$\sqrt{1 - v^2/c^2}$. If, therefore, the apparatus is tuned to resonance in the first position and then the resonator turned through 90° (the generator being kept stationary), it ought to be necessary to retune it to a slightly higher frequency. The experiment should preferably be carried out at a high altitude.

Assuming $v/c \sim 10^{-4}$, the frequency difference for centimetre waves should be about 150 c./s. The absence of such an effect would be a new and independent confirmation of the validity of the special theory of relativity, whereas a positive effect would contradict the principle of relativity.

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An Electrical Effect in Liquid Crystalline Solutions containing Amphiphilic Salts

A CHARACTERISTIC feature of micellar solutions containing amphiphilic compounds is the segregation of liquid amphiphilic regions within the solution¹.

In certain circumstances, which have been discussed in detail elsewhere¹, this process may result in the formation of very interesting lamellar or smectic liquid crystalline solutions. These solutions are characterized by high and anomalous viscosity and by showing marked birefringence. If they are stirred, or when they are drawn into capillaries, considerable tracts of the solution may be given a definite orientation which, in the absence of further disturbance, may be retained for weeks (for references, see footnote 1). In the absence of such orientation, all possible arrangements of liquid crystalline regions must be presumed to occur.

It is interesting to speculate what effect an applied potential difference would have on the ions within such an unorientated liquid crystalline solution. Let us consider two liquid crystalline regions, of the extreme orientations shown at I (a) and (b), Fig. 1, held between two electrodes. If now a potential difference is applied as in II, one might expect that the mean alignment of the molecules at (b) would be unaffected, but that at (a) a definite alteration in the mean alignment of the molecules would be produced through ionic migration. Since the refractive indices along and across the paraffin chains are different, the change Ia $\rightarrow$ IIa should produce a change in refractive index in the direction XY at (a), whereas no such change would occur at (b). If the solution, containing a random arrangement of regions such as (a) and (b), initially appears clear

Fig. 1. Effect of an applied potential difference on differently orientated regions of liquid crystal

Fig. 2. A 20 per cent (w) liquid crystalline solution of tetradecane-7 sodium sulphate photographed against a white background: above, with no applied P.D.; below, with an applied P.D. of the order of 30 volts/cm.

(or almost clear), an alteration in the arrangement of the (a) regions on the application of a potential difference, while the (b) regions remain unaffected, might lead to the appearance of turbidity.

This is possibly the origin of the effect shown in Fig. 2, which illustrates the marked turbidity that appears almost instantaneously on applying a potential difference of the order of 30 volts/cm. to an almost clear liquid crystalline solution (20 per cent w) of tetradecane-7 sodium sulphate in water. On removal of the potential difference, apart from changes due to electrolysis in a small region around the electrodes, the turbidity rapidly disappears. This would be expected on account of the relaxation of the distorted liquid crystals through thermal motion. A turbidity is not produced on application of a 50-c./s. a.c. potential difference of a similar order to this solution.

A turbidity was also observed on application of a continuous potential difference to other aqueous liquid crystalline solutions; for example, tetradecane-7 potassium sulphate (c. 20 per cent w), 'Aerosol OT' (20 per cent w)², or pentadecane-8 sodium sulphate (3.1 per cent w).

The liquid crystalline solution (described in ref. 1, Fig. 2 (5)) containing undecane-3 sodium sulphate solution (5 ml., 20 per cent w), hydrocarbon B (5 ml.) and octanol-1 (1.2 ml.) also showed a similar reversible production of turbidity on the application of a potential difference.

Attempts were also made to observe whether a similar turbidity could be obtained with liquid crystalline solutions similar to that described in the preceding paragraph, but with polyethylene glycol mono-oleate in place of undecane-3 sodium sulphate as amphiphilic compound. Sodium sulphate was added to provide conducting ions. Negative results only were obtained.

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¹ Winsor, P. A., *Indust. Eng. Chem.*, **45**, 1086 (1953).

² Philippoff, W., and McBain, J. W., *Nature*, **164**, 885 (1949).