappearance and reversal to longer wavelengths, as might be expected.

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