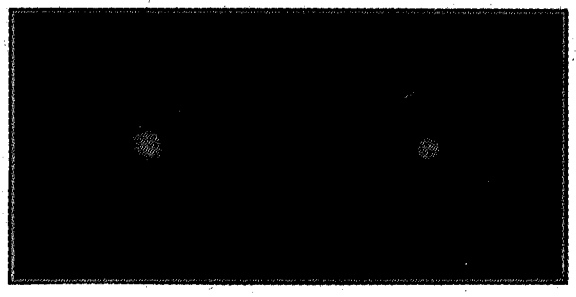
Nature (*London*) **120** 514 (1927)

X-ray diffraction in liquids

The experimental studies described in a previous note in *Nature* (23 April, p. 601) have been continued by one of us (C M Sogani) and the structure of some thirtyfive liquids has been studied by X-radiation. The present note indicates briefly some of the outstanding results of the investigation.

The twenty aromatic liquids examined indicate a remarkable variation of the structure of the diffraction halo with the form, position and mass of the substituent groups which replace the hydrogen atoms in benzene. Ortho-, para- and meta-compounds are readily distinguished by their X-ray liquid haloes. When the benzene ring is loaded in an unsymmetrical manner, there is a broadening of the halo, which is the more striking the heavier the mass of the substituent group. The research furnishes numerous examples of this effect, a striking illustration being the difference in the haloes due to aniline and nitrobenzene respectively (figure (*a*) and (*b*)). In several of the liquids, the halo becomes doubled, a good example being that of mesitylene, where the two rings are of nearly equal intensity.



a *b*

Figure 1. Diffraction holes. *a*. Aniline; *b*. Nitrobenzene.

The aliphatic liquids examined include several of the paraffins, some alcohols, and an extended series of the fatty acids ranging from formic acid up to brassidic acid, which has a chain of 22 carbon atoms. The results confirm the prediction of Raman and Ramanathan (*Proc. Indian Assoc. Cultiv. Sci.*, 1923, **8**, p. 154) that with such asymmetrical molecules, we may have more than one halo, the sizes of which correspond to different special configurations of neighbouring molecules

relatively to each other in the liquids. The most striking illustrations of this are furnished by acetic acid and glycerine, each of which gives two haloes, corresponding respectively to the mean distance between neighbouring molecules which lie side by side and those which lie end to end. With very long molecules, however, only the former type of halo appears on the plates, and its size, as expected, is found to be independent of the length of the carbon chain. With the earlier members of the aliphatic series, noticeable variations appear both in the size and the character of the halo with increasing length of the chain.

The case of liquid mercury, which has also been examined, is of great interest in view of the monatomic character of its molecules, and also in view of the theoretical proof by Raman and Ramanathan (*loc. cit.*; 1923) that the X-ray scattering by liquids at small angles would be determined by the compressibility of the liquid. Mercury has the smallest compressibility of all known liquids ($3{\cdot}9 \times 10^{-12}$), and in agreement with the theory of Raman and Ramanathan, it is found to give a halo with a sharply defined inner margin and a very clear space within.

Further details will be found in papers appearing in the *Indian J. Phys.*

C V RAMAN
C M SOGANI

210 Bowbazaar Street
Calcutta, 25 August